Debt Burden after College

The Effect of Student Loan Debt on Graduates' Employment, Additional Schooling, Family Formation, and Home Ownership

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Borrowing among 2007-08 bachelor's degree recipients

- Two-thirds of students receiving their bachelor's degree take out loans to fund their postsecondary education.
- Average amount borrowed as of 2007-08 = $24,700 in federal and private loans, which is about $29,000 in 2018 dollars.

Research Question

What are the effects of student loan debt on bachelor's degree recipients' employment, post-bachelor's enrollment, family formation, home ownership, and net worth four years after graduation?

Data

- B&B:08/12 is a nationally representative longitudinal survey of approximately 17,000 students representing the 1.6 million students who completed the requirements for a bachelor's degree during the 2007–08 academic year.
- Interviewed three times:
  - near the end of their senior year in college in 2007–08,
  - approximately one year later in 2009–10, and
  - again approximately four years later in 2012–13.
- This cohort is particularly relevant because it includes students who graduated in 2007–08, at the beginning of the Great Recession, amid a poor job market and with more limited access to credit.

Additional data sources

- Postsecondary institutional records
- The federal National Student Loan Data System (NSLDS)
- The Integrated Postsecondary Education Data System (IPEDS), which is also administered by NCES
- The American Fact Finder at the U.S. Census Bureau

Analysis sample

- First-time bachelor's degree recipients
  - 94%
- Responded to both follow-up interviews
  - N~12,580
- Panel analysis weight (WTE000)
  - Adjusts for the unequal probability of students participating in all three waves of the study, making our sample nationally representative, even given the survey non-respondents

Treatment variable

- Cumulative amount of debt borrowed for the graduate's 2007–08 bachelor's degree.
  - Primary source is NSLDS
  - Private loan info from survey
  - Includes all loans (public and private) taken for undergraduate education through 2008
    - Except for federal Parent PLUS loans, which are taken out in the parent's name, and thus not required to be repaid by the student
- About one third of the sample did not borrow to finance their bachelor's degree
- Among the two-thirds that did borrow:
  - The bottom third borrowed less than $16,000,
  - The middle third borrowed between $16,000 and $28,000, and
  - The top third borrowed between $28,000 and $150,000 in loans

Methodological challenge

- Amount borrowed is endogenous
- OLS model will produce biased estimates of the effect of debt on outcomes
- To correct for endogeneity, we use a two-stage least squares (2SLS) instrumental variables approach
  - This approach involves identifying a variable that predicts undergraduate debt amount but is otherwise uncorrelated with post-bachelor's degree outcomes and is also uncorrelated with any unobserved factors affecting the outcomes
  - To the extent that the instrumental variable predicts debt amount but is otherwise unrelated to post-bachelor's outcomes, the instrument can serve as an alternative to random assignment for a non-experimental identification strategy

How does IV work?

- For any endogenous regressor, there are some aspects of it that are randomly assigned
- IV creates a variable that is correlated to your variable of interest, but only captures the random aspects of it
- Using the fitted value of the endogenous predictor from the first stage allows you to make **causal claims** about the effect of the endogenous predictor (assuming you have a valid instrument)

Instrumental variable

- **IV = enrollment-weighted average in-state public tuition over the four years prior to bachelor's degree attainment**
- Calculated as the average of in-state tuition and mandatory fees at all public 4-year institutions in a graduate's home state, weighted by undergraduate enrollment size at each institution, summed over the previous four years before graduation (2004-05 to 2007-08)

Control variables

- Student-level
  - Sex, race/ethnicity, dependency status, age, parental education, family income, college admissions test scores, attendance intensity, field of study
- Institution-level
  - Postsecondary institution type and selectivity
- Regional characteristics
  - Characteristics of the home zip code, including racial composition, educational attainment, unemployment rate, median family income, and poverty level

Empirical model

$$Post\_bachelors\_outcome_i = \beta_0 + Debt\_amount_i\beta_1 + X_i\,\beta_2 + \mu_i$$

- $Post\_bachelors\_outcome_i$ represents the dependent variable of interest (e.g., employment, earnings, additional enrollment, marriage, having children, buying a home) for graduate i;
- $Debt\_amount_i$ represents the amount of undergraduate debt incurred for graduate i;
- X_i captures observable covariates that may be related to post-bachelor's degree outcomes
- The error term, μ_i, captures unexplained variation for graduate i

