

Higher Education Borrowing

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Using the 1992-93 Baccalaureate and Beyond Longitudinal Study and 1997 follow-up, this study examined which factors influence the decision to borrow and the amount of borrowing for higher education. A double-hurdle model was applied to analyze both the decision to borrow and the borrowed amount equations. Current income and asset holdings had generally negative impacts on higher education debt, while expected future income increased amounts borrowed. Total costs had a positive effect on the probability and the level of borrowing. Total grants received had a negative influence on amount borrowed, but a positive influence on the participation decision.

Key words: Borrowing for college costs, Credit, Double-hurdle model, College education financing, Higher education debt

Introduction

The rate at which high school graduates attend college has been growing for all income groups over the past two decades, as a college education is known to be a desirable investment to increase an individual's lifetime earnings. As of 1997, bachelor's degree recipients earned, on average, 77% more than those with only a high school diploma (National Center for Education Statistics, 1998).

Although a college degree yields significant financial benefits to the holder, an individual's chances of entering and completing college are highly dependent on his or her economic background, relative to the costs of attendance. For the 2000-01 academic year, average undergraduate charges for tuition, fees, and room and board were estimated to be \$8,470 at public four-year institutions, and \$22,541 at equivalent private institutions. Over the 10 year period ending in 2001, after adjusting for inflation, average tuition and fees for public four-year institutions rose 51%, compared to 34% for private four-year colleges. Between 1980-81 and 2000-01, tuition for both public and private four-year college increased more than 110% greater than inflation, while households' real incomes remained stagnant (Glaudieux, Swail & Dorsey, 2000a). These trends in college costs and household incomes challenge low- and middle- income families' ability to access higher education, as the share of income required to pay college costs increases.

Governments (at both the federal and state level), institutions, and other organizations have a role in

financing college education by providing financial aid. The most prominent trend in financial aid has been a growing reliance on debt-financed higher education. Loans of all types are becoming the major source of funding to enable middle-class students to go to college and student loans are now the primary means of providing a general subsidy to citizens seeking a higher education (Hartman, 1971). However, the growth in loans as a means of subsidy potentially could, however, make a college education more difficult to obtain, especially for low-income students or for those averse to risk. According to Glaudieux, Swail and Dorsey (2000b), financial aid to college students was estimated to be \$68 billion in 1999-2000, a real increase of 4% over the preceding year. Over the past decade, total financial aid increased approximately 90% in constant dollars, while the loan aid portion more than doubled, compared to a two-thirds increase in the grant aid portion. Similarly, over the past quarter century, federal student aid has evolved from a grant-based system to one which is loan-based, changing the way students' higher education is financed.

Concern is increasingly expressed regarding student debt levels and whether or not the growing dependence on loans is creating serious problems for both borrowers and society. Previous studies have shown the impact of student loans through the effects loans have on educational decisions; such as access, college choice, and persistence (Braunstein, McGrath & Pescatrice, 1999; Campaigne & Hossler, 1998; Cuccaro-Alamin & Choy, 1998; St. John, Kirshstein & Noell, 1991; St. John & Noell, 1989). However, little research has been devoted

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to study factors that influence both the decision to borrow and the amount borrowed by undergraduates or their families. Although the National Center for Education Statistics of the U.S. Department of Education has reported descriptive analyses of undergraduate federal loan borrowing (Berkner, 1998; Berkner, 2000; Choy & Geis, 1997; Choy, 2000b), research has not been reported that identifies the determinants of the decision to borrow money for one's undergraduate education and, if they borrow, how much to borrow, in a multivariate framework, so that filling that gap in the literature is the purpose of this article.

Review of Literature

Human capital theory views higher education as an investment in productive abilities, skills, and knowledge of individuals or of society as a whole (Becker, 1964; Thurow, 1970; Bryant, 1990). The theory asserts that changes in prices (e.g., tuition and fees) or subsidies (e.g., grants or loans) alter the costs of college and lead students to reassess the net benefit from incremental investments in higher education. The value of human capital is typically expressed in terms of the present value of income that individuals receive in return for their productive contributions.

Leslie and Brinkman (1988) stated that a person considering a college education has a choice between two streams of earnings over his or her lifetime. The first stream - that of a high school graduate - begins immediately but does not increase much. The other stream - that of a college graduate - has a negative income for the first four years, owing to the direct costs of college and the opportunity cost of forgone earnings. The investment period is followed by a period in which the salary may be less than that of the high school graduate, but it soon rises above the non-college educated person's income stream. If the benefit - the present value of the difference between the two income streams - is more than the total costs, the individual will choose a college education.^a In this economic framework, a rational person invests in education up to the point at which the marginal benefits of another unit of education no longer exceed its marginal costs. Thus, the changes in college attendance rates reflect changes in the marginal costs and benefits associated with the investment aspects of college attendance (Cohn, 1979; Geske, 1996; Sheehan, 1973).

