

How Do Colleges Respond to Changes in Federal Student Aid?

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Abstract

A major goal of federal student aid is to increase access to college. However, increases in federal student aid may be less effective than one might expect at increasing access if colleges raise their tuitions or use federal student aid as a substitute for grant aid from their own funds. I use variation in federal student aid caused by the Higher Education Amendments of 1992 to identify institutional response to changes in federal financial aid. I also investigate whether institutions react differently to changes in grant aid vs. loan aid and whether public four-year institutions behave differently than private four-year institutions. I find that private institutions increase the amount of both institutional aid and tuition revenues in response to increases in both federal grant and federal loan aid. Public institutions may raise tuition revenues and decrease institutional aid in response to federal grant aid, but have no significant reaction to federal loan aid.

1. Introduction

During the first half of the 1990s, the U.S. federal government substantially increased the amount of student aid, from \$29.1 billion in AY1991-92 to \$41.4 billion in AY1995-6¹. The main goal of this aid is to increase access to a higher education for students who would not otherwise be able to afford it. Various studies have shown that increases in financial aid, especially in grant form, can increase the chance of attending college for some students.² However, students are not the only ones affected by changes in student aid. Institutions also respond to changes in the amount of federal student aid, possibly leading to unintended consequences. For example, institutions may raise tuitions in an attempt to capture part of any financial aid increase. Alternatively, increased federal aid could raise demand for a college education, driving up prices. Tuitions rose 11% at private four-year institutions and 20% at public four-year institutions during the period above, suggesting that tuition and federal student aid could be linked in this manner.

Increases in federal student aid may also cause institutions to cut back on the amount of institutional aid they give, using federal aid as a substitute. Or it may prompt institutions to increase the amount of institutional aid they give because increased federal aid makes it cheaper to admit higher need students and also encourages more higher-need students to attend college. Institutional and other grants increased by 33% during this period, indicating that increases in federal student aid may be linked to increases in institutional grant aid. To fully understand the impacts of changes in federal aid policy, it is important to learn how institutions respond to

¹ The College Board, *Trends in Student Aid*, 2000. Amounts are in 1999-2000 constant dollars.

changes in the amount of federal aid their students receive.

The only previous study to look at how institutions react to changes in federal aid was conducted by McPherson and Schapiro (1991b, 1993). They find some evidence of crowd-in of institution-based aid for private institutions, but no effect for public schools. They find tuition at public schools increased in response to increases in federal aid, but found no significant effect on private tuitions. As in the previous work, I will use institutional finance and enrollment data from the Integrated Postsecondary Education Data System (IPEDS), the successor to the HEGIS data used in the earlier study, to examine how institutions change institution-based aid and tuition in response to changes in financial aid. This study adds three improvements. The first improvement is better identification of institutions' responses to federal aid by taking advantage of changes made to the federal student aid laws in the 1992 Amendments to the Higher Education Act. The amendments excluded home equity from the calculation of a student's need. They also made more students eligible for larger amounts of aid, causing a large increase in aid to institutions. To capture these changes, I use as an instrument for federal aid the interaction of median home equity for the state in which the institution is located and a dummy equal to one for years after the amendments. This interaction term should capture the fact that institutions whose students have higher home equity would have experienced a larger increase in aid due to the amendments than would institutions whose students have lower home equity.

The second improvement is the addition of data on the amount of federal student loan aid received by each institution. Previous studies only had data on federal grant and work study aid. I add in data from the Department of Education on the amount of aid received of each type of

² See Dynarski (1999, 2000), McPherson and Schapiro (1991b), and Savoca (1991) for examples.

federal student aid, including each type of federal student loans. This will allow for separate analysis of institutions' reactions to federal loan aid vs. federal grant aid.

The third improvement is the inclusion of institutional fixed effects in the regressions. This controls for differences in institutional grant aid and tuition revenues that are due to unique characteristics of each institution. As shown in the tables, including fixed effects does make a difference in the results, generally improving their significance.

My results indicate that private institutions react similarly to federal student grants as to federal student loans, increasing institution-based aid and tuition revenues in response to increases in both kinds of aid. In particular, I find that for every additional dollar per student in federal student grant aid, private four-year institutions increase institution-based grant aid per student by \$1.48 and raise tuition revenues by \$3.24. They raise institution-based grants by 58 cents and tuition revenues by \$1.30 per student for every dollar per student increase in federal loan aid. In contrast, I find that public institutions may reduce institution-based grant aid in response to an increase federal grant aid. They may also raise tuition in response to federal grant aid. My results show no significant response to federal loan aid by public institutions.