Stage 1

$$Debt\_amount_i = Average\_tuition_i\alpha_1 + X_i\alpha_2 + \varepsilon_i$$

- $Debt\_amount_i$ is the amount of undergraduate debt incurred by student i
- $Average\_tuition_i$ is the average in-state public tuition in student i's state of permanent residence (weighted by undergraduate enrollment size, and summed over the four years prior to graduation)
- X_i represents student-level covariates, and
- ε_i captures unmeasured factors for student i

Stage 2

$$Post\_bachelor's\_outcome_i = \widehat{Debt\_amount_i}\ \beta_1 + X_i\beta_2 + \epsilon_i$$

- $Post\_bachelor's\_outcome_i$ is the outcome of interest for student I
- $\widehat{Debt\_amount_i}$ is the predicted debt amount from the first stage for student i
- X_i represents the same set of student-level covariates used in the first stage
- ϵ_i captures unmeasured factors for student i
- β_1 captures the average causal effect of debt on the post-college outcome of interest

IV Assumptions

Conditions that the instrument must meet to produce unbiased estimates of the treatment effect:

1. Nonzero causal effect of instrument on treatment,
2. Random assignment,
3. Exclusion restriction,
4. Monotonicity, and
5. Stable unit treatment value assumption (SUTVA)

- The instrument is able to predict treatment status
  - *Z* and T are strongly correlated
  - The first-stage *F*-statistic is statistically significant at the 0.05 level
  - The first-stage *F*-statistic exceeds the critical value for the 2SLS size of nominal 5% Wald test at the 10% level. This is a test of the null hypothesis at the 5% level that the maximum relative bias is at least 10%
- Weak instruments can produce estimates that are more biased than OLS

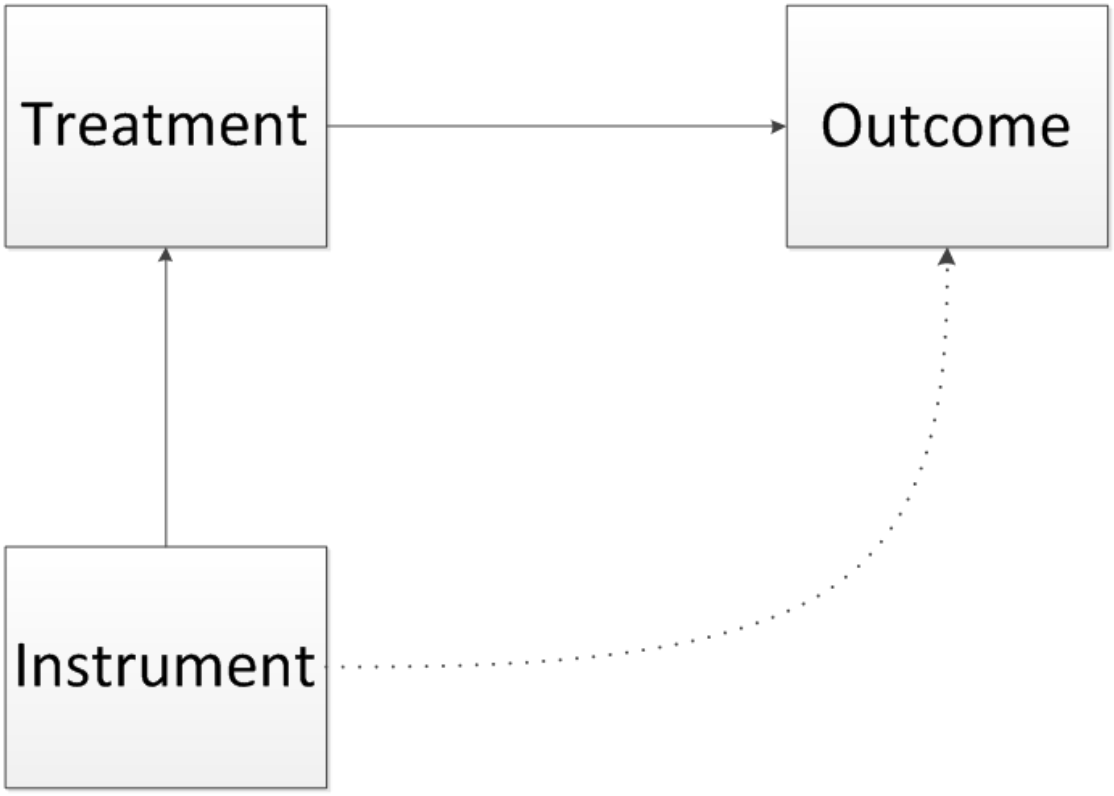
First-stage results

- The instrument is statistically significant at the $p < 0.01$ level
  - For every $1,000 increase in the sum of four years of enrollment-weighted average in-state public tuition, graduates, on average, accumulate $286 more dollars of education-related debt over the course of their undergraduate education
- The value for the first-stage *F*-statistic across specifications ranges from 38.3 to 56.8, all exceeding the critical value of 16.4
  - When an F-statistic exceeds this critical value for 2SLS models with one endogenous regressor and one instrument, the null hypothesis of having a weak instrument can be rejected with 95% confidence using a Wald test