Many studies have found that the demand for college attendance is negatively related to college costs (Clotfelter, Ehrenberg, Getz & Siegfried, 1991;

Ehrenberg & Smith, 1991). Leslie and Brinkman (1988) examined the variation in the effect tuition had on different income levels and found that low-income families were more responsive to changes in tuition than other families. Miller and Hexter (1985) suggested that middle-income families should consider outside assistance, by way of a financing pattern that mixes grants, loans, and student work, to fill the gap between available household resources and the full cost of attendance. Between 1980-81 and 1999-2000, tuition for public four-year colleges increased 114%, and tuition for equivalent private colleges increased 118%. Over this same time period, median income for families whose householders were between the ages of 45 and 54 rose only 20% (Glaudieux, et al., 2000a). Over the past decade, financial aid increased by almost 90% in constant dollars. Of this, loan aid has increased by 125%, compared to a 55% increase in grant aid. In 1999-2000, loans compromised 59% of total financial aid available to students, compared to 41% in 1980-81 (Glaudieux, et al., 2000b). With federal aid in the form of grants declining, college costs rising sharply, and family incomes remaining relatively stagnant, families increasingly borrow in order to pay for college. Loans provide students a way to invest in the future, and are viewed as a source of federal aid to low- and middle-income households. In the 1998-99 academic year, the federal government provided over 70% of all direct aid to postsecondary students, and almost 60% of this aid was in the form of loans (Glaudieux, et al., 2000b).

Federal student loans have limits on the maximum amounts that students may borrow; varying by dependency, class level, and type of loan. Generally, independent students are able to borrow larger amounts than dependent students by combining both subsidized and unsubsidized loans. Appendix 1 provides more details on federal loan programs. State and private loan programs increased in the 1980s, as college prices outpaced inflation and rates of income growth. Most private loan plans are directed toward parents, rather than students, because private lenders do not consider a student's potential future earnings as adequate security for a bank loan (Lee & Clery, 1999; Margolin, 1989).

Berkner (1998) described trends in student loans within the context of the total price of attendance and undergraduates' family income in the 1995-96 academic year. This descriptive study reported that students were more likely to take out loans when their tuition and other educational expenses were high, and less likely to borrow

when their family incomes were high. Among undergraduates with an annual price of attendance of \$8,000 or more, nearly 47% took out a student loan in 1995-96, borrowing an average amount of \$4,600, while about 2% of those with a price of attendance of less than \$4,000 took out a student loan, borrowing an average of \$1,600. At all income levels, independent students borrowed about \$1,000 more than dependent students.

Choy (2000) focused on low-income undergraduates, defined as those whose family income was below 125% of the federally established poverty level for their family size, and examined how they paid for college in 1995-96. The study reported that approximately 51% of the low-income students attending full-time, full-year borrowed money through any type of loan, with an average of \$4,700.

Using data collected from the Baccalaureate and Beyond (B&B) and the Beginning Postsecondary Student (BPS) surveys, Choy and Geis (1997) reported the cumulative amount borrowed for postsecondary education. They found that about 49% of those receiving a bachelor's degree in 1992-93 borrowed from some source - whether federal, state, institutional, family or other - and that their average amount borrowed was \$10,200. Graduates of private, not-for-profit institutions borrowed more, on average, than did graduates of public institutions (\$12,800 vs. \$8,700). Berkner (2000) explained that four-year colleges and universities experienced a large growth in the percentage of undergraduates borrowing between 1992-93 and 1995-96, both at public and private institutions.

Merisotis and Parker (1996) found that from 1990 to 1993, traditional college-age students - 18 to 24 years old - saw their borrowing rise by 4%, while older students experienced a 24% increase. Borrowing for White students rose by 9% between 1990 and 1993, while non-White students experienced a 19% increase. St. John and Noell (1989) analyzed the effects of different types of financial aid on the enrollment of minority students. Since Black applicants were less likely than other applicants to attend college, and since there has been speculation that the increase in the use of loans could have contributed to the downturn in Black enrollment, special consideration was given to the impact that specific types of aid had on minority applicants. They found that when loans were the only form of aid offered, there was a positive effect on the enrollment decisions for Whites and Blacks, but not for Hispanics.

In summary, previous studies have examined and analyzed trends and impacts of borrowing for higher education. The socioeconomic conditions associated with a borrower, such as his or her income, economic background, gender, race, and choice of institution, all have an effect on whether or not to borrow, and on how much is borrowed. These results will be examined further in this empirical study.

Theoretical Framework

If getting an education is considered a simple capital investment, the decision to borrow to finance this investment can be considered as a comparison of the present value of the benefits to the present value of the costs, with the interest rate determined by the cost of capital (Bodie & Merton, 1998). For students with personal or family assets, the appropriate interest rate is the aftertax rate of return on the assets, but for students without financial assets, the appropriate interest rate may be the interest rate on loans. All other things equal, including equal costs, students with higher expected future income should be more likely to borrow. For a student who plans to work for 30 years, the present value of a dollar of increased annual income would be about 13 dollars at a real interest rate of 6%, which means that higher future income should be associated with much higher amounts borrowed.

Details of a more complex theoretical framework are shown in Appendix 1. In summary, the model explains that higher education demand will be influenced by households' present resources, expected future income, prices of consumption goods, price of education, interest rates households face in the market (assumed constant), and the subjective rate of time preference. As an increase in the demand for education would directly affect the demand for debt to pay for that education, in the context of the budget constraint and preferences, theoretical expectations are thus implied for the analysis.

