The Effect of Households' Student Debt on Life Satisfaction

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Abstract
This study finds a negative effect of holding student-loan debt on the life satisfaction of household heads using longitudinal data from the 2011 to 2017 U.S. Panel Study of Income Dynamics and a fixed-effects modeling approach. Although debt is taken to improve future utility, it provides disutility to the head of household until it is paid off. Thus, financial planners and educators should remind their clients about the consequences of holding student-loan debt in the short term, not just the future benefits.

Keywords Student debt · Student loans · Life satisfaction · Well-being · Mundlak correction

Introduction

Student-loan debt has become one of the main sources of financing for the acquisition of human capital. Data from the Federal Reserve Bank of New York (2018) show that student-loan debt ranks second to mortgage debt as the most common type of household debt among U.S. households. These data further show that the total amount of student-loan debt has increased from $240 billion in quarter one of 2003 to approximately $1.50 trillion in quarter four of 2018, representing almost a 525 percent increase. These data also indicate that nearly 45 million Americans have student-loan debt as of 2018. The rise in student-loan debt may be attributed to several factors, including the high cost of college education (Schell-Olsen 2018; Ma et al. 2018), higher anticipated earnings from having a college degree (Bricker et al. 2017; Abel and Deitz 2014), and low levels of college-education savings (Lusardi 2011).

All things being equal, the increasing pattern of student-debt usage suggests that student loans make college education accessible for many financially constrained households. However, the rate at which student-loan debt is rising, coupled with its potential adverse repercussions on families and the economy, has made student-loan debt a significant topic of interest to policy makers, practitioners, and academics (Avery and Turner 2012; Oliff et al. 2013). Cho et al. (2015) and Gayardon et al. (2018) provide reviews of research examining the consequences of financing college education with student loans. Among the effects of student-loan debt identified in the literature, life satisfaction is one of the least examined. Kim and Chatterjee (2019) provide a pioneering study in this area using a panel data set focusing on working adults.

The purpose of this paper is twofold. First, this study seeks to examine student-loan debt and its effects on life satisfaction among U.S. households using a longitudinal data set from the U.S. Panel Study of Income Dynamics (PSID). It takes advantage of the available extended PSID data set from 2011 to 2017 and extends the work of Kim and Chatterjee (2019) in three ways. To begin with, the study adopts the Mundlak correction approach and Wooldridge's (2010) suggestion for dealing with random effects and unbalanced panel data sets to improve on the random effects methodology that Kim and Chatterjee (2019) use. In addition, Kim and Chatterjee (2019) limited their study to households under age 55. This study includes all age groups (that is, from age 18 and over) in the econometric analysis because student-loan debt is held by households of all different ages

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(Federal Reserve Bank of New York 2018). Another feature of this study which distinguishes it from Kim and Chatterjee (2019) is that it applies survey weights to allow inferences to the national population. The application of survey weights in the analyses could help to obtain unbiased estimates (Gouskova et al. 2008; Longhi and Nandi 2015).

The second objective of this study is to perform sensitivity analysis of the effect of student-loan debt on life satisfaction using the retired households subsample. Based on data from the U.S. Federal Reserve and the U.S. Consumer Financial Protection Bureau, the CNBC reports that student debt holders who are 65 and over find it difficult to pay their loans (Nova 2018). The CNBC report also indicates that, as of 2018, the amount of student-loan debt on the balance sheets of older adults exceeded $260 billion. The U.S. News and World Report (Brandon 2017) and the AARP Foundation (Khalfani-Cox 2017) also provide reports similar to that of CNBC. These reports indicate that retired households are confronted with the burden of student-loan debt. However, empirical studies examining how student debt influences the life satisfaction of these households are sparse. Consequently, this sensitivity analysis will provide financial planners and educators with empirical results to guide their discussions with clients concerning the consequences on life satisfaction of having student debt in retirement.

Literature Review

The decision to invest in human capital through college education is a household choice. When household members eventually choose to invest in college, they may finance college education from different sources such as scholarships, savings, current income, and loans. Based on economic theory, a household that desires to maximize returns from college education but without adequate means of financing may resort to borrowing to smooth consumption.

The higher the returns that a household expects to earn from investments in college, the more likely it is that the liquidity constrained household will contract student loans to pay for college. The availability of student loans makes the attainment of college degrees affordable and possible for households having inadequate financial resources (Nica and Bonciu 2017). However, the expected returns from investing in college education through student debt may not be determined with certainty (Webber 2016; Avery and Turner 2012).

Several outcomes could emerge when a household finances college education through debt (Gayardon et al. 2018). Research has shown that student-loan debt could influence outcomes such as homeownership (Letkiewicz and Heckman 2018; Mountain et al. 2020), career choices (Sieg and Wang 2018; Schmeiser et al. 2016; Rothstein and Rouse 2011), postgraduate education (Zhang 2013), marriage choices (Sieg and Wang 2018; Gicheva 2016), health (Walsemann et al. 2015), financial distress, anxiety, and hardship (Bricker and Thompson 2016; Despard et al. 2016; Archuleta et al. 2013), stock ownership (Korankye and Guillemette 2020), and financial well-being and life satisfaction (Kim and Chatterjee 2019; Henager and Wilmarth 2018; Xiao et al. 2009).

Henager and Wilmarth (2018) used cross-sectional data from the 2012 National Financial Capability Study to examine the association between financial wellness and student-loan debt. They found that student-loan debt is associated negatively with financial wellness. The results suggest the presence of student-loan debt could influence adversely the likelihood that a student-loan debt holder will report high financial wellness.

Kim and Chatterjee (2019) found a negative association between student-loan debt and life satisfaction among U.S. households in general, and African Americans and Hispanics in particular. The authors, however, limited their study to working adults aged 18–54. Their approach excluded the large segment of individuals above 54 years who may have student-loan debt on their balance sheet. The presence of student-loan debt has been found to influence financial distress (Bricker and Thompson 2016), and even older adults may be susceptible to this effect as well.

Among college students, Xiao et al. (2009) showed that financial behavior is an important factor that could influence life satisfaction. In their study, Xiao et al. (2009) ascertained that the presence of educational debt influences adversely financial satisfaction and the Grade Point Average of students. Dugan and Marken (2014) also reported that college graduates with undergraduate student-loan debts from $50,000 upwards are more likely to report low physical, social, purpose, community, and financial well-being than those without student-loan debt.

The current paper complements the sparse studies on life satisfaction and student-loan debt among U.S. households. Most of the current studies on student-loan debt, with the exception of Kim and Chatterjee (2019), used cross-sectional data to analyze the relationship between student-loan debt and satisfaction. Gayardon et al. (2018) suggested using longitudinal data to study the long-term effects of student-loan debt over life course events. In the words of Baltagi (2008), "Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom, and more efficiency" (p. 7).

In addition, most of these studies measure student-loan debt as a dichotomous variable only. However, the current paper measures student-loan debt as a dichotomous as well as a quadratic continuous variable. Modelling student-loan debt as a dichotomous variable allows the current paper to examine the effect of student-loan debt on life satisfaction

among households with student loans versus those without student loans. Modelling student debt also as a quadratic continuous variable allows the current paper to examine the curvilinear relationship between student debt and life satisfaction of households. According to Gicheva and Thompson (2015), higher student debt relates to higher probability of experiencing financial hardship. Kim and Chatterjee (2019) examined the linear relationship between student debt and life satisfaction.