The paper is organized as follows: Section 2 gives a background on federal student aid and previous research. Section 3 discusses empirical methods. Section 4 describes the data. The results are presented in Section 5 and discussed in Section 6. Section 7 concludes.

2. Background

2.1. Federal Student Aid

Federal student aid comes in three basic forms: grants, loans, and work study. The Pell Grant program gives grants to high-need students. The Stafford loan program provides subsidized loans to high-need students as well as unsubsidized loans to other students. Subsidized loans are interest-free until 6 months after the student is no longer enrolled at the school. Parents can also take out federal loans through the PLUS program. The federal government's campus-based aid program gives aid to the individual institutions to distribute. Campus-based aid programs include SEOG grants and low-interest Perkins loans, both of which are given to high-need students. Another campus-based program is Federal Work Study, through which the government subsidizes wages for student jobs provided through the school. The amount of student aid provided through federal work study is very small compared to that given through the various grant and loan programs, and is not included in this study. In AY1991-92, the federal government gave out \$26.9 billion dollars in federal student aid, \$18.2 billion of which was in loans. By AY1995-96, total federal aid had grown 42% to \$41.4 billion, primarily due to loan aid, which had grown 73% to \$31.4 billion. Total grant aid (Pell + SEOG) actually fell during this period, from \$7.7 billion in AY1991-92 down to \$6.6 billion in AY1995-96.³

In order to qualify for federal student aid, students and their families must fill out a Free Application for Federal Student Aid (FAFSA), which asks for detailed information on the family's income and assets. The federal government determines each student's eligibility for aid

³ The College Board, *Trends in Student Aid*, 2000. Amounts are in 1999-2000 constant dollars.

by plugging the income and asset data into a ‘needs-analysis’ formula which calculates how much the family should be able to pay, and thus how much extra the family needs to cover costs of attendance for each student. The formula essentially adds the parents’ income and 12% of their assets (minus allowances for things like living expenses, child care, and retirement expenses), and applies a ‘tax rate’ to them. The amount of this ‘tax’ is the government’s assessment of how much a family can afford to spend on their family members’ college educations that year. This amount is then divided by the number of family members in college to determine the expected parental contribution (EPC) for each student. The student’s income and 35% of his assets are added to the EPC to get the expected family contribution (EFC). Finally, the student’s financial need is calculated as the difference between this EFC and total costs of attendance, including tuition, room and board, and other expenses. For students receiving federal aid, the amount of aid received cannot exceed the student’s need⁴. This is true even if only part of the student’s aid package comes from federal sources.

In 1992, the federal government amended the needs-analysis formula in a number of ways that caused more students to become eligible for federal aid and caused students already eligible to become eligible for larger amounts. The major change to the rules was the exclusion of home equity from the calculation of available assets. Also, a ‘Simplified Needs Analysis’ was introduced, allowing families with less than \$50,000 in income, and who were eligible to file 1040EZ forms, to have all of their assets excluded from the needs-analysis calculation. This new

⁴ An exception to this is the federal Stafford Unsubsidized student loan program, which began in AY1992-93. Students can borrow from this program up to the cost of attendance, regardless of the student’s determined level of need.

needs-analysis formula was called the ‘Federal Methodology’⁵. The amendments also increased borrowing limits on federal student loan programs. Other changes in that time period included the introduction of Stafford Unsubsidized loans in AY1992-93 and the start of the Ford Direct Loan program in AY1994-95. The Stafford Unsubsidized loans provides unsubsidized federally guaranteed student loans regardless of student need. The Ford Direct Loan program allows students to attain a guaranteed student loan directly from the government, rather than through a third party.

2.2. Previous Research

There has been little research on the effects of federal financial aid on institutional aid. The only authors who have studied this topic specifically are McPherson and Schapiro (1991b, 1993). They use government data from the HEGIS survey on enrollment and finances for higher education institutions to analyze how tuition, institutional aid, and instructional expenditures are affected by changes in federal student aid. They looked only at the effect of federal student grant aid, as the HEGIS surveys do not identify the amount of loan aid received by students at each institution. They find that tuition at public four-year colleges rose by 50 cents for every additional dollar of federal student aid. They found no relationship between tuition and federal aid for private four-year institutions. Private schools appeared to increase their own institutional student aid by 20 cents for every dollar of federal aid. No significant response was found for

⁵ It should be noted that not all schools use the Federal Methodology. Some schools, mostly wealthier private schools, use what is called the Institutional Methodology developed by the College Selection Service (CSS). The Institutional Methodology has a generally stricter calculation of EFC and continues to include home equity in the calculation. However, if a student is to receive any federal student aid, the Federal Methodology must be used for that student.

public schools. They found no relationship between federal student aid and instructional expenditures, though they did find some evidence of scale effects in instructional spending.