Empirical Model and Hypotheses

The theoretical framework demonstrates that the amount borrowed for a college education, B_i , can be a function of a household's income, asset earnings, the price of a college education, and other family characteristics affecting preferences. Expressed algebraically,

$$L = \alpha_0 + \beta_{d1} D + \beta_{r1} R_1 + \dots + \beta_{r5} R_5 + \beta_{dr1} DR_1 + \dots + \beta_{dr5} DR_5 + \beta_{cy} Y_c + \beta_c C + \beta_g G + \beta_{h1} H_1 + \dots + \beta_{h4} H_4 \quad (1)$$

where

L is the household's borrowing for 1992-93 college costs in dollar amount.

D is a dummy variable indicating dependency status: D = 1 if a student is dependent, D = 0 if a student is independent.

R_j represents variables related to the current resources of the household (total income, home equity, family business, parent's monetary assets, student's monetary assets).

Y_e is the expected future income of the student.

C is the total cost of college.

G is the amount of total grants.

H_j represents variables related to the characteristics of the household (age, gender, race, and household size).

In this study, a dummy variable for the dependency status (D) of the student interacts with each element of a vector of resources. The terms $\beta_{dr1}DR_1 \dots \beta_{dr5}DR_5$ represent interaction terms of a dummy variable for dependency status and the five variables related to household resources. The dummy variable interaction technique tests whether there exist differences in both the intercept and the slope coefficients for the two regression equations by dependency status. If the coefficients $\beta_{dr1} \dots \beta_{dr5}$ are statistically significant, the effect of a change in that resource on borrowing behavior is significantly different for dependent students compared to independent students.

The following hypotheses are posited based on the theoretical framework and previous research. Taking other socioeconomic variables into account, higher education debt is:

1. Negatively related to households' current resources (income and assets) and differently affected by dependency status.
2. Positively related to higher expected future income.
3. Positively impacted by the total costs of college attendance.
4. Total grants received reduce the need to borrow money but, due to grants being an indicator of need, increase the probability of borrowing
5. Positively associated with higher current consumption needs (younger students, larger household size).
7. Greater for non-White households than White households.

Methods

Data and Sample

The data used on this study were taken from the 1993 Baccalaureate and Beyond Longitudinal Study and the

1997 follow-up survey (B&B). The B&B study, developed by National Center for Education Statistics (2002), U.S. Department of Education, provides information concerning educational and work experiences of baccalaureate recipients following completion of their degree, as well as information concerning their undergraduate education (U.S. Department of Education, 2000). The B&B study allows an understanding of the students' education investment decision.

The sample of this study is composed of those who received bachelor's degrees in the 1992-93 academic year and, by 1997, did not enroll for additional postsecondary education, resulting in a sample of 4,524 students for analysis.^b

Variables

The first dependent variable was coded as dichotomous; 1 if the student borrowed, 0 if otherwise. For the sample of borrowers, the second dependent variable was the total amount of money borrowed for 1992-93 college expenses. It was composed of student borrowing (the amount students borrowed for their 1992-92 college expenses) and parental borrowing (the amount parents borrowed for students' college expenses). Student borrowing included loans funded by federal, state, institutional or other organizations, and loans from parents, other relatives or friends. Parental borrowing included loans sponsored by federal, state, school, as well as private sources.

Table 1 presents the measurement and description of the independent variables used. A dummy variable was used to control for dependency status. Current resources of the household included total income, home equity, family business or farm equity, parents' financial assets, and student's financial assets. Total income, as is customary in education research, was measured by the amount of the student's income if the student is independent, and by the sum of the student's own and parents' income if the student was dependent. Home equity and family business and farm equity were the other assets available to proxy wealth. If the student was dependent, the value of the parent's home or business and farm equity was reported and, if the student was independent, the value of the student's home or business and farm equity was reported. Dependent students' asset holdings were not considered because too few of dependent students had their own home, family business or farm equity. Measures of parents' liquid assets and students' liquid

assets were available for both dependent and independent students.

The student's estimated expected income was generated by regressing reported 1996 annual job income of the degree recipient against undergraduate major, GPA, institution type, region of institution, age and race. In estimating expected future income, the dependent variable was restricted to a respondent's job-related income, rather than total household income, to estimate the students' future income based on their educational attainment and related factors. Appendix 1 reports the results of the regression analysis to estimate students' future income and will not be discussed here.

Table 1.
Definitions of Independent Variables

Variables (reference group in parentheses)	Description
Dependency status (independent)	Dependent student = 1, Independent student = 0
Current resources	
Total income	Dependent students: Parents' income + students' income Independent students: Students' income
Home equity	Dependent students: Parents' home equity (few dependent students had own home equity) Independent students: Students' home equity
Family business and farm	Dependent students: Parents' business and farm equity Independent students: Students' business and farm equity
Parents' liquid assets	Parents' liquid assets, both for dependent and for independent students
Student's liquid assets	Students' liquid assets, both for dependent and for independent students
Expected Income	Respondent's income estimated as a function of undergraduate major, GPA, institution type, region, race, age) (see Appendix 3)
Price of College Attendance	
Total costs	Total amount of tuition and non-tuition costs
Total grants	Total amount of all federal, state, institutional and other grants received.
Other Characteristics	
Age	Age at receipt of bachelor's degree
Gender (female)	Male=1, Female=0
Race (non-white)	White=1, non-white=0
Household size	Number of family members

Dependent student asset holdings were not included except for liquid assets, because too few dependent students held such assets.

Two variables were related to the net price of college attendance: total costs of college education and total amount of grants received. Total costs were the sum of tuition, fees, and other direct costs of attendance, such as the amount spent for books, supplies, and equipment.