Moreover, little is known about whether the effect of student-loan debt on life satisfaction differs among retired households. Thus, another contribution of the current paper is that it examines the effect of student-loan debt on life satisfaction among this subsample to provide specific empirical results for practitioners and policy makers. This contribution also makes the current paper unique from that of Kim and Chatterjee (2019) and others. The current paper considers the retired subsample because retired households are generally at the decumulation phase of the life cycle, relying mostly on non-labor sources of income. The fear of outliving resources is prevalent among these households (Hart 2016) and the presence of student-loan debt could influence the well-being of retirees beyond that of all households. Hira and Mugenda (1998) point out that retired and non-retired households have different financial behaviors and situations.

Data

The current paper uses an unbalanced longitudinal data set from the U.S. Panel Study of Income Dynamics (PSID) (Arbor 2019). The PSID collects individual and household-level data biennially from a nationally representative sample of the American population. The data set for this particular study comes from the 2011, 2013, 2015, and 2017 waves of the individual- and family-level files. These are the years where complete data for the main variables of interest in the current study are available. The total number of observations for the empirical analysis is 31,960 household waves. This study applies survey weights in the empirical analysis to reflect the national population. In addition, all variables in the current study with dollar denominated values are adjusted for inflation using 2011 as the base year. The values for the consumer price index are obtained from the U.S. Bureau of Labor Statistics.

The dependent variable for the current study is life satisfaction. The PSID asks respondents, *"Please think about your life as a whole. How satisfied are you with it? Are you completely satisfied, very satisfied, somewhat satisfied, not very satisfied, or not at all satisfied?"* The life satisfaction variable is ordinal, and it is reverse coded so that 1 represents "not at all satisfied," 2 equals "not very satisfied," 3 equals "somewhat satisfied," 4 represents "very satisfied,"

and 5 equals "completely satisfied." Reverse coding the life satisfaction variable from lowest to highest allows easy interpretation of the empirical results.

The main explanatory variable is student-loan debt, and it is measured in two ways. First, student-loan debt is measured as a dichotomous variable, taking a value of 1 if the household has student-loan debt and 0 otherwise. Second, student-loan debt is measured as a continuous variable based on the amount of student debt a household owes. The amount of student debt, scaled to US$10,000s, is measured as a second-degree polynomial to capture the potential non-linear effects of student debt.

The other explanatory variables include age of household head, educational attainment of household head, marital status of household head, number of children, and health status of household head. The rest of the explanatory variables include race status of the head of household, retirement status of household head, total household income, credit-card debt, mortgage debt, total other debt, and total net assets. Age, education, number of children, household income, credit-card debt, mortgage debt, total other debt, and net assets are measured as continuous variables. The total other debt variable is the sum of the family loan, legal, and medical debts. The net-assets variable available in the PSID includes the aggregate values of home equity, farm/business assets, checking/savings, real estate assets, stocks, vehicles, annuity/individual retirement accounts, and other assets, net of debt.

Similar to the rescaling of the student-loan debt amount, both the credit card and total other debt variables are scaled to US$10,000s, while household income is scaled to US$100,000s. The mortgage debt and net asset variables also are rescaled, but this time, they are rescaled into $1 million because of their large values. The age and household income variables also are measured as second-degree polynomials to capture their potential non-linear effects on the dependent variable.

The marital status variable is measured as a dichotomous variable, where married households are coded as 1 and 0 otherwise. The health status variable is measured as four dummies comprising excellent, very good, good, and fair. The reference category is poor health status. The employed variable is measured as a dichotomous variable that equals 1 if the respondent is employed and 0 otherwise. The race variable is dichotomous, taking a value of 1 if the respondent is White and 0 otherwise. The retirement status variable also is measured as a dichotomous variable, taking a value of 1 if the respondent is retired and 0 otherwise. The study includes wave dummies for 2013, 2015, and 2017 to capture time-varying effects. The reference category for the wave variable is the year 2011.

Appendix Table 1 provides the descriptive statistics for the dependent and explanatory variables for all households.

Table 1 Summary statistics for all households

	Overall Mean (S.E.)	2011 Mean (S.E.)	2013 Mean (S.E.)	2015 Mean (S.E.)	2017 Mean (S.E.)
Dependent variable: Life satisfaction					
Not at all satisfied	0.0124 (0.0009)	0.0131 (0.0019)	0.0122 (0.0019)	0.0118 (0.0017)	0.0126 (0.0020)
Not very satisfied	0.0362 (0.0015)	0.0360 (0.0028)	0.0385 (0.0030)	0.0353 (0.0031)	0.0349 (0.0030)
Somewhat satisfied	0.2822 (0.0035)	0.2824 (0.0069)	0.2749 (0.0069)	0.2837 (0.0070)	0.2879 (0.0070)
Very satisfied	0.4681 (0.0038)	0.4646 (0.0075)	0.4675 (0.0075)	0.4730 (0.0076)	0.4672 (0.0075)
Completely satisfied	0.2011 (0.0030)	0.2039 (0.0060)	0.2068 (0.0060)	0.1962 (0.0059)	0.1974 (0.0059)
Main explanatory variables					
Student loan dummy (Model 1)	0.1908 (0.0027)	0.1867 (0.0053)	0.1893 (0.0053)	0.1965 (0.0055)	0.1909 (0.0054)
Student loan amount ($10 k) (Model 2)	0.6544 (0.0164)	0.5738 (0.0307)	0.5978 (0.0295)	0.7087 (0.0343)	0.7418 (0.0368)
Other explanatory variables					
Race (1 = White)	0.7879 (0.0030)	0.7976 (0.0058)	0.7909 (0.0059)	0.7857 (0.0060)	0.7768 (0.0061)
Age	52.3337 (0.1362)	51.7505 (0.2666)	52.1382 (0.2690)	52.4192 (0.2757)	53.0579 (0.2781)
Education (years)	13.6716 (0.0197)	13.5661 (0.0396)	13.6467 (0.0395)	13.7203 (0.0395)	13.7582 (0.0392)
Number of children	0.4966 (0.0063)	0.5292 (0.0133)	0.5171 (0.0129)	0.4769 (0.0121)	0.4615 (0.0119)
Household income ($100 k)	0.7357 (0.0074)	0.7255 (0.0136)	0.7483 (0.0180)	0.7347 (0.0134)	0.7344 (0.0134)
Health status					
Poor	0.0489 (0.0018)	0.0467 (0.0033)	0.0489 (0.0035)	0.0492 (0.0035)	0.0508 (0.0037)
Fair	0.1350 (0.0027)	0.1312 (0.0053)	0.1343 (0.0054)	0.1322 (0.0054)	0.1426 (0.0056)
Good	0.3151 (0.0035)	0.3106 (0.0070)	0.3181 (0.0071)	0.3093 (0.0071)	0.3225 (0.0071)
Very good	0.3508 (0.0036)	0.3508 (0.0071)	0.3418 (0.0070)	0.3573 (0.0072)	0.3534 (0.0072)
Excellent	0.1503 (0.0025)	0.1607 (0.0052)	0.1569 (0.0052)	0.1520 (0.0051)	0.1307 (0.0048)
Married	0.4739 (0.0037)	0.4988 (0.0075)	0.4822 (0.0075)	0.4591 (0.0075)	0.4545 (0.0074)
Employed	0.6221 (0.0038)	0.6280 (0.0075)	0.6240 (0.0076)	0.6209 (0.0077)	0.6151 (0.0077)
Retired	0.2440 (0.0036)	0.2281 (0.0070)	0.2422 (0.0072)	0.2491 (0.0073)	0.2575 (0.0073)
Net assets ($1 m)	0.3512 (0.0097)	0.3375 (0.0185)	0.3367 (0.0198)	0.3615 (0.0208)	0.3699 (0.0184)
Credit card debt ($10 k)	0.2622 (0.0049)	0.3170 (0.0117)	0.2523 (0.0095)	0.2436 (0.0091)	0.2339 (0.0084)
Mortgage debt ($1 m)	0.0550 (0.0007)	0.0608 (0.0016)	0.0554 (0.0014)	0.0523 (0.0014)	0.0514 (0.0014)
Total other debt ($10 k)	0.1190 (0.0127)	0.1572 (0.0384)	0.1138 (0.0147)	0.1260 (0.0245)	0.0775 (0.0154)