The instrument serves to randomize cases to treatment assignment

- Or at least ignorably so, conditional on adding covariates
- Regress instruments on covariates
- If covariates and instruments are related, include covariates as controls in model

The instrument is related to the outcome only through its effect on treatment status



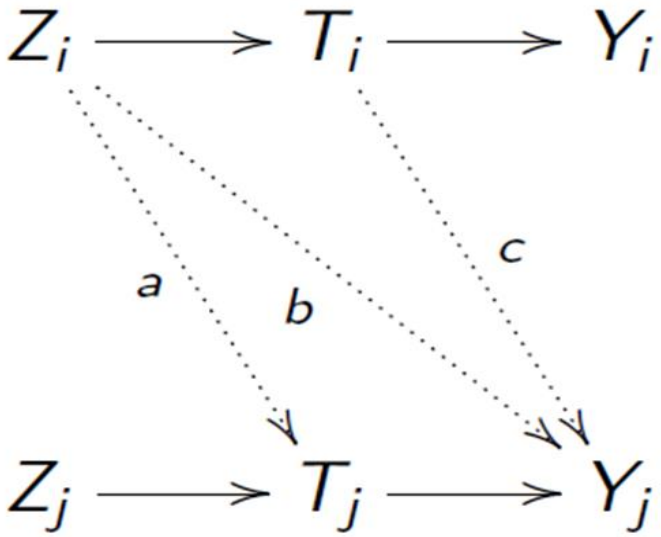
Exclusion Restriction

The effect of the instrument on the treatment condition is the same for all

- Cases who are assigned to the treatment condition take the treatment while all others do not
- Assumes no defiers
- Local Average Treatment Effect (LATE)

Treatment status not affected by instrument	Treatment status affected by instrument
Always-takers	**Compliers**
Never-takers	Defiers

Stable Unit Treatment Value Assumption



- "Noninterference" or "treatment spillover effects"
  - Potential outcomes are assumed to be unaffected by the responses to treatment or treatment-assignment status of other units in the study group
  - Violated if:

a) Assignment of Person I affects treatment of Person J

b) Assignment of Person I affects outcome of Person J

c) Treatment of Person I affects outcome of Person J

Descriptive Statistics – Selected outcomes

Variable	Mean
Employed in 2012	80.0%
Earnings in 2012 (among those employed)	$48,122
Job related to bachelor's degree major	76.4%
Job required bachelor's degree	65.3%
Ever married by 2012	44.9%
Had a child by 2012	24.4%
Own home by 2012	36.8%

Descriptive Statistics –treatment and instrument

Variable	Mean
Cumulative loan amount borrowed for undergraduate education through 2007-08	$16,495
Sum of average enrollment-weighted public tuition in home state between 2004-05 and 2007-08	$23,003

Descriptive Statistics – Selected covariates

Variable	Mean
Female	57.7%
Age when awarded bachelor's degree	25.1 years
Dependent when awarded bachelor’s degree	64.2%
College admissions test score	897.7
Enrolled exclusively full time in 2007-08	61.6%
Institution sector in 2007-08: Public 4-year	59.2%
Median family income of permanent residence zip code	$59,022.50

Coefficients for IV and OLS outcome models

Outcome	IV: Amount borrowed ($1,000s), fitted value	OLS: Amount borrowed ($1,000s)
Employed in 2012	0.00284	0.000315
	(0.00273)	(0.000269)
Percentage of months employed between bachelor's degree and 2012	0.307	0.0283
	(0.223)	(0.0183)
Percentage of months unemployed between bachelor's degree and 2012	-0.00509	0.0112
	(0.0819)	(0.00743)
Percentage of months out of the labor force between bachelor's degree and 2012	**-0.305**	**-0.0396****
	(0.204)	**(0.0170)**
Hours worked in 2012 (conditional on working)	-0.0263	-0.000912
	(0.0680)	(0.0108)