The total amount of grants received was equal to the sum of federal, state, institutional, and other grants.

Other characteristics included gender, age, race and household size. Continuous variables were used for age and household size, while dummy variables were used to control for gender and race.

Double-Hurdle Model

Many students did not borrow to fund their education, so the variable for the amount of borrowing by contained a large proportion observations at zero. When a dependent variable has zero for a significant fraction of the observations, ordinary least squares regression is inappropriate since it would lead to biased and inconsistent estimates (Greene, 2000). In order to model such a distribution, an empirical method is needed to account for the probability of non-occurrence of the event. The Tobit model has been traditionally used when the data censors at zero. In the Tobit model, however, a variable that increases the probability of a non-zero observation also increases the mean of the dependent variable (Breen, 1996; Greene, 2000). Given this, the double-hurdle model, proposed by Cragg (1971), has proven superior to the Tobit model for models where the participation decision is different from the level of participation (Jones, 1989; Flood & Gråsjö, 1998; Sharpe, et al., 2001), yet they are dependent, sequential decisions. Such is the case under consideration.

The logic of the double-hurdle model is appropriate when individuals must pass a separate hurdle before they are observed to have a positive level of borrowing; the decision to borrow and the level of borrowing. In this study, the double-hurdle model is specified as follows:

Decision to borrow equation:

$$\begin{aligned} P^* &= X\beta \alpha & (2) \\ P &= 0 \text{ if } P^* \leq 0 \\ P &= 1 \text{ if } P^* > 0 \end{aligned}$$

Level of borrowing equation:

$$\begin{aligned} B^* &= X\beta \beta & (3) \\ B &= B^* \text{ if } P = 1 \\ B &= \text{not observed if } P = 0 \end{aligned}$$

where $X\beta$ and $X\beta$ represent the independent variables that influence the decision to borrow and the level of borrowing, and α and β represent the unknown parameters. We observe P , a dichotomous variable, which is the realization of an unobserved (or latent)

variable, P^* , having a normally distributed and independent error (not shown in Equation 2). For values of $P = 1$, we observe B , which is the observed realization of a second latent variable (Abdel-Ghany & Silver, 1998; Breen, 1996; Jones, 1989).

Findings and Discussion

Borrower / Non-borrower / Comparisons

In the 1992-93 academic year, about 43% of sample households borrowed money for educational expenses. The mean loan amount of those who borrowed was \$4,639. Table 2 presents descriptive statistics of the independent variables included in the double-hurdle model, to compare the characteristics of borrowers and non-borrowers. For each variable, Table 2 shows the sample average or frequencies computed over the subset of 1,935 borrowers and the 2,589 non-borrowers. Bold, italic fonts indicate significant t-tests of mean differences and significant chi-square tests for assessing association between the two sub-samples.

For both dependent and independent students, a majority were non-borrowers. Between dependent and independent students, the composition of borrowing status was not significantly different. Approximately 42% of dependent students were borrowers, while 44% of independent students were borrowers.

In the case of both independent and dependent students, those who borrowed money for their college costs had significantly lower incomes than did those who did not borrow. Among independent students, those who borrowed money for college costs had a mean income of \$15,277, while the average income of those who did not borrow was \$27,410. The dependent students who borrowed for their college costs had a mean parental plus student income of \$54,468, whereas dependent non-borrowers had a mean income of \$75,377.

As for the value of home equity, both independent and dependent students who borrowed money had significantly less home equity than the non-borrowers. Those who were independent and borrowed money had \$4,172 of home equity, while those who were independent and did not borrow had greater home equity of \$18,196. The dependent students who borrowed money had \$41,388 of home equity, whereas the dependent non-borrowers had \$54,285. These results also indicated that independent borrowers had one-tenth of the home equity values when compared with that of dependent borrowers. Summary statistics for the family business or farms showed that both independent and

dependent borrowers had less equity than their non-borrower counterparts, but the differences were not statistically significant.

Table 2.
Descriptive Statistics of Two Sub-Samples

Variables	Borrowers (n=1,935)	Non-borrowers (n=2,569)
Total amount borrowed	4,639	--
Dependency status		
Dependent students (2,561)	41.9%	58.1%
Ind. students (1,963)	43.9%	56.1%
Total income (dep. based)	\$37,735*	\$54,455*
Dependent students	\$54,468*	\$75,377*
Independent students	\$15,277*	\$27,409*
Home equity (dep. based)	\$25,499*	\$38,544*
Dependent students	\$41,388*	\$54,285*
Independent students	\$4,172*	\$18,196*
Family business (dep. based)	\$5,641	\$7,531
Dependent students	\$9,597	\$11,039
Independent students	\$331	\$2,996
Parents' liquid assets	\$2,872*	\$5,089*
Dependent students	\$4,171*	\$8,067*
Independent students	\$1,129	\$1,240
Students' liquid assets	\$1,008*	\$4,909*
Dependent students	\$927*	\$2,653*
Independent students	\$1,118*	\$7,826*
Expected income	\$31,877*	\$32,362*
Tuition, fees & other costs	\$13,022*	\$9,632*
Total grants	\$1,998*	\$754*
Age when received BA	24.96*	25.91*
Male gender (n=2,010)	847	1,163
Female gender (n=2,514)	1,088	1,426
Race=white (n=3,983)	41.7%*	58.3%*
Race= non-white (n=541)	50.6%*	49.4%*
Household size	3.05	3.08

*Means or distributions of borrowers significantly different from non-borrowers at 0.05 level.