Table 1 (continued)

	Overall Mean (S.E.)	2011 Mean (S.E.)	2013 Mean (S.E.)	2015 Mean (S.E.)	2017 Mean (S.E.)
Year					
2011	0.2562 (0.0033)				
2013	0.2509 (0.0033)				
2015	0.2482 (0.0033)				
2017	0.2448 (0.0032)				
N	31,960	7810	7878	7899	8373

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied

From 2011 to 2017, an average of 20% of household heads report "completely satisfied", 47% indicate "very satisfied", and 28% report "somewhat satisfied" with life. Only few household heads say they are "not very satisfied" or "not at all satisfied" with life, respectively.

Appendix Table 1 also shows that the average percent of U.S. households with student debt from 2011 to 2017 is about 19%. These households owe $34,302 in student-loan debt on average (not shown in Appendix Table 1). The average amount of student-loan debt for all households, including those without student loans, is $6,544. Appendix Table 1 further indicates that the average age is 52 years, mean years of education is approximately 14, and the average amounts owed in credit-card debt, mortgage debt, and total other debts for all households from 2011 to 2017 are $2,622, $55,000, and $1,190 respectively.[1]

Appendix Table 2 contains the summary statistics for retired households. The percentage of retired households reporting "completely satisfied", "very satisfied", and "somewhat satisfied" with life are approximately 24%, 47%, and 25%, respectively. Few retired households say they are either "not very satisfied" or "not at all satisfied" with life. Additionally, Appendix Table 2 shows that the percentage of retired households having student debt in 2011 is 3.16%, while that of 2017 is 3.33%. The average student-loan debt owed by retired households, including those with zero student debt balances, is $762. When the retired households with student debt only are considered, these households owe an average of $24,000 in student debt. In 2011 and 2017, the retired households with student debt owed $20,293 and $26,759 respectively.[2] On average, the retired households (including those with zero balances) owe over $27,000 in mortgage debt, $1,600 in credit-card debt, and $727 in total other debts.

Model

The current paper estimates random effects ordered probit models, with Mundlak (1978) correction, of the effect of student-loan debt on life satisfaction. The categorical and ordered nature of the dependent variable makes the ordered probit model more appropriate than continuous regression.

Random effect models assume that any unobserved heterogeneity is uncorrelated with the explanatory variables. To relax this assumption, Mundlak (1978) recommends adding the mean of the explanatory variables that are not time-invariant to the random effects model. The Mundlak (1978) approach has been found to provide consistent parameter estimates of the random effects model for a balanced panel (Longhi and Nandi 2015). With large sample sizes, Dieleman and Templin (2014, 2016) show, through simulation, that the fixed effect estimator and the Mundlak-approach estimator are both consistent parameter estimators, and hence equivalent. To provide consistent parameter estimates for unbalanced panels, Wooldridge (2010) suggests extending the Mundlak (1978) correction to include dummies for each wave and their associated means. Given that this paper uses unbalanced longitudinal data, the current paper incorporates Wooldridge's (2010) suggestion into the models.

To achieve the research objectives, the current study estimates two main models for all households. Model 1 compares the effect of student-loan debt on life satisfaction for households with student loans versus those without student loans. Model 2 estimates the effect of the amount of student-loan debt on life satisfaction for all households. Under each

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[1] These values include those with zero balances.

[2] The average amounts of student debt owed by retired households with student debt are not shown on Appendix Table 2.

Table 2 Summary statistics for retired households

	Overall Mean (S.E.)	2011 Mean (S.E.)	2013 Mean (S.E.)	2015 Mean (S.E.)	2017 Mean (S.E.)
Dependent variable: Life satisfaction					
Not at all satisfied	0.0131 (0.0023)	0.0141 (0.0044)	0.0097 (0.0040)	0.0089 (0.0037)	0.0197 (0.0056)
Not very satisfied	0.0328 (0.0033)	0.0302 (0.0061)	0.0316 (0.0067)	0.0336 (0.0066)	0.0355 (0.0065)
Somewhat satisfied	0.2490 (0.0078)	0.2478 (0.0159)	0.2524 (0.0158)	0.2432 (0.0157)	0.2527 (0.0154)
Very satisfied	0.4663 (0.0088)	0.4688 (0.0181)	0.4453 (0.0177)	0.4851 (0.0178)	0.4658 (0.0172)
Completely satisfied	0.2388 (0.0075)	0.2392 (0.0156)	0.2611 (0.0154)	0.2292 (0.0147)	0.2263 (0.0140)
Main explanatory variables					
Student loan dummy (Model 1)	0.0318 (0.0029)	0.0316 (0.0059)	0.0298 (0.0056)	0.0324 (0.0059)	0.0333 (0.0056)
Student loan amount ($10 k) (Model 2)	0.0764 (0.0093)	0.0642 (0.0161)	0.0793 (0.0218)	0.0721 (0.0181)	0.0890 (0.0179)
Other explanatory variables					
Race (1 = White)	0.8522 (0.0062)	0.8558 (0.0128)	0.8581 (0.0122)	0.8494 (0.0124)	0.8460 (0.0121)
Age	72.6432 (0.1649)	72.3518 (0.3495)	72.4608 (0.3294)	72.6723 (0.3272)	73.0605 (0.3138)
Education (years)	13.4123 (0.0478)	13.2605 (0.1010)	13.3205 (0.0982)	13.5153 (0.0939)	13.5403 (0.0894)
Number of children	0.0520 (0.0051)	0.0448 (0.0100)	0.0555 (0.0107)	0.0564 (0.0106)	0.0512 (0.0094)
Household income ($100 k)	0.5460 (0.0101)	0.5311 (0.0200)	0.5575 (0.0223)	0.5425 (0.0172)	0.5522 (0.0210)
Health status					
Poor	0.0858 (0.0049)	0.0893 (0.0100)	0.0815 (0.0097)	0.0848 (0.0097)	0.0876 (0.0098)
Fair	0.1945 (0.0071)	0.2019 (0.0146)	0.1918 (0.0141)	0.1850 (0.0139)	0.1995 (0.0139)
Good	0.3527 (0.0085)	0.3582 (0.0176)	0.3605 (0.0173)	0.3651 (0.0172)	0.3279 (0.0162)
Very good	0.2762 (0.0079)	0.2420 (0.0155)	0.2881 (0.0159)	0.2751 (0.0159)	0.2974 (0.0159)
Excellent	0.0908 (0.0050)	0.1086 (0.0112)	0.0781 (0.0094)	0.0900 (0.0099)	0.0876 (0.0091)
Married	0.4829 (0.0088)	0.4903 (0.0181)	0.4919 (0.0178)	0.4714 (0.0176)	0.4786 (0.0171)
Net assets ($1 m)	0.6040 (0.0246)	0.5876 (0.0600)	0.5724 (0.0436)	0.5734 (0.0360)	0.6796 (0.0541)
Credit card debt ($10 k)	0.1622 (0.0091)	0.2064 (0.0249)	0.1489 (0.0171)	0.1498 (0.0156)	0.1461 (0.0143)
Mortgage debt ($1 m)	0.0271 (0.0010)	0.0254 (0.0019)	0.0269 (0.0021)	0.0289 (0.0021)	0.0271 (0.0019)
Total other debt ($10 k)	0.0727 (0.0387)	0.1872 (0.1587)	0.0406 (0.0145)	0.0491 (0.0237)	0.0206 (0.0068)
Year					
2011	0.2394 (0.0076)				
2013	0.2490 (0.0077)				

Table 2 (continued)

		Overall Mean (S.E.)	2011 Mean (S.E.)	2013 Mean (S.E.)	2015 Mean (S.E.)	2017 Mean (S.E.)
	2015	0.2533 (0.0078)				
	2017	0.2583 (0.0077)				
	N	4517	1031	1096	1141	1249

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied

main model, the current study performs sensitivity analysis for retired households.