This study uses a model similar to that used by McPherson and Schapiro (1991b), where endowments and state appropriations are important factors in institutional decisions regarding institutional aid and tuition. I improve on McPherson and Schapiro's work by using a more complete data set with data on the amount of federal student loans each institution received. Also I use a more convincing instrument⁶ based on the exclusion of home equity from the needs-analysis formula and the increase in the amount of aid, especially loan aid, received by students, and thus institutions, due to the 1992 HEA Amendments. I improve on their work by adding institution fixed effects to control for differences in tuition revenues and institutional grant aid due to the peculiarities of each institution.

An indication that institutions may react differently to grants vs. loans is that students react differently to different types of aid. Savoca (1991) finds that a shift in the composition of financial aid away from grants and towards loans adversely affects enrollments at postsecondary institutions, though by a small amount only. Schwartz (1985) finds that publicly provided grants have a positive effect on the probability of attending college, while student loans have no significant effect. Since the type of aid affects students' enrollment decisions differently, and colleges care about enrollment, we may hypothesize that institutions view loan aid differently from grant aid as well. The findings in this study suggest that private institutions actually react

⁶ McPherson and Schapiro don't state specifically what they use in their instrument set other than the exogenous variables in the model.

in the same qualitative manner to grant aid as to loan aid, though the reaction to loan aid is smaller in magnitude.

3. Empirical Methods

3.1. OLS and Models with Institution Fixed Effects

Following McPherson and Schapiro, I assume that changes in institution-based aid stem primarily from wealth effects. For consistency with the previous research, I use the same components of wealth as do McPherson and Schapiro, namely: federal student aid, endowment, state and local appropriations, federal grants and contracts, and state and local grants and contracts. Unlike McPherson and Schapiro, I do not include tuition revenues in my model. I exclude tuition because it is endogenous to institution-based aid since institutions often set these two variables simultaneously. We would expect tuition revenues and institution-based aid to have a positive relationship, as institutions will raise the amount of institution-based aid to help students pay for increases in tuition. Thus, omitting this variable may cause the other coefficients to be positively biased. Using the instrumental variables strategy described below should correct for the omitted variables bias caused by leaving tuition out of the model.

Economic conditions in the state in which the institution is located could have some effect as well, so I include median income for the state in which the institution is located. This could reflect the wealth of the students attending the school since the vast majority of students at public institutions, and over 60% of students at private institutions come from within the state. I also include median home equity in the state in which the school is located to reflect both the wealth of students at the institution and the economic conditions in the state. Year fixed effects

were included to capture any year-to-year changes due to omitted variables that affected all institutions. Institution fixed effects were included to capture trends in institution-based aid or tuition that were due to some unique characteristic of that institution not included in the regression. I began by estimating OLS models of the following form:

$$(1) \text{ instaid}_{it} = \beta_0 + \beta_1 \text{ fedgrant}_{it} + \beta_2 \text{ endow}_{it} + \beta_3 \text{ slappr}_{it} + \beta_4 \text{ fedgrts}_{it} + \beta_5 \text{ slgrts}_{it} + \beta_6 \text{ medinc}_{it} + \beta_7 \text{ home_eq}_{it} + \beta_8 t + \beta_9 i + \varepsilon_{it}$$

Where:

instaid_{it} = institution-based grant aid per student at institution i in year t

fedgrant_{it} = federal student grant aid per student at institution i in year t

endow_{it} = endowment per student at institution i in year t

slappr_{it} = state and local appropriations per student received by institution i in year t

fedgrts_{it} = federal grants and contracts per student received by institution i in year t

slgrts_{it} = state and local grants and contracts per student received by institution i in year t

medinc_{it} = median income for year t for state in which institution i is located

home_eq_{it} = median home equity for year t for state in which institution i is located

t = year fixed effects

i = institution fixed effects

To see if schools responded differently to grant aid than to loan aid, I also ran regressions using average federal student loan aid per student in place of the federal grant aid variable. I run the regressions separately for grant aid and loan aid since I will be using the same instrument for both types of aid in my instrumental variables estimation. For consistency with the IV equations, I also estimate separate OLS models for federal grant aid and federal loan aid, rather than including both in the same model. Because private institutions may have different goals than public institutions, as well as different ways of deciding how much aid to provide, I run all

regressions separately by sector. The coefficient of interest, β_1 , tells us how institutions change institutional aid in response to a dollar increase in federal grant or loan aid.