The analyses were weighted by the adjusted weight (see Endnote 1).

Measures are differently based on the dependency status (see Table 1).

Regarding parents' liquid assets, dependent, non-borrower students reported significantly greater liquid assets (\$8,067) than dependent students who borrowed (\$4,171). As for students' liquid assets, both independent and dependent borrowers had significantly less liquid assets than non-borrowers. The average amount of students' liquid assets for independent borrowers was \$1,118, whereas the average amount for independent non-borrowers was \$7,826. In the case of dependent students, the average amount of liquid assets was \$927 for borrowers and \$2,653 for non-borrowers. It was also found that, regardless of whether students borrowed, independent students had more liquid assets than did dependent students.

Mean expected future income was \$31,877 for borrowers and \$32,362 for non-borrowers, and the difference was statistically significant. Regarding the total costs of college attendance, those who borrowed money faced significantly higher costs (\$13,022) than those who did not borrow (\$9,632). The average amount of grants received was also significantly greater for borrowers (\$1,998) than for non-borrowers (\$754).

Summary statistics showed that the age difference between borrowers and non-borrowers was statistically significant. Those who borrowed money, through any type of loan, were about 25 years of age on average, and those who did not borrow were slightly older, at 26 years. There was not a significant difference between male and female students in the percentage borrowing for college. Non-White students were significantly more likely to borrow than were White Students.

Results of Double-Hurdle Analysis

The double-hurdle estimates indicate that some independent variables have different effects on the decision to borrow, as compared to the effects on the amount borrowed, once that decision has been reached. The results of the double-hurdle analyses for total borrowing for the 1992-93 college costs are presented in Table 3.

As total income decreased, households were more likely to participate in the student loan market, and independent students were even more likely to borrow, as income decreased, compared to dependent students, at their average level of income. As for the level of borrowing, one more dollar of income decreased the predicted amount of borrowing by independent students by \$ 0.033, while it increased the predicted amount of borrowing by dependent students by \$0.016 (the sum of

the coefficient of income and the coefficient of the income-dependency term = $-.033 + .049 = .016$). It is evident that the response to income varies by dependency status, as the resource constraints and borrowing capacities differ.

Table 3.
Results of Double-Hurdle Analysis for Total Debt

Variables	Probit: Decision to borrow (n = 4,524)	Truncated regression: Amount borrowed (n=1,935)
	<u>Coefficient</u>	
Dependent status	-0.552†	-10,441.8‡
Total income	-0.234E-4‡	-0.033*
Total income×dependent status	0.160E-4‡	0.049†
Home equity	-0.309E-5*	0.020*
Home equity×dependent status	0.253E-5	0.020*
Family business, farm	-0.331E-5	-0.057
Family business, farm × dependent status	0.384E-5	0.050
Parents' liquid assets	-0.337E-5	0.145‡
Parents' liquid assets×dep. status	0.316E-5	-0.152‡
Students' liquid assets	-0.210E-4‡	0.034
Students' liq. assets×dep. status	-0.308E-4†	-0.144*
Expected income	-0.171E-5	0.065†
Total costs	0.448E-4‡	0.554‡
Total grants	0.557E-4‡	-0.401‡
Age	0.009	6.770
Male gender	0.048	-151.162
White race	-0.063	663.897
Household size	0.044*	-372.943
Intercept	-0.552†	-10,441.8‡
Lambda (λ)		16,276.2‡
Log likelihood	-2,600.07‡	-19,306.96‡

The analyses were weighted by the *adjusted weight* (see Endnote 1).

For a technical explanation of Lambda(λ), see Endnote 2.

* $p < .05$

† $p < .01$

‡ $p < .001$

Home equity was a significant negative factor to the decision to borrow while, at the same time, it had a significant and positive marginal effect on the level of borrowing. The opposite signs of these coefficients indicate that students or their parents were less likely to borrow as the value of their home equity increased but, if they made a decision to borrow, the value of their home equity increased the amount borrowed. These results may be driven from the fact that this study included parents' private loans for education and those who have more collateral in the form of home equity would be able to borrow more.

The parents' liquid assets had no significant effect on the decision to borrow. On the other hand, for independent students, the amount borrowed increased as the parents' liquid assets increased, whereas for dependent students, the parents' liquid assets had almost no effect on the amount borrowed. For dependent students, an increase of \$1.00 in parents' liquid assets was associated with an increase of less than \$0.01 in the amount borrowed (sum of 0.145 and -0.152 is -0.007). For both independent and dependent students, personal liquid assets had a significant negative impact on the decision to borrow, and this relationship was more negative for dependent students than for independent students. Dependent students' liquid asset level was a significant negative factor for loan amounts, with a \$1.00 increase associated with a \$0.14 decrease in loan amount, whereas independent students' liquid assets was not a significant factor for loan amounts.

As expected, the greater a student's expected future income the greater the level of borrowing. One more dollar of expected income increased the predicted amount borrowed by \$0.065, controlling other factors. Importantly, this indicates that as a student's estimated expected future income increases, the student or the parents borrow greater amounts to fund the investment in the student's human capital.