The two main models are stated below.

$$l\,satisfaction^*_{it} = \beta_0 + \beta_1\,\text{Student loan dummy}_{it} + \beta'_j x_{it} + \alpha_i + \varepsilon_{it} \tag{1}$$

$$l\,satisfaction^*_{it} = \beta_0 + \beta_1\,\text{Student loan amount}_{it} + \beta_2\,\text{Student loan amount squared}_{it} + \beta'_j x_{it} + \alpha_i + \varepsilon_{it} \tag{2}$$

where, for each model:

$$\alpha_i = \alpha_0 + \alpha_1(mean\,of\,time - varying\,explanatory\,variables) + \theta_i$$

$$l\,satisfaction_{it} = \begin{cases} 1 \text{ if } l\,satisfaction^*_{it} \leq u_1 (Not\,at\,all\,satisfied) \\ 2 \text{ if } u_1 < l\,satisfaction^*_{it} \leq u_2 (Not\,very\,satisfied) \\ 3 \text{ if } u_2 < l\,satisfaction^*_{it} \leq u_3 (Some\,what\,satisfied) \\ 4 \text{ if } u_3 < l\,satisfaction^*_{it} \leq u_4 (Very\,satisfied) \\ 5 \text{ if } u_4 < l\,satisfaction^*_{it} \leq u_4 (Completely\,satisfied) \end{cases}$$

The term $lsatisfaction^*_{it}$ is the latent variable representing the utility of household i at time t. The unobserved thresholds are $u_1, u_2, u_3,$ and u_4. The observed variable, $lsatisfaction_{it}$, represents the values 1 to 5 that are obtained from the responses to the question on life satisfaction.

The intercepts are β_0 and the slope parameters are β_1, β_2, and β_j, where j represents the slope parameter for each of the other explanatory variables. Instead of relying on the regression coefficients for the analysis, the current study estimates the marginal effects to make it possible to determine the partial effects of both the incidence and the amount of student-loan debt on each level of life satisfaction.

The term α_i captures the time-invariant, individual-specific factors outside the time-variant individual factors that are not part of the model. The mean of the time-varying predictor variables includes all the explanatory variables in each model, except the race variable. The race variable is excluded from the group-level means of the time-varying explanatory variables because it is time-invariant. The sensitivity analysis for the retired households also models educational attainment as a time-invariant variable because education is not time-varying for most retirees.

The error term is ε_{it}, and the term θ_i follows the normal distribution independent of the explanatory variables.

The term x_{it} represents the other explanatory variables including age, educational attainment, marital status, number of children, health status, race, retirement status, total household income, total other debt, and net assets. Wave dummies for the years 2011, 2013, 2015, and 2017 also are included as explanatory variables.

The current study tests the hypothesis that student-loan debt has a negative effect on life satisfaction. The life-cycle theory of consumption suggests that households maximize utility by borrowing to smooth consumption. Households with resource constraints take student loans to pay for college education costs in anticipation that they will add value to their human capital, earn adequate returns in future, repay the student-loan debt, and live a satisfied life.

According to human capital theory (Becker 1993), investing in education positively influences future outcomes such as job prospects, wealth, and satisfaction. Thus, a household that anticipates receiving positive net benefits from education will want to invest in college education. However, the expected outcomes from investing in college education are uncertain over the life cycle (Avery and Turner 2012). The borrower may not be able to complete college or the expected job, income, or wealth outcomes may not be realized. Hence, although a student loan can help a household enhance its human capital acumen, the debt itself serves as a constraint to the satisfaction of the household.

Walsemann et al. (2015) point out that, although student loans can make it possible for a household to acquire human capital, the need for repayment can induce stress and worries among borrowers. The level of stress may be compounded by the fact that, in the United States, student-loan debt may not be forgivable when a person files for bankruptcy. Based on economic theory, as the amount of

student-loan debt increases, the probability of default also increases (Yannelis 2016), raising the possibility of credit impairment and diminished well-being.
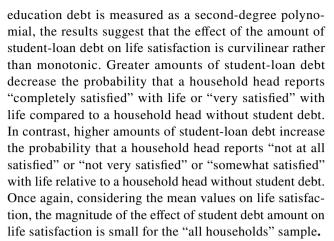
The other explanatory variables are standard control variables and are included in the model to account for other unobserved characteristics that may influence life satisfaction. Household income, marital status, and net assets are included in the model to account for resource availabilities and opportunities. Age is included to account for life-cycle effects associated with cognitive ability and risk preferences that may influence life satisfaction. Educational attainment accounts for human capital and income prospects, while number of children reflect household constraints and preferences. Health and retirement status variables also form part of the model to account for opportunities and/or constraints. The study also includes the credit-card debt, mortgage debt, and total other debt variables in the model to account for additional household constraints associated with holding debts other than student loan.

Results

Appendix Tables 3 and 4 contain the results of the random effects ordered probit model, with Mundlak correction, of the influence of student-loan debt on life satisfaction for all households. Each table shows the marginal effects and standard errors of the explanatory variables on the dependent variable. Appendix Table 3 reports the results for comparing life satisfaction for households with student-loan debt to that of households without student-loan debt, while Appendix Table 4 reports the results of the effect of the amount of student-loan debt owed on life satisfaction.

All else constant, Appendix Table 3 shows that the presence of student-loan debt decreases the probability that a household head reports "completely satisfied" with life by 0.02 or "very satisfied" with life by 0.01 compared to a household head without student debt. The presence of student-loan debt, however, increases the probability that a household head reports "somewhat satisfied" with life by 0.02 compared to a household head without student debt. The incidence of student-loan debt also increases the probability that a household head reports "not very satisfied" or "not at all satisfied" with life compared to a household head without student debt. Overall, heads of households with student-loan debt report lower life satisfaction compared with heads of households without student-loan debt. However, considering the mean scores on the levels of life satisfaction, the presence of student-loan debt does not have a substantial economic effect on life satisfaction.

When the amount of student debt is considered, Appendix Table 4 shows that it has a statistically significant effect on life satisfaction. Given that the amount of education debt is measured as a second-degree polynomial, the results suggest that the effect of the amount of student-loan debt on life satisfaction is curvilinear rather than monotonic. Greater amounts of student-loan debt decrease the probability that a household head reports "completely satisfied" with life or "very satisfied" with life compared to a household head without student debt. In contrast, higher amounts of student-loan debt increase the probability that a household head reports "not at all satisfied" or "not very satisfied" or "somewhat satisfied" with life relative to a household head without student debt. Once again, considering the mean values on life satisfaction, the magnitude of the effect of student debt amount on life satisfaction is small for the "all households" sample.