I also want to estimate how institutions adjust their tuition revenues in response to changes in federal student aid. As with the institution-based aid models, I assume that tuition decisions are based on the institution's revenues, the main sources of which are federal student aid, endowment income, and state and local appropriations, federal grants and contracts, and state and local grants and contracts. As in the above regression, I include the median family income and median home equity for the state in which the institution is located to account for economic conditions in that state and for the wealth of the student body. Year and institution fixed effects were included in this equation, as well. Institution-based aid was left out due to the endogeneity problem described above. As with equation (1), the using instrumental variables model described below should alleviate this problem.

The equation for the tuition regressions is as follows:

$$(2) \text{ tuitrev}_{it} = \beta_0 + \beta_1 \text{ fedgrant}_{it} + \beta_2 \text{ endow}_{it} + \beta_3 \text{ slappr}_{it} + \beta_4 \text{ fedgrts}_{it} + \beta_5 \text{ slgrts}_{it} + \beta_6 \text{ medinc}_{it} + \beta_7 \text{ home_eq}_{it} + \beta_8 t + \beta_9 i + \varepsilon_{it}$$

Where:

tuitrev_{it} = gross tuition revenues per student at institution i in year t

fedgrant_{it} = federal student grant aid per student at institution i in year t

endow_{it} = endowment per student at institution i in year t

slappr_{it} = state and local appropriations per student received by institution i in year t

fedgrts_{it} = federal grants and contracts per student received by institution i in year t

slgrts_{it} = state and local grants and contracts per student received by institution i in year t

medinc_{it} = median income for year t for state in which institution i is located

home_eq_{it} = median home equity for year t for state in which institution i is located

t = year fixed effects

i = institution fixed effects

Equation (2) was also run using federal student loan aid per student in place of federal student grant aid. As with the institutional aid equations, regressions were run separately for each sector. The coefficient of interest is β_1 , which will give us the amount, in dollars per student, by which institutions change their tuition revenues in response to a dollar change in federal grant or loan aid.

3.2. Instrumental Variables

The amount of federal aid students get is based partly on how much money they get from other sources, including scholarships given out of institutional funds. Thus there is an endogeneity problem with using OLS to estimate equation (1). The government subtracts aid from other sources from a student's calculated need. As a result, when the amount of institution-based aid a student receives increases, the amount of federal student aid she receives decreases. An institution that increases institution-based aid to its students will likely cause them to qualify for less federal aid overall. Hence our OLS coefficients for federal aid will be too high, either overestimating the amount of crowd-out or underestimating the amount of crowd-in.

There is a similar endogeneity problem with the tuition regressions. The federal government calculates student need as total costs of attending college (including tuition) minus the expected family contribution. When tuition increases, it causes the students' calculated need to increase, allowing them to qualify for more federal aid. Hence our OLS coefficients for

federal aid in the tuition regressions will be too low, either underestimating the amount of crowd-out or overestimating the amount of crowd-in.

To get around this, an instrument must be found for federal aid that is related to federal aid but not to the amount of scholarships an institution decides to give out or to the amount of gross tuition an institution charges. My choice of instrument is based on the changes in the federal Needs Analysis formula that first took effect in the 1993-94 academic year. The amount of federal aid students qualified for increased for most students with the revised needs analysis rules. The rule changes excluded a student's family's home equity from the EFC, causing students with higher home equity to qualify for more aid. A majority of most any institution's student body comes from within the state in which the institution is located. Thus, one would expect that schools in states with higher median home equity would have a larger increase in student aid after the new rules took effect. To capture this variation, the interaction of the median home equity variable and a dummy variable equal to one for AY1993-94 and later years was used as an instrument for federal student aid. The main effect of home equity is included in the second stage regression to help account for trends in the wealth of students. Median home equity has an effect on institution-based aid and tuition revenues outside of its effect on federal financial aid in that students that have more home equity wealth will be less likely to need institution-based aid and will be better able to afford higher tuition payments.

The first stage of the IV regressions for the both the institutional grant aid and tuition equations were as follows:

$$(3) \text{ fedgrant}_{it}^* = \alpha_0 + \alpha_1 \text{home_eq}_{it}^* \text{post1992} + \alpha_2 \text{endow}_{it} + \alpha_3 \text{slappr}_{it} + \alpha_4 \text{fedgrts}_{it} + \alpha_5 \text{slgrts}_{it} \\ \alpha_6 \text{medinc}_{it} + \alpha_7 \text{home_eq}_{it} + \alpha_8 t + \alpha_9 i + \epsilon_{it}$$

Where:

post1992 = dummy equal to 0 for AY1992-93 and earlier, 1 for AY1993-94 and later years

and the other variables are as described for equation (1) above.