As hypothesized, the sum of tuition, fees, room and board, and other costs was found to have a significant and positive effect on both the decision to borrow and the level of borrowing. When total costs increased, respondents were more likely to decide to borrow, and if they did, to borrow \$0.554 more when total costs increase by one dollar. The total amount of grants

received had opposite signs in the decision to borrow equation and the level of borrowing equation. The sum of grants received increased the probability of borrowing, but decreased the borrowing amount by \$0.401 dollar when the sum of grants increased by one dollar. Generally, those who qualify for financial aid depend on both grants and loan programs, easily explaining the effect of grants on the probability of borrowing, as grants and loan are complementary within the financial aid equation. However, given this pairing of grants with loans, the loan amount decreases when the grant amounts increases.

Older students were found to be more likely than younger students to decide to borrow money from college loan sources, but age did not have a significant effect on the amount they borrowed. The race variable indicated that the probability of borrowing was not affected by race. The results, however, showed that White families borrowed significantly more money than did non-White borrowing families, while controlling for other factors, perhaps indicating greater preferences for consumption than their non-white cohorts, or greater certainty with respect to the expected benefits of the education.

The probability of borrowing was significantly increased as household size increased, indicating that lesser per-capita resources led households to secure other means to relax the budget constraint, while financing the education investments of its members. However, the amount borrowed was negatively related to family size. The burden of repayment could in part explain this negative relationship between household size and the level of borrowing.

Summary and Conclusion

The results of the study showed that current resources were significant factors for both the decision to borrow and the level of borrowing for college education. Generally, income was negatively related to the decision to borrow, as well as the amount borrowed. On the other hand, assets, in general, reduce the probability that independent students seek borrowed funds, but increase the amount they borrow, if they decided to borrow. The lack of a substantial effect of parents' liquid assets on the amount borrowed by dependents students is puzzling. The intra-family resource management results deserve greater research. While those who need the resources appear to seek educational loans, policy makers need to review cases where greater loans are employed by individuals with lesser financial need than others. In particular, the potential exists for funding to be used for

purposes other than educational funding. As such the increase demand for money, albeit unnecessary, increases the costs and potential burden on those who do not have such assets. These distributional issues are not well understood.

The fact that expected future income had a significant positive impact on the amount borrowed indicates that a student or the parents borrow greater amounts to fund the investment in the student's human capital, as the student's estimated expected future income increases. The college costs had a significant positive effect on both the decision to borrow and the level of borrowing. Generally, greater grants increase the probability that a student would borrow but worked to decrease the amount they borrow. Yet, once their borrowing decision is made, the grants work to reduce the amount needed to be borrowed. As the coefficient on grants is less than one, one can infer that loans remain a necessary source of funding. If an institution's retention rate is closely tied to the economic life of their students, then increasing grants would work to decrease actual borrowing. As a result, the current economic well-being of the students are improved.

The results of this study underscore the importance of using a double-hurdle to model higher education debt. The results of double-hurdle model show that several factors had differential effects on each estimated equation. Thus, the double-hurdle analysis provided more information than the Tobit model could have provided regarding the roles of each variable to the decisions to borrow and on borrowing levels.

Findings of this study can provide financial aid administrators and policy makers with the information necessary to develop effective financial aid programs, to better target loans and grants to undergraduate students through pricing and other mechanisms. Moreover, the data may be useful to those administrative decisions regarding pricing and the balancing of University budgets. Given the stagnation of household income, escalating college costs, and growing reliance on loans, policy makers must take special care to ensure qualified low-income students have access to relatively inexpensive and worthwhile higher education opportunities, while simultaneously ensuring the financial viability of their campus

Financial aid administrators increasingly fear that student borrowing is reaching excessive levels. They question that student loan payments potentially force a generation

of college students, especially those planning to pursue graduate degrees, to limit their education choices, restrict their career plans to more lucrative fields of work, or fundamentally alter family and lifestyle goals. If so, there is a growing need to restructure financial aid programs. Loans should not be the major source of financial aid for low-income and working-class students, and federal and state governments should offer a strong program of basic grants and scholarships as the bedrock of educational opportunity. The insights of this study provide some boundaries to those future financial aid program development discussions.

Appendix 1 Description of Federal Loans

In the 1999-2000 academic year, the federal government provided over 70% of all direct aid to postsecondary students, and almost 60% of this aid was in the form of loans (Glaudieux, et al., 2000b). These federally supported loans are categorized by several characteristics. First of all, the federal loan programs include student loans and parent loans. Most of the federal loan programs are loans to students; these include Stafford/SLS loans, Perkins loans, income contingent loans, and several other loans to students in the health professions. The Parents' Loan for Undergraduate Students (PLUS) program is a loan for parents.

Secondly, the federal student loans are categorized as subsidized or unsubsidized. In subsidized loans, students are not charged interest within the time they are enrolled. In order to qualify for an interest-free subsidized loan, students must demonstrate financial need. In unsubsidized loans, the federal government does not pay any of the interest for students, who may borrow money to pay for educational expenses without demonstrating need (Berkner, 2000; National Center for Education Statistics, 2000).