The adverse effect of student-loan debt on life satisfaction moves in tandem with the hypothesis of the current study. The result also supports the findings of previous studies such as Kim and Chatterjee (2019), Henager and Wilmarth (2018), Dugan and Marken (2014), and Xiao et al. (2009). According to the human capital theory, a household that anticipates the marginal cost of college education to be less than or equal to the marginal benefits to be derived from college would want to invest in postsecondary education. When the household is financially constrained, the life-cycle theory of savings and consumption suggests that the household can borrow to pay for college to smooth consumption. The borrowings, however, serve as a constraint to the utility maximization of the household, and the results of the current study suggest that this constraint tends to influence life satisfaction of the head of household negatively.

Unlike student-loan debt, the results in Appendix Table 3 show, albeit less substantial economically, that mortgage debt is associated positively with the probability that a household head reports "very satisfied" or "completely satisfied" with life. The presence of mortgage and education debts is a constraint to the utility function of the household. However, mortgage and student debt pertain to housing and human capital investment respectively, making the differing direction of their effects on life satisfaction not entirely surprising. One may attribute the differences to the fact that student-loan debt is associated with greater uncertainty of benefits, whereas mortgage debt is associated more with the certainty of immediate benefits.

The results also show that both student-loan debt and credit-card debt are associated negatively with the probability that a household head reports "very satisfied" or "completely satisfied" with life. Kim and Chatterjee (2019) also find a negative association between credit-card debt and life satisfaction. Perhaps, the burden of making regular interest disbursements and principal repayments on the student-loan debt, amidst the uncertainties, induces financial distress, anxiety, and hardship as pointed out by Bricker and

Table 3 Random effects ordered probit model with Mundlak correction for life satisfaction (Model 1)—all households

	Not at all satisfied M. effects (S.E.)	Not very satisfied M. effects (S.E.)	Somewhat satisfied M. effects (S.E.)	Very satisfied M. effects (S.E.)	Completely satisfied M. effects (S.E.)
Main explanatory variable					
Student loan dummy	0.0020***	0.0044***	0.0178***	− 0.0053***	− 0.0189***
	(0.0001)	(0.0003)	(0.0013)	(0.0004)	(0.0014)
Other explanatory variables					
Married (versus not married)	− 0.0102***	− 0.0220***	− 0.0895***	0.0269***	0.0948***
	(0.0003)	(0.0006)	(0.0022)	(0.0007)	(0.0023)
Employed	− 0.0036***	− 0.0078***	− 0.0319***	0.0096***	0.0338***
	(0.0001)	(0.0003)	(0.0012)	(0.0004)	(0.0013)
Retired	− 0.0029***	− 0.0064***	− 0.0259***	0.0078***	0.0274***
	(0.0002)	(0.0004)	(0.0016)	(0.0005)	(0.0017)
Net assets ($1 m)	− 0.0008***	− 0.0018***	− 0.0073***	0.0022***	0.0078***
	(0.0001)	(0.0001)	(0.0005)	(0.0002)	(0.0006)
Credit-card debt ($10 k)	0.0011***	0.0023***	0.0093***	− 0.0028***	− 0.0098***
	(0.0001)	(0.0001)	(0.0006)	(0.0002)	(0.0006)
Mortgage debt ($1 m)	− 0.0011*	− 0.0025*	− 0.0101*	0.0030*	0.0107*
	(0.0007)	(0.0015)	(0.0061)	(0.0018)	(0.0064)
Total other debt ($10 k)	0.0003***	0.0006***	0.0023***	− 0.0007***	− 0.0024***
	(0.0000)	(0.0000)	(0.0002)	(0.0001)	(0.0002)
Race (1 = White)	0.0013***	0.0028***	0.0116***	− 0.0035***	− 0.0123***
	(0.0001)	(0.0003)	(0.0010)	(0.0003)	(0.0011)
Age	− 0.0005***	− 0.0011***	− 0.0046***	0.0013***	0.0050***
	(0.0001)	(0.0003)	(0.0010)	(0.0003)	(0.0011)
Education (years)	0.0010***	0.0021***	0.0086***	− 0.0026***	− 0.0091***
	(0.0001)	(0.0003)	(0.0011)	(0.0003)	(0.0012)
Number of children	− 0.0008***	− 0.0018***	− 0.0072***	0.0022***	0.0077***
	(0.0001)	(0.0002)	(0.0007)	(0.0002)	(0.0008)
Household income ($100 k)	− 0.0001	− 0.0001	− 0.0006	0.0002	0.0006
	(0.0001)	(0.0002)	(0.0008)	(0.0002)	(0.0008)
Health status (versus poor)					
Fair	− 0.0077***	− 0.0166***	− 0.0678***	0.0204***	0.0718***
	(0.0002)	(0.0005)	(0.0019)	(0.0006)	(0.0020)
Good	− 0.0151***	− 0.0327***	− 0.1334***	0.0400***	0.1412***
	(0.0003)	(0.0005)	(0.0019)	(0.0007)	(0.0020)
Very good	− 0.0192***	− 0.0415***	− 0.1692***	0.0508***	0.1792***
	(0.0003)	(0.0005)	(0.0020)	(0.0007)	(0.0021)
Excellent	− 0.0224***	− 0.0485***	− 0.1976***	0.0593***	0.2092***
	(0.0003)	(0.0006)	(0.0023)	(0.0008)	(0.0024)

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied. Wave dummies and the panel-level means of all time-varying explanatory variables are included in the model, but are not shown here. Marginal (M) effects are shown along with standard errors (S.E)

***Indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N = 31,608

Thompson (2016), Despard et al. (2016), and Archuleta et al. (2013).

Most of the results for the other explanatory variables in Appendix Tables 3 and 4 show statistically significant effects on life satisfaction. For instance, being retired increases the probability that a household head is "very satisfied" or "completely satisfied" with life compared to not being retired. Employed household heads have a greater probability of being "very satisfied" or "completely satisfied" with life compared to household heads who are not employed. Compared to non-married household heads, being married increases the probability that a household head is "very satisfied" or "completely satisfied" with life. Compared to a household head with poor health status, a household head with fair, good, very good, or excellent health status has a greater probability of reporting "very satisfied" or "completely satisfied" with life.

Table 4 Random effects ordered probit model with Mundlak correction for life satisfaction (Model 2)—all households