The second stage regressions were then estimated as follows:

$$(4) \text{ instaid}_{it} = \beta_0 + \beta_1 \text{fedgrant}^*_{it} + \beta_2 \text{endow}_{it} + \beta_3 \text{slappr}_{it} + \beta_4 \text{medinc}_{st} + \beta_5 t + \beta_6 i + \varepsilon_{it}$$

$$(5) \text{ tuitrev}_{it} = \beta_0 + \beta_1 \text{fedgrant}^*_{it} + \beta_2 \text{endow}_{it} + \beta_3 \text{slappr}_{it} + \beta_4 \text{medinc}_{st} + \beta_5 t + \beta_6 i + \varepsilon_{it}$$

As with the OLS analysis, equations (3), (4), and (5) were each run separately by sector.

The regressions were also run by sector using federal student loan aid in place of federal student grant aid.

4. Data

4.1. Preparation

Most of the data used in this paper comes from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS) finance survey. The IPEDS finance survey collects revenue and expenditure data for all post-secondary institutions in the United States. Enrollment data was taken from the IPEDS enrollment survey. The IPEDS data does not have very detailed information on the amount of federal student aid received by an institution (though it does break out federal grant revenues and Pell grant expenditures). To make up for this lack, data on all types of federal student aid received by each school was obtained from the U.S. Department of Education. This data covered the amount of Pell grants, Campus-based aid (SEOG grants, Perkins loans, campus work study), and federal student loans (Stafford subsidized

and unsubsidized, PLUS, SLS, and direct loans) received by students at each institution.

Unfortunately, each section of the Dept. of Education uses a different identification code for the institutions, but no one seems to have a key to link all the codes. Different sections also use different abbreviations and titles for many institutions. As a result, I was not able to match up aid data to every institution in the IPEDS data. The schools included in this paper are those where I was able to match at least some federal aid data to an institution in the IPEDS database. The final sample is described below.

The data was prepared as follows. Only four-year public and private institutions located in the 50 U.S. states and the District of Columbia were included in this study. Total enrollment was calculated as full-time enrollment plus one half times part-time enrollment. Institutions with an undergraduate enrollment of fewer than 200 students were dropped. The remaining data covered 522 public four-year institutions and 1080 private four-year institutions. The enrollment figure used to calculate all dollars per student variables includes both undergraduate and graduate student enrollment at an institution. The enrollment data was matched up with the IPEDS finance data for each institution. The federal financial aid data was then matched up to each school, where possible. I was not able to match up any federal grant aid data for 64 public institutions and 103 private institutions. Federal loan aid data was not found for 44 public institutions and 95 private institutions.

All dollar values were converted to 1995 dollars using the CPI-U. To get the variables in terms of dollars per student, the relevant dollar values were divided by total enrollment for that institution. Institutions were not included in the regression estimations if they did not have all the required variables for at least one year prior to the 1992 HEA Amendments and one year

after. Five public institutions and 38 private institutions were not included in the federal grant aid estimations because of they did not have enough years of complete data. Those same institutions also did not have the required data for the loan equations.

Many of the records were missing endowment data for at least one year. Institutions with missing endowment values include some state college systems such as the California State University system and the Pennsylvania State University system. Many of the private four-year institutions missing endowment data were non-traditional colleges, such as bible colleges or art or business colleges. Since so many institutions were missing endowment data, I imputed values for endowments.⁷ If the institution had some years where endowment was not missing, I imputed endowment for the missing years using the endowment data for that institution. If the institution had no endowment data for any year, I imputed endowment based on the endowments of similar institutions in each year.⁸ The final sample, including institutions with imputed endowment values, contains 453 public four-year institutions and 939 private four-year institutions in the models estimating the effects of federal student grant aid, and 473 public institutions and 947 private institutions in the models estimating the effects of federal student loan aid. These samples each contain 87% to 91% of the original sample of U.S. institutions with undergraduate enrollment of at least 200. I ran each model using both the sample with the imputed endowments in place of the missing endowments and the sample containing only institutions with non-missing endowment for at least one year before and after the HEA

⁷ It is possible that, for many of these institutions where endowment was missing for all years, endowment was missing because the school has no endowment. I estimated regressions replacing all missing values with zeros. The results were very close to those obtained from using the imputed values.

⁸ A more detailed description of the imputation process can be found in Appendix A.