Coefficients for IV and OLS outcome models, continued

Outcome	IV Model: Amount borrowed ($1,000s), fitted value	OLS model: Amount borrowed ($1,000s)
Satisfaction with work/life balance in 2012	-0.00624	-0.000245
	(0.00408)	(0.000327)
Earnings in 2012 (logged)	**0.0103****	**0.000113**
	(0.00512)	**(0.000620)**
Satisfaction with compensation in 2012	0.00103	-0.000682
	(0.00380)	(0.000479)
Primary job in 2012 closely related to major	**0.00779*****	**-0.000196**
	(0.00300)	**(0.000268)**
Primary job in 2012 requires a BA degree	**0.0138*****	**0.000410**
	(0.00241)	**(0.000382)**
Employed in the public sector in 2012	0.00113	0.000128
	(0.00312)	(0.000321)

Employment outcomes

- For every $5,000 in additional debt, the average graduate
  - Earned 5% higher earnings
  - Was 3.9 percentage points more likely to have a job in 2012 that was related to their bachelor's degree major,
  - Was 6.9 percentage points more likely to have a job that required a bachelor's degree

Employment outcomes, continued

- The amount graduates borrowed for their education was ***not*** statistically significantly related to
  - Likelihood of being employed in 2012
  - The number of hours worked (conditional on working)
  - The percentage of time graduates spent employed, unemployed, or out of the labor force
  - The likelihood of working in the public sector
  - Job satisfaction with work/life balance
  - Job satisfaction with compensation

Employment outcomes by sex

- Female graduates who borrowed:
  - Spent more time employed in the four years after graduation
  - Spent fewer months out of the labor force.
  - Were less likely to be satisfied with their work-life balance
- Female graduates with an additional $5,000 of debt earned an average of 8.8 percent more, while among male graduates there was no statistically significant effect.
- Both male and female graduates were more likely to hold a primary job that required a bachelor's degree with increased debt, but female graduates were not significantly more likely to hold a job closely related to their college major, in contrast to male graduates.

Employment outcomes by dependency status

- With increased loan debt, **dependent** students are:
  - Less satisfied with their work/life balance,
  - Earn more, and
  - Are more likely to choose a job that requires a bachelor's degree
- With increased loan debt, **independent** students are:
  - More likely to choose a job that requires a bachelor's degree

Post-bachelor's degree enrollment

- No significant effect of debt on the likelihood of enrolling in additional education as of 2012.
  - Could indicate that there is no real relationship between debt and post-baccalaureate enrollment, or perhaps
  - The lack of a significant finding may signal that the effect of undergraduate debt on subsequent enrollment operates under differential mechanisms, inducing some graduates to avoid or delay additional enrollment while inducing others to pursue additional enrollment.
  - No significant effects for any of the subgroups investigated

Family formation

- Borrowing an additional $5,000 for postsecondary education is associated with a 7.8 percentage point lower likelihood of ever having been married as of 2012
- Graduates were 5.0 percentage points less likely to have a child in 2012 for each additional $5,000 in student loan debt
- Similar effects of the decreased likelihood of being married for both male and female graduates as well as dependent and independent graduates
- Effects on having a child, however, are only statistically significant for females

Home ownership

- Increased debt was not significantly related to whether graduates owned their own home in 2012
- The relationship between debt and home ownership was also not significant when exploring the results separately by gender and dependency status

Net Worth

"Suppose you (and your spouse/partner) were to sell all your major possessions, turn all of your investments and other assets into cash, and pay off your debts. Do you think you would have something left over, break even, or be in debt?"

- Borrowing an additional $5,000 is associated with a 6.4 percentage point increase in the likelihood of "being still in debt after selling all your possessions and assets."
- The effects are similar for male and female graduates
- The overall negative effect of debt on net worth is being driven by dependent students, as the effect of debt on net worth of independent students is not statistically significant

Alternative specifications

IV model limited to graduates who attend college in-state

- Limited to the 74% of graduates who graduated from an in-state college
- For most outcomes, estimate of the debt effect is similar in magnitude and significance to the main model, suggesting that the influence of potential noncompliers is small
- This indicates that the fact that our instrument is more correlated to debt burden for some students than others does not seem to affect our overall findings

Alternative specifications, continued

IV model limited to graduates who had not enrolled in additional education as of 2012

- Limited to those who had not enrolled in additional postsecondary education after their 2008 bachelor's degree as of 2012
- The results are very similar for those with no enrolment and the full analysis sample

Conclusion

- Student loan debt is related to some important postbaccalaureate outcomes, as measured in the four years after graduation
- There are several decisions that students make related to college that affect their level of borrowing (i.e., institution choice, living arrangements, attendance intensity, how much to work), and in order to make informed decisions, it is important that students understand the consequences of borrowing additional debt.
- The significant relationships indicate that graduates are making decisions based on their debt that they would not have otherwise made, suggesting that perhaps the choices they made were less desirable to them

Citation

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