	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)
Main explanatory variable					
Student loan amount ($10 k)	0.0006***	0.0014***	0.0057***	− 0.0017***	− 0.0061***
	(0.0000)	(0.0001)	(0.0003)	(0.0001)	(0.0004)
Other explanatory variables					
Married (versus not married)	− 0.0102***	− 0.0221***	− 0.0899***	0.0270***	0.0952***
	(0.0003)	(0.0006)	(0.0022)	(0.0007)	(0.0023)
Employed	− 0.0036***	− 0.0078***	− 0.0319***	0.0095***	0.0337***
	(0.0001)	(0.0003)	(0.0012)	(0.0004)	(0.0013)
Retired	− 0.0029***	− 0.0063***	− 0.0256***	0.0077***	0.0271***
	(0.0002)	(0.0004)	(0.0016)	(0.0005)	(0.0017)
Net assets ($1 m)	− 0.0008***	− 0.0018***	− 0.0072***	0.0022***	0.0076***
	(0.0001)	(0.0001)	(0.0005)	(0.0002)	(0.0006)
Credit-card debt ($10 k)	0.0010***	0.0022***	0.0091***	− 0.0027***	− 0.0097***
	(0.0001)	(0.0001)	(0.0006)	(0.0002)	(0.0006)
Mortgage debt ($1 m)	− 0.0011	− 0.0024	− 0.0096	0.0029	0.0101
	(0.0007)	(0.0015)	(0.0061)	(0.0018)	(0.0064)
Total other debt ($10 k)	0.0003***	0.0006***	0.0022***	− 0.0007***	− 0.0024***
	(0.0000)	(0.0000)	(0.0002)	(0.0001)	(0.0002)
Race (1 = White)	0.0012***	0.0027***	0.0110***	− 0.0033***	− 0.0116***
	(0.0001)	(0.0003)	(0.0010)	(0.0003)	(0.0011)
Age	− 0.0005***	− 0.0011***	− 0.0045***	0.0013***	0.0049***
	(0.0001)	(0.0025)	(0.0010)	(0.0003)	(0.0011)
Education (years)	0.0009***	0.0018***	0.0075***	− 0.0023***	− 0.0080***
	(0.0001)	(0.0003)	(0.0011)	(0.0003)	(0.0012)
Number of children	− 0.0008***	− 0.0017***	− 0.0071***	0.0021***	0.0075***
	(0.0001)	(0.0002)	(0.0007)	(0.0002)	(0.0008)
Household income ($100 k)	− 0.0001	− 0.0002	− 0.0007	0.0003	0.0007
	(0.0001)	(0.0002)	(0.0008)	(0.0002)	(0.0008)
Health status (versus poor)					
Fair	− 0.0077***	− 0.0167***	− 0.0679***	0.0204***	0.0719***
	(0.0002)	(0.0005)	(0.0019)	(0.0006)	(0.0020)
Good	− 0.0151***	− 0.0328***	− 0.1335***	0.0401***	0.1413***
	(0.0003)	(0.0005)	(0.0019)	(0.0007)	(0.0020)
Very good	− 0.0192***	− 0.0416***	− 0.1693***	0.0508***	0.1793***
	(0.0003)	(0.0005)	(0.0020)	(0.0007)	(0.0021)
Excellent	− 0.0224***	− 0.0486***	− 0.1979***	0.0594***	0.2096***
	(0.0003)	(0.0006)	(0.0023)	(0.0008)	(0.0024)

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied. Wave dummies and the panel-level means of all time-varying explanatory variables are included in the model, but are not shown here. Marginal (M) effects are shown along with standard errors (S.E)

***Indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N = 31,608

Sensitivity Analyses

Retired Households

Appendix Tables 5 and 6 contain the results of the sensitivity analyses on the effect of student-loan debt on life satisfaction for retired households. Appendix Table 6 shows that the curvilinear effect of the amount of student-loan debt on life satisfaction for all households also holds for retired households. Specifically, greater amounts of student-loan debt decrease

the probability that the head of a retired household reports "completely satisfied" or "very satisfied" with life by 0.05 and 0.01, respectively. The level of student debt, however, increases the probability that the head of a retired household reports "not at all satisfied" or "not very satisfied" or "somewhat satisfied" with life compared to that of the head of a retired household without student debt.

The analysis for all households shows that retirees are more satisfied with life than non-retirees. However, Appendix Table 5 shows that the presence of student-loan

Table 5 Random effects ordered probit model with Mundlak correction for life satisfaction (Model 1)—retired households

	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)
Main explanatory variable					
Student loan dummy	0.0098*** (0.0006)	0.0187*** (0.0011)	0.0800*** (0.0047)	− 0.0133*** (0.0009)	− 0.0952*** (0.0056)
Other explanatory variables					
Married (versus not married)	− 0.0159*** (0.0007)	− 0.0304*** (0.0012)	− 0.1299*** (0.0050)	0.0216*** (0.0010)	0.1545*** (0.0060)
Net assets ($1 m)	− 0.0003** (0.0001)	− 0.0006** (0.0003)	− 0.0026** (0.0011)	0.0004** (0.0002)	0.0031** (0.0013)
Credit-card debt ($10 k)	0.0014*** (0.0002)	0.0027*** (0.0003)	0.0115*** (0.0015)	− 0.0019*** (0.0002)	− 0.0137*** (0.0017)
Mortgage debt ($1 m)	0.0002 (0.0022)	0.0004 (0.0041)	0.0019 (0.0177)	− 0.0003 (0.0029)	− 0.0023 (0.0210)
Total other debt ($10 k)	0.0014*** (0.0001)	0.0026*** (0.0002)	0.0112*** (0.0011)	− 0.0019*** (0.0002)	− 0.0133*** (0.0013)
Race (1 = White)	0.0009*** (0.0003)	0.0016*** (0.0005)	0.0071*** (0.0022)	− 0.0012*** (0.0004)	− 0.0084*** (0.0026)
Age	− 0.0020*** (0.0003)	− 0.0037*** (0.0005)	− 0.0158*** (0.0023)	0.0026*** (0.0004)	0.0188*** (0.0027)
Education (years)	0.0003*** (0.0000)	0.0005*** (0.0001)	0.0021*** (0.0003)	− 0.0004*** (0.0001)	− 0.0025*** (0.0004)
Number of children	− 0.0076*** (0.0004)	− 0.0144*** (0.0008)	− 0.0612*** (0.0033)	0.0103*** (0.0006)	0.0734*** (0.0039)
Household income ($100 k)	− 0.0013*** (0.0003)	− 0.0025*** (0.0006)	− 0.0106*** (0.0025)	0.0022*** (0.0005)	0.0123*** (0.0029)
Health status (versus poor)					
Fair	− 0.0088*** (0.0004)	− 0.0168*** (0.0007)	− 0.0720*** (0.0030)	0.0120*** (0.0006)	0.0857*** (0.0036)
Good	− 0.0156*** (0.0005)	− 0.0299*** (0.0008)	− 0.1278*** (0.0032)	0.0213*** (0.0008)	0.1520*** (0.0038)
Very good	− 0.0204*** (0.0006)	− 0.0389*** (0.0009)	− 0.1663*** (0.0035)	0.0277*** (0.0010)	0.1978*** (0.0041)
Excellent	− 0.0270*** (0.0007)	− 0.0515*** (0.0012)	− 0.2204*** (0.0043)	0.0367*** (0.0013)	0.2622*** (0.0051)

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied. Wave dummies and the panel-level means of all time-varying explanatory variables are included in the model, but are not shown here. Marginal (M) effects are shown along with standard errors (S.E)

***Indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N = 4508

debt has an adverse effect on the life satisfaction of retired-household heads with student-loan debt compared to retired-household heads without student-loan debt. Specifically, the probability that the head of a retired household with student-loan debt reports "completely satisfied" with life decreases by 0.10 compared to that of the head of a retired household without student debt. This is unlike the negative 0.02 marginal effects associated with the student-loan debt dummy variable for all households. Considering the mean score on "completely satisfied" with life of 0.24, the results show that having student-loan debt on the balance sheet of a retired household does not only have a statistical significance, but also an economic significance on the utility of the retired household.

Overall, the sensitivity analysis suggests that the effect of student debt on the life satisfaction of retired-household heads is large, while that for all households is moderate. The results lend support to the statement that retirees have different financial situations (Hira and Mugenda 1998) compared to other households, necessitating the need for retired households to adopt appropriate financial behaviors to maintain their well-being.