Amendments. The sample using only non-missing endowments used in the federal grant aid models contained 330 public institutions, about 63% of the original sample, and 881 private institutions, 82% of the original sample. In the models estimating the effects of federal loan aid, the samples include 345 public institutions and 887 private institutions. As shown in the tables, the results for the various regressions are fairly similar between the two samples, especially for private four-year institutions.

Some institutions that have several campuses list all of their institutional finance data under one main campus or central office, called a ‘parent’, in the IPEDS data. Usually, these are university systems, like the University of California system, that have many campuses.⁹ In most of the child/parent cases in the IPEDS data, each child campus has its own financial data and the central office record lists revenues and expenditures that are shared by the system as a whole. In most of the cases, endowment data was listed only in the record for the central office. The ID for the parent institution is listed in the record for the ‘child’ institution. Since each child campus may have separate financial aid and enrollment data (since this data comes from other databases), these data were summed over the parent and child institutions and placed in the record for the parent institution. Only the record for the parent institution, containing the combined data for all children as well as for the parent, was used in the data set. This summing of many campuses should not affect the results since enrollment is also summed and all the finance data is calculated in terms of dollars per-student. Further, only 18 public four-year institutions and 55 private four-year institutions included in this study were parent-child

⁹ Other public four-year child/parent systems included the Ohio University and SUNY systems. Private four-year systems included the Long Island University system and the Claremont Colleges in Southern California.

composite records.¹⁰ Also, there is no reason to believe that the relationship between federal aid and institutional aid or federal aid and tuition is any different for parent-child systems than for single-campus institutions. In fact, running the regressions with parent-child records omitted gives very similar results as when they are included.

To create the median home equity instrument for the IV analysis, home equity data was gathered from the U.S. Census Bureau's American Housing Survey. Home equity was calculated as the value of the home minus all mortgages and debts owed on that home. Since the Census Bureau gathers this data by Metropolitan Statistical Area (MSA) rather than by state, the following method was used to calculate median home equity by state. Median home equity was first calculated by MSA. Median equity for a state was calculated as the average of the median home equity values for each of the MSAs located in that state. If MSA covered more than one state, it was counted as being part of each of those states.

4.2. Description

Table 1 lists some sample descriptive statistics by institution type in constant 1995 dollars. Enrollment remained fairly constant at both public and private schools, with public four-year institutions having over 5 times as many students, on average, as private four-year institutions. Institutions of both types received on average about \$400-\$500 of federal grant aid per student, though public universities received much more grant aid in total due to higher enrollments. Federal grant aid decreased sharply beginning AY1993-94, in part due to a decrease of \$100 in the maximum award value and in part due to a smaller number of Pell Grants

¹⁰ These composite institutions represent 101 public and 115 private child institutions.

awarded overall. This maximum remained fairly constant in current dollar terms, but decreased in constant dollars due to inflation, causing the average federal grant aid per student received by universities to decrease as well, as shown in Figure 1. Since the maximum Pell Grant is generally lower than attendance costs for both public and private institutions, both types of schools received roughly the same amount of grant aid per student.

By contrast, federal loan aid jumped substantially in AY1993-94 due to the 1992 HEA amendments. Private four-year institutions received an average of \$2,203 per student in AY1992-93 and saw that amount increase 39% the next year. Federal loan aid at public four-year institutions jumped 43% between AY1992-93 and AY1993-94, from \$1,238 per student to \$1,772. As shown in Figure 2, both types of institutions continued to have large increases in federal loan aid, with public institutions seeing their loan aid per student grow an additional 27% between AY1993-94 and AY1995-96 and private institutions seeing a 21% growth during that period. This large growth in federal loan aid underscores the importance of analyzing the effects of loans in addition to grant aid.

Private institutions give out much higher levels of institution-based scholarships than public schools, giving out an average of \$1,873 per student in AY1991-92. This amount grew fairly steadily to \$2,561 by AY1995-96. Public four-year institutions gave out much lower levels of institution-based aid, about \$204 per student in AY1991-92. However, as shown in Figure 3, the growth in institution-based aid was nearly the same for public four-year institutions as for private four-year institutions. As seen in Figure 4, tuition revenues were steadily increasing for all institution types over the time period studied. Public four-year institutions collected tuition revenues of \$2,840 per student in AY1991-92, increasing 19.5% to \$3,395 by

AY1995-96. Private 4-year schools had much higher tuition revenues, starting at \$9,417 per student in AY1991-92 and growing to \$10,694 by AY1995-96.