Thirdly, all federal student loans are categorized by methods of borrowing and repayment. Federal Direct Loan Programs (FFDLP) are loans directly provided by the federal government and are paid back to the federal government. The Perkins Loan, formerly called National Direct Student Loans, is a campus-based loan. A small amount of federal funding is annually given to institutions, which can be loaned out to students, paid back to the institution, and then reloaned to other students in need of the loan. The Perkins Loan program charges no interest while students are in school, and then offers an extremely low-interest rate coupled with a ten-year repayment plan, with repayment beginning only after graduation. It is intended for undergraduate and graduate students who demonstrate the greatest financial need. The Federal Family Education Loan Program (FFELP) is issued by the Department of Education through schools containing an approved network of commercial lenders who provide loans to students. These loans are most often labeled Direct Loans, Stafford / SLS loans, Guaranteed Student Loans (GSL), and PLUS Loans (Margolin, 1989; U.S. Department of Education, 2000).

In the 1998-99 academic year, unsubsidized borrowing by students (Stafford Unsubsidized) and parents (PLUS) accounted for more than \$15 billion, or 45%, of the federal education loan volume. In the same year, undergraduate and graduate students borrowed a total of \$11 billion through the Direct Student Loans and \$22.6 billion through Federal Family Education Loans. Over the past two years, the FDSL's

share of the total loan volume has leveled off at about one third (Glaudieux, Swail & Dorsey, 1999).

1) *Subsidized Stafford Loans*

Subsidized Stafford loans are available to both dependent and independent students on the basis of need, and have an interest rate in the 5-6% range. Because the federal government pays the yearly interest while students are in school, they are called subsidized loans. The maximum amount of subsidized Stafford loan increases as one progresses forwards their degree. Juniors and seniors may be eligible for up to \$ 5,500 per year. Repayment of Stafford loans begins six to nine months after the student is no longer enrolled in at least a half-time (six credit hours) basis (Glaudieux, et al., 2000b).

The Federal Undergraduate Stafford Loan is a simple interest, government guaranteed, no collateral loan. The interest rate effective through June 2003 is 3.46% while in school and 4.06% after school (StudentMarket.Com, 2002). The interest rate is capped at 8.25%. Students may borrow while in school and begin repayment six months after leaving school or graduating.

Dependent students may borrow up to the following amounts:

Freshman	\$2,625
Sophomore	\$3,500
Junior	\$5,500
Senior	\$5,500

Independent students may borrow up to the following amounts:

Freshman	\$6,625
Sophomore	\$7,500
Junior	\$10,500
Senior	\$10,500

(Source: Studentmarket.com, 2002).

2) *Unsubsidized SLS*

Unsubsidized loans are not based on financial need and borrowers are responsible for paying interest on the loan while in school. Unsubsidized Supplemental Loans for Students (SLS) are awarded to financially independent students who meet the federal conditions for self-supporting status. The annual amount available on this loan is up to \$4,000 for freshmen and sophomores, and for juniors \$5,000 and seniors. SLS loans are primarily intended to allow independent students to supplement the subsidized federal Stafford loan amounts, although some dependent undergraduates with exceptional need could also qualify (Glaudieux, et al., 2000b).

3) *Perkins Loans*

Federal Perkins loans are need-based loans and are awarded to students who show exceptional financial need. The Perkins loan has a very low interest rate (5%) and students don't make any loan payments while in school. It is intended to supplement the Pell grant, so priority is given to Pell grant recipients. The loan amount is depending on when the student applies, the student's level of need, and the funding level of the school. Students can borrow up to \$ 4,000 for each year of undergraduate study (Glaudieux, et al., 2000b).

4) *Income Contingent Loans*

The income contingent loans provide undergraduates with all the money they need, and after graduation, sets the repayment level at some percentage of the borrower's income. The federal income contingent loan offers a 15% cap on payments and low monthly payments for the first year or two (Cronin and Simmons, 1987).

5) *Parental Borrowing*

Federal, private, and college-sponsored loan options are available to parents. The federal Parent Loans to Undergraduate Students (PLUS) is the largest source of parent loans, and is designed to help parents of undergraduate students meet the cost of their education. The annual amount available on a federal PLUS loan is the total cost of education minus any other financial aid received (Glaudieux, et al., 2000b). A number of financial institutions offer private education loans for parents, although these loans usually carry a higher interest rate than PLUS loans. Moreover, a small number of colleges offer their own loans to parents, usually at a better rate than does the federal PLUS. The Federal PLUS (Parent Loan for Undergraduate Students) is a simple interest, government guaranteed, no collateral loan. The interest rate effective through June 2003 is 4.86%. The interest rate is capped at 9%. Parents may be eligible to borrow up to the total cost of college less all financial aid received. parents are eligible for the PLUS if they meet the minimum government credit requirements. Parents begin repayment 30 days after the final disbursement for the academic year. The PLUS is based on a ten-year repayment plan with no prepayment penalties.

**Appendix 2
Theoretical Framework**

Consider a person who wishes to maximize utility over two periods. Assuming that utility depends on consumption in these two periods and that earnings can be influenced by education, the consumer has to decide how much to invest in education in the beginning period. In the first period (during college), the income of this consumer, Y_0 , may be spent either on expenditures on goods (P_0C_0) or on the college education (P_eE_0):

$$Y_0 = P_0C_0 + P_eE_0 \tag{4}$$

The relationship between education consumption (during college) and income in the second period (post-college),

$$Y_1 = f(E_0) \tag{5}$$

is characterized by the usual assumptions in economic theory, that $f'(E_0) > 0$ and $f''(E_0) < 0$.