Table 6 Random effects ordered probit model with Mundlak correction for life satisfaction (Model 2)—retired households

	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)
Main explanatory variable					
Student loan amount ($10 k)	0.0052*** (0.0004)	0.0099*** (0.0007)	0.0428*** (0.0032)	− 0.0069*** (0.0005)	− 0.0509*** (0.0038)
Other explanatory variables					
Married (versus not married)	− 0.0160*** (0.0007)	− 0.0306*** (0.0012)	− 0.1309*** (0.0050)	0.0219*** (0.0011)	0.1556*** (0.0060)
Net assets ($1 m)	− 0.0003** (0.0001)	− 0.0006** (0.0003)	− 0.0025** (0.0011)	0.0004** (0.0002)	0.0030** (0.0013)
Credit-card debt ($10 k)	0.0014*** (0.0002)	0.0027*** (0.0003)	0.0116*** (0.0015)	− 0.0019*** (0.0003)	− 0.0137*** (0.0017)
Mortgage debt ($1 m)	0.0002 (0.0022)	0.0004 (0.0041)	0.0018 (0.0177)	− 0.0003 (0.0030)	− 0.0021 (0.0210)
Total other debt ($10 k)	0.0014*** (0.0001)	0.0027*** (0.0003)	0.0115*** (0.0011)	− 0.0019*** (0.0002)	− 0.0137*** (0.0013)
Race (1 = White)	0.0008*** (0.0003)	0.0016*** (0.0005)	0.0068*** (0.0022)	− 0.0011*** (0.0004)	− 0.0081*** (0.0026)
Age	− 0.0019*** (0.0003)	− 0.0037*** (0.0005)	− 0.0156*** (0.0023)	0.0026*** (0.0004)	0.0186*** (0.0027)
Education (years)	0.0003*** (0.0000)	0.0005*** (0.0001)	0.0022*** (0.0003)	− 0.0004*** (0.0001)	− 0.0026*** (0.0004)
Number of children	− 0.0075*** (0.0004)	− 0.0144*** (0.0008)	− 0.0615*** (0.0033)	0.0103*** (0.0006)	0.0731*** (0.0039)
Household income ($100 k)	− 0.0013*** (0.0003)	− 0.0025*** (0.0006)	− 0.0105*** (0.0025)	0.0022*** (0.0005)	0.0122*** (0.0029)
Health status (versus poor)					
Fair	− 0.0089*** (0.0004)	− 0.0170*** (0.0007)	− 0.0726*** (0.0030)	0.0122*** (0.0006)	0.0863*** (0.0036)
Good	− 0.0156*** (0.0005)	− 0.0299*** (0.0008)	− 0.1278*** (0.0032)	0.0214*** (0.0008)	0.1519*** (0.0038)
Very good	− 0.0204*** (0.0006)	− 0.0389*** (0.0009)	− 0.1663*** (0.0035)	0.0278*** (0.0010)	0.1977*** (0.0041)
Excellent	− 0.0270*** (0.0007)	− 0.0516*** (0.0012)	− 0.2208*** (0.0043)	0.0370*** (0.0013)	0.2625*** (0.0051)

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied. Wave dummies and the panel-level means of all time-varying explanatory variables are included in the model, but are not shown here. Marginal (M) effects are shown along with standard errors (S.E)

**Indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N = 4508

Using Student Debt Percentage of Income

As a robustness check, the study also estimates the effect of student debt as a percentage of household income on the life satisfaction of the head of household. The results are reported in Appendix Tables 7 (for all households) and 8 (for retired households). Compared to the means of 35% for all households and 2% for retired households, the sizes of the marginal effects are small.[3] Nonetheless, the results show

that student debt is associated negatively with being "very satisfied" or "completely satisfied" with life, even when it is measured as a percentage of household income.

Conclusion

The current research examines the relationship between student-loan debt and life satisfaction among U.S. households. The study uses longitudinal data sets from four waves, 2011, 2013, 2015, and 2017, of the U.S Panel Study of Income Dynamics for the analysis. To obtain the empirical results, two main random effects ordered probit models

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[3] The means for student debt percentage of household income are not shown in the Table for descriptive statistics.

Table 7 Random effects ordered probit model with Mundlak correction for life satisfaction (sensitivity)—all households

	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)
Main explanatory variable					
Student debt percentage of total household income	2.76×10^{-8}** (0.0000)	6.04×10^{-8}** (0.0000)	2.46×10^{-7}** (0.0000)	-7.35×10^{-8}** (0.0000)	-2.60×10^{-7}* (0.0000)
Other explanatory variables					
Married (versus not married)	− 0.0099*** (0.0003)	− 0.0217*** (0.0006)	− 0.0884*** (0.0022)	0.0265*** (0.0007)	0.0936*** (0.0023)
Employed	− 0.0037*** (0.0001)	− 0.0080*** (0.0003)	− 0.0326*** (0.0012)	0.0098*** (0.0004)	0.0345*** (0.0013)
Retired	− 0.0030*** (0.0002)	− 0.0066*** (0.0004)	− 0.0267*** (0.0016)	0.0080*** (0.0005)	0.0282*** (0.0017)
Net assets ($1 m)	− 0.0008*** (0.0000)	− 0.0018*** (0.0001)	− 0.0075*** (0.0005)	0.0022*** (0.0002)	0.0079*** (0.0006)
Credit-card debt ($10 k)	0.0011*** (0.0000)	0.0023*** (0.0001)	0.0095*** (0.0006)	− 0.0029*** (0.0002)	− 0.0101*** (0.0006)
Mortgage debt ($1 m)	− 0.0013** (0.0007)	− 0.0029** (0.0015)	− 0.0119** (0.0061)	0.0036** (0.0018)	0.0127** (0.0064)
Total other debt ($10 k)	0.0003*** (0.0000)	0.0006*** (0.0000)	0.0023*** (0.0002)	− 0.0007*** (0.0001)	− 0.0024*** (0.0002)
Race (1 = White)	0.0011*** (0.0001)	0.0025*** (0.0003)	0.0102*** (0.0010)	− 0.0031*** (0.0003)	− 0.0108*** (0.0011)
Age	− 0.0005*** (0.0001)	− 0.0011*** (0.0003)	− 0.0046*** (0.0010)	0.0013*** (0.0010)	0.0049*** (0.0011)
Education (years)	0.0011*** (0.0001)	0.0023*** (0.0003)	0.0094*** (0.0011)	− 0.0028*** (0.0003)	− 0.0100*** (0.0012)
Number of children	− 0.0009*** (0.0001)	− 0.0019*** (0.0002)	− 0.0077*** (0.0007)	0.0023*** (0.0002)	0.0081*** (0.0008)
Health status (versus poor)					
Fair	− 0.0077*** (0.0002)	− 0.0168*** (0.0005)	− 0.0682*** (0.0019)	0.0204*** (0.0006)	0.0721*** (0.0020)
Good	− 0.0150*** (0.0003)	− 0.0329*** (0.0005)	− 0.1338*** (0.0019)	0.0400*** (0.0007)	0.1416*** (0.0020)
Very good	− 0.0190*** (0.0003)	− 0.0416*** (0.0005)	− 0.1694*** (0.0020)	0.0507*** (0.0007)	0.1794*** (0.0021)
Excellent	− 0.0222*** (0.0003)	0.0486*** (0.0006)	− 0.1978*** (0.0023)	0.0592*** (0.0008)	0.2094*** (0.0024)

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied. Wave dummies and the panel-level means of all time-varying explanatory variables are included in the model, but are not shown here. Marginal (M) effects are shown along with standard errors (S.E)

**Indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N = 31,568

with Mundlak correction are estimated in the current paper. For each model, the study also incorporates Wooldridge's (2010) suggestion for estimating random effects using unbalanced panel data. A dummy variable indicating the presence of student-loan debt forms the main explanatory variable for the first main model, while the amount of student debt owed constitutes the main explanatory variable for the second main model.