Endowments at all types of institutions grew slightly over the time period, with endowments at private four-year schools consistently about 10 times higher per student than at public 4-year institutions. State and local appropriations stayed fairly constant for public 4-year institutions at around \$6,300 per student. State and local appropriations for private schools decreased over the period studied, but were less than one percent of what public four-year schools received to begin with.

5. Estimation and Results

5.1. OLS and Fixed Effect Models

The OLS models described in section 3.1 were estimated using the data described above. The results for equation (1), using institution-based grant aid as the dependent variable, are shown in Table 2. Before institution fixed effects are included (Model 1), the results show that federal grant aid crowds-in institution-based aid for private four-year institutions. Adding institution fixed effects changes the sign of this coefficient from negative to positive for both Model 2 (using imputed values for missing endowment data) and Model 3 (using only observations with non-missing endowment). This sign change demonstrates the importance of including institutional fixed effects in the model. The coefficients on federal loan aid are positive for both public and private four-year institutions. Adding institution fixed effects lowers the magnitude of the coefficient for both types of institutions. It also causes the coefficient on loan aid to become insignificant for private four-year institutions when imputed endowment values are used.

The OLS results show that institutions increase grant aid from their own funds when their endowments increase. The coefficient on endowment is insignificant for public institutions when imputed endowment is used, probably because many of the institutions with missing endowments likely had very low or zero endowments. The results show that changes in state and local appropriations had no significant effect on institution-based aid for either type of school. Public institutions reduce institutional grant aid when federal grants and contracts increase. Private institutions decrease institution-based aid when state and local grants and contracts increase, while public institutions appear to have no significant reaction. The results are mixed with respect to state median income. I find that public institutions decrease institution-based aid when state median home equity increases, while private institutions increase it.

The results for equation (2), using tuition revenues as the dependent variable, are in Table 3. When no institution fixed effects are included, the results show that both public and private four-year institutions decrease their tuition revenues in response to an increase in federal grant aid, but increase tuition revenues in response to federal loan aid. Adding institution fixed effects changes the coefficient on federal grant aid to significantly positive for both kinds of institutions. Adding institution fixed effects also lowers the magnitude of the coefficients for federal loan aid.

The OLS results show that both kinds of institutions increase tuition revenues when their endowments increase, perhaps because they can now better afford to help students pay the higher tuition with increased institution-based aid, as indicated above. The results are mixed with regard to the effect of changes in state and local appropriations on tuition revenues. Institutions appear to increase tuition revenues when federal grants and contracts increase, though the results

change significance for public institutions depending on which set of observations and which equation is used. Private institutions increase tuition revenues when state and local grants and contracts are increased. Results are mixed for the effect of state median income and state median home equity on tuition revenues.

5.2. Instrumental Variables

The results for the first stage of the instrumental variables analysis are presented in Table 4. Models 1 and 2 use imputed endowment values for those observations missing endowment data. Model 2 contains institution fixed effects, while Model 1 does not. Model 3 uses only observations with non-missing endowment data and includes institution fixed effects. The coefficient on the instrument is positive, as expected, and significant for all the models except for the models using federal loan aid as the dependent variable with the sample of public four-year institutions. This confirms, for the most part, that institutions in states with higher median home equity received larger increases in federal aid per student after the HEA Amendments than institutions in states with lower median home equity.

It should be noted that most of this additional aid is likely to go to students with low to medium levels of home equity. Students with high home equity are more likely to have high family income as well, which would make them ineligible for any grant aid, before or after the exclusion of home equity from the needs analysis. Likewise, students with very low home equity are more likely to have low family income and may have already qualified for the maximum Pell Grant before the home equity exclusion. They may have also already qualified for enough loans to cover all costs of attendance since costs are lower at public institutions.

Thus, they would also not see any increase in federal aid as long as costs of attendance remained constant.

The coefficient on state median income is negative, reflecting the fact that institutions in states with higher median income likely have students with higher income who thus qualify for less federal aid. However, the results are only significant for private four-year institutions. The coefficient on median home equity is negative and significant in almost all the regressions, except for the federal loan equations using the public institution sample. This is the expected sign, as it indicates that institutions in states with higher home equity will likely have students who qualify for less federal student aid due to higher home equity.