Future income is an increasing function of the consumption of education during college and the primary reason an individual attends college is to realize increased lifetime earnings. Those who pay college costs are assumed to do so because they expect the college education to increase their lifetime earnings.

Making use of (4) and (5), the intertemporal utility function from one's consumption during college, C_0 , consumption after college, C_1 , and educational investment made during college, E_0 , will be maximized with respect to an intertemporal budget constraint.

Using the usual type of derivation of conditions^d, it can be shown that marginal rate of substitution of college education for current consumption equals the ratio of net costs of education and the price of consumption goods. The net costs of education equals the marginal costs of education minus the marginal discounted benefits of education. If the price of education increases and the price of current consumption is fixed, the marginal rate of substitution of current consumption for

education would increase implying that the demand for education would decrease.

The model predicts that a consumer whose subjective rate of time preference equals the real market rate of interest will equalize consumption in both periods. The issue is how the relative size of the real interest rate and the subjective rate of time preference affects the marginal rate of substitution of consumption across time. As the subjective rate of time preference increases, holding the real interest rate constant, the marginal rate of substitution of current consumption for future consumption declines. That is, the consumer is willing to give up smaller amounts of current consumption exchange for additional future consumption, or alternatively, the consumer is willing to give up more future consumption in exchange for additional units of current consumption. This produces the condition where the consumer prefers to consume more in the current period than in future periods, and thus leads to an expected increase in borrowing.

An individual's subjective rate of time preference is a central concept in intertemporal choice models, as it shows how the consumer values paying or receiving one dollar tomorrow instead of today and this is what the consumer is likely to do in choice situations where costs and benefits accrue in different time periods. A larger rate of discount applied to future consumption, defines the consumer to be more present-oriented. If an individual is infinitely myopic, consumption in the second period does not generate any utility. In literature regarding labor market search behavior, the annual subjective rate of time preferences is assumed to be fixed at 5 to 10% (Kooreman & Wunderink, 1997).

The marginal rate of substitution of education for future consumption is composed of two components; the relationship between the real interest rate and an individual's subjective rate of time preference, as well as the relationship between the net cost of education and the price of consumption. An individual's preference for education versus future consumption is affected by the real interest rate, the subjective rates of time preference, the price of education, the price of consumption, and the marginal benefit of education. An increase in the price of education, ceteris paribus, would increase the equilibrium marginal rate of substitution of education for future consumption, thus decreasing the relative demand for education. An increase in the marginal benefit of education (i.e. the additional income that results from additional education) or an increase in the subjective rate of time preference (i.e. present oriented) would decrease the equilibrium marginal rate of substitution of education for future consumption, thus increasing the demand for education. In response, an individual would borrow against future consumption in order to invest in current education. It can be shown that greater expected future income, coupled with lower current income, increases the demand for consumers to borrow.

Appendix 3 Results of Regression Analysis for Expected Income

Variable	Coefficient
Undergraduate major (reference group = Business, Management)	
Education	-11,639.58†
Engineering	7,493.41†
Health professions	1,894.64
Public affairs/Social services	-6,792.61†
Biological sciences	-8,019.66†
Math and other sciences	2,657.65
Social science	-1,372.31
History	-13,115.16†
Humanities	-10,406.6.58†
Psychology	-13,805.47†
Other	-5,160.04†
Normalized GPA on 4.0 scale	733.46
Type of institution (reference group = public)	
Private, not for profit	-114.08
Private, for profit	-4,289.16
Region of institution (reference group = Southeast)	
New England	4,407.07‡
Mid East	705.31
Great Lakes	1,892.68*
Plains	-1,854.43
Rocky Mountain	-3,230.87*
Far West	2,406.78*
Outlying areas	-15,194.24‡
Age when received BA	274.63‡
Race = White (vs Non-white)	342.18

The analyses were weighted by the *adjusted weight*. (see Endnote 1)
 * p < .05 † p < .01 ‡ p < .001

Endnotes

- a. In reality, even a rational individual can only choose college if financing is available. The calculation of the present value of the high school income stream and of the college income stream should be based on the interest rate available to the student.
- b. This study employed the B&B panel weight to compensate for the probability of selection to the B&B sample and to adjust for nonresponse. The panel weight was calculated by making a nonresponse adjustment to a baseline weight, computed by area, institution, and student level components. In using this raw panel weight, however, the sample size increased and, therefore, the estimated standard errors were dramatically decreased, as the statistical package calculates this value using the sum of the weights (in this case, $n = 565,401$) as the sample size. In order to preserve the effective sample size while still adjusting for the unequal probability of selection, this study creates a new adjusted weight by dividing the raw panel weight by its mean: w_i / w_m , where $w_m = 3w_i / n$. By using this adjusted weight, the estimates of the means and standard errors can be considered correct (Thomas & Heck, 2001).
- c. The level of borrowing equation (3) is estimated for the cases in which the amount of borrowing was greater than zero. The inverse Mill's ratio, or the hazard rate, is usually symbolized by λ (Breen, 1996; Greene, 2000; Heckman, 1979). Therefore, the truncated equation is expressed as:

$$E(B_i | B_i > 0, X_i) = X_i B_i + \sigma \lambda$$

Consequently, this study calculated λ , the inverse Mill's ratio, and finally estimated the regression coefficients for the independent variables and for λ to obtain consistent and unbiased estimates.

- d. Contact one of the authors for the details of the theoretical derivations shown in Appendix 2.

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