The findings for all households indicate that the availability of student debt on the balance sheet of a household decreases the probability that the head of household is "completely satisfied" or "very satisfied" with life compared to

the head of household without student debt. Conversely, it increases the probability that a household head is either "not at all satisfied," "not very satisfied," or "somewhat satisfied" with life. The results, using the amount of student debt, show that greater amounts of student-loan debt decrease the probability that the head of household will report a higher level of life satisfaction. The results suggest that although student-loan debt can help households enhance their human capital capabilities, the debt limits the ability of households to maximize their utility. Presumably, the uncertainty associated with borrowing to invest in human capital, the burden of repayment, and the financial constraint associated with

Table 8 Random effects ordered probit model with Mundlak correction for life satisfaction (sensitivity)—retired households

	Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Completely satisfied
	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)	M. effects (S.E.)
Main explanatory variable					
Student debt percentage of total household income	4.25×10^{-5}*** (0.0000)	0.0001*** (0.0000)	0.0004*** (0.0000)	− 0.0001*** (0.0000)	− 0.0004*** (0.0000)
Other explanatory variables					
Married (versus not married)	− 0.0158*** (0.0007)	− 0.0309*** (0.0012)	− 0.1321*** (0.0050)	0.0215*** (0.0010)	0.1573*** (0.0060)
Net assets ($1 m)	− 0.0003*** (0.0001)	− 0.0007*** (0.0003)	− 0.0029*** (0.0011)	0.0005*** (0.0002)	0.0035*** (0.0013)
Credit-card debt ($10 k)	0.0015*** (0.0002)	0.0029*** (0.0003)	0.0124*** (0.0015)	− 0.0020*** (0.0002)	− 0.0147*** (0.0017)
Mortgage debt ($1 m)	0.0009 (0.0021)	0.0017 (0.0041)	0.0075 (0.0177)	− 0.0012 (0.0029)	− 0.0089 (0.0210)
Total other debt ($10 k)	0.0013*** (0.0001)	0.0025*** (0.0003)	0.0106*** (0.0011)	− 0.0017*** (0.0017)	− 0.0126*** (0.0013)
Race (1 = White)	0.0007*** (0.0003)	0.0014*** (0.0005)	0.0059*** (0.0022)	− 0.0010*** (0.0004)	− 0.0070*** (0.0026)
Age	− 0.0019*** (0.0003)	− 0.0037*** (0.0005)	− 0.0158*** (0.0023)	0.0026*** (0.0004)	0.0189*** (0.0027)
Education (years)	0.0001** (0.0000)	0.0002** (0.0001)	0.0007** (0.0003)	− 0.0001 (0.0000)	− 0.0008** (0.0004)
Number of children	− 0.0074*** (0.0004)	− 0.0145*** (0.0008)	− 0.0620*** (0.0033)	0.0101*** (0.0006)	0.0738*** (0.0039)
Health status (versus poor)					
Fair	− 0.0085*** (0.0004)	− 0.0170*** (0.0007)	− 0.0714*** (0.0030)	0.0116*** (0.0006)	0.0850*** (0.0036)
Good	− 0.0152*** (0.0005)	− 0.0297*** (0.0008)	− 0.1271*** (0.0032)	0.0207*** (0.0008)	0.1523*** (0.0038)
Very good	− 0.0197*** (0.0005)	− 0.0386*** (0.0009)	− 0.1651*** (0.0035)	0.0269*** (0.0010)	0.1966*** (0.0041)
Excellent	− 0.0264*** (0.0007)	− 0.0517*** (0.0012)	− 0.2209*** (0.0043)	0.0360*** (0.0013)	0.2630*** (0.0051)

Author's analysis using the 2011 to 2017 PSID. Survey weights are applied. Wave dummies and the panel-level means of all time-varying explanatory variables are included in the model, but are not shown here. Marginal (M) effects are shown along with standard errors (S.E)

**Indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N = 4502

having the student-loan debt makes consumption smoothing and the resulting utility maximization difficult to attain.

The results for the retired households reveal that the life satisfaction of retired-household heads also is influenced adversely by student-loan debt. The key difference between the empirical results for all households and the retired households is that the effect of student-loan debt on life satisfaction for retired households is large, but that for all households shows moderate economic significance.

The current study makes the following recommendations based on the empirical results obtained in this research. Financial planners and educators could consider advising households about the consequences of holding student-loan debt on life satisfaction. Given the prevalence of financial illiteracy (Lusardi and Mitchell 2011), it might be the case

that many households have little to no idea regarding the adverse effect that student debt may have on life satisfaction. Awareness of the potential negative effects of student-loan debt may help households to use student debt more responsibly. For the retired households, the large effect of student debt on life satisfaction suggests that financial planners and educators could consider helping or advising clients not to carry student debt into retirement or incur the same while in retirement.

More efforts also could be made to encourage households to save for college education. The current extension of the 529 savings plan to cover secondary education is good, but it may not necessarily encourage non-savers to save for college. A policy such as automatic enrollment, which is being utilized to encourage retirement

savings currently, may be explored as a mechanism to help more households save for college. Tax incentives could be offered to boost enrollment. When college savings increase, the use of student debt may decrease, and the life satisfaction of household heads may increase. This assertion may hold because the current study finds that household heads with student debt have a lower probability of reporting "completely satisfied" with life, compared to households without student-loan debt.

In addition, users of student-loan debt may be assigned financial mentors to guide them to utilize the loans they acquire in their academic pursuits and financial behaviors efficiently. Research shows that financial education may improve financial behavior (Wagner and Walstad 2019; Xiao and O'Neill 2016; Lusardi and Mitchell 2014). Therefore, it is expected that offering customized financial education to student debt borrowers could help them appreciate the uncertainties associated with human capital investment, and possibly help them to make the right financing choices.

This paper also recommends that households consider the affordability of the college they plan to attend. There are several accredited postsecondary institutions in the United States with varied costs of attendance. It is, therefore, essential for financially constrained households to consider attending less expensive colleges that they could graduate with zero or less debt. Households also could prioritize maximizing financial aid, including taking advantage of all scholarship opportunities available. Some colleges and universities offer work-study opportunities, and this option could be explored as well in choosing the type of institution to attend.

The following are some of the limitations that one may observe from the current study along with the suggestions for future research. The negative effect of student-loan debt on life satisfaction might not be conclusive. There are possibilities that the head of households with student-loan debt has a lower level of life satisfaction momentarily from the start to the period of final repayment. They may likely begin to experience high levels of life satisfaction after repaying the student-loan debt. Future studies may explore, longitudinally, whether the life satisfaction of household heads improve after the households have discharged their student loan indebtedness.

The PSID data set does not make a distinction regarding the type(s) of student loan a household holds on its balance sheet. Different student loan programs may have different effects on the life satisfaction of the household head. Future research may consider examining the effect of the different forms of student loan programs on the life satisfaction of the household head using a longitudinal data set. Regarding retirees, the data set does not show whether the student debt is for their personal education or the education of their children. Future studies may consider making this distinction if data set is available.

Despite these limitations, the current study complements the existing studies to show that student debt could influence life satisfaction adversely. This negative effect is observed even after incorporating Mundlak correction and Wooldridge's (2010) suggestion to improve upon the model estimation technique used by Kim and Chatterjee (2019).

Appendix

See Tables 1, 2, 3, 4, 5, 6, 7 and 8.

Availability of Data and Materials This paper uses the publicly available Panel Study for Income Dynamics data set. It can be found here: https://simba.isr.umich.edu/default.aspx.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

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