5.2.1. Institutional grant aid

Table 5 lists results from equation (4), the second stage of the regressions on institution-based grant aid. The results indicate that private four-year institutions increase institution-based aid when either federal grant or loan aid is increased. Private institutions decrease institution-based grant aid by \$1.48 per student for every dollar per student decrease in federal grant aid.¹¹ They also increase institution-based aid by 58 cents per student for each dollar per student increase in federal loan aid. For public four-year institutions, I find a negative effect on institution-based aid in response to changes in federal grant aid, but it is only significant when imputed endowment is used. One explanation for why private institutions have a larger and more significant response to federal financial aid than public institutions is that private institutions simply have more institutional funds to disburse. It is also possible that they have

¹¹ Recall that federal grant aid decreased slightly over the period analyzed, while federal loan aid increased quite a bit.

more flexibility over their budgets and over how much money to provide in the form of institutionally-funded scholarships. This is because they are usually run by a private governing board, rather than a government-appointed board, like many public postsecondary institutions. Thus, they do not have to accede as much to the wishes of the state or community. The response to federal student loan aid is roughly 40% of the response to federal grant aid, which is consistent with the assumption in the previous literature that federal student loans have a subsidy value of between 30% and 50% of the total loan value.¹²

The positive coefficient on federal financial aid for private institutions could be a reflection of the increase in federal student aid making it possible for more students with higher financial need to attend college. The decrease in federal grant aid possibly caused fewer high-need students to attend college since both the Federal Pell Grant and SEOG grant are aimed at high-need students. Since institutions would have fewer high-need students, they would be able to decrease the amount of institution-based aid they disburse. As federal aid packages changed to include fewer grant dollars and more loan dollars, it is likely that including institution-based grant aid in student aid packages became a more effective way to attract preferred students. There is recent evidence that private institutions have been increasingly using institution-based aid to compete for top students.¹³ Another explanation is that the changes in the 1992 HEA Amendments, especially the increases in federal loan aid, were targeted largely at middle- to

¹² Feldstein (1995) assumes the subsidy value of a loan to be 50% of the dollar value. Kane (1995) puts the subsidy value of federal students loans at approximately one-third of the value.

¹³ Seaman (2001). According to a college guide from 1994, this competition can take the form of tuition discounts as well as financial aid. This practice of using financial aid and tuition discounts to compete for top students has grown since the Justice Department's 1991 ruling against the Overlap Group, a group of 23 elite colleges which collaborated in setting aid packages. (Sanoff, Alvin P., with Jo Ann Tooley, Andrew Krackov,

high-income students, and may have helped to increase the college attendance rates of these students. Due to higher costs of attendance at private institutions, these students are more likely to need extra help in the form of institution-based scholarships at private institutions than at public institutions.

With regard to other sources of institutional wealth, one would expect institutions to give out more scholarships from their own funds when their endowments are higher. The regression results confirm this for private four-year institutions, showing that private institutions increase their grant aid per student by about \$0.60 to \$1.20 for every \$100 increase in the value of their endowment per student. For public institutions, I find a significant relationship between endowments and institutional aid only in the models using federal grant aid. I find no significant relationship between state and local appropriations and institutional aid for either public or private institutions. This could be because state and local appropriations stayed fairly constant throughout the period analyzed.

The models using federal student grant aid show a negative relationship between federal grants and contracts and institutional aid for public institutions. Some of this aid could be used to pay for things like hiring students as research assistants. Those research assistants would then need less institution-based aid. That same story may explain the negative relationship between state and local grants and contracts and institution-based aid in most of the models for private institutions. There is no significant relationship between state median income and institution-based aid for either institution type. The coefficient on state median home equity is positive, but

Kristen Lieight and Andrea R. Wright, "Almost Anything Goes," *America's Best Colleges*, Washington, D.C.: U.S. News & World Report, 1994, p. 43-46.)

small, for private institutions. It is small and negative for public institutions in the model using federal grant aid, but is insignificant in the model using federal loan aid.

5.2.2. Tuition Revenues

Table 6 lists results from equation (5), the second stage of the regressions on tuition revenues. I find a positive relationship between tuition revenues and both types of federal aid for private four-year institutions. I find that public institutions may increase tuition revenues in response to decreases in federal grant aid, depending on which sample is used, but have no significant reaction to changes in federal loan aid. Private four-year institutions decrease tuition revenues by \$3.24 per student for every dollar decrease in federal grant aid. They also increase tuition revenues by \$1.30 per student for every \$1 per student increase in federal student loan aid. One explanation is that institutions increase tuition in order to capture increases in federal student aid. As explained earlier, a student's need is defined as the difference between the costs of attending a college and the student's expected family contribution. Thus, when tuition is higher, the student can qualify for more federal aid. Since students who need it are receiving more federal aid, the institution can raise tuition levels for everyone.

Another possible explanation is that the increase in federal loan aid encouraged more students to attend college. This may have increased the demand for a college education, driving prices up. Also, since the changes in federal loan aid were targeted primarily at middle- to high-income students, institutions may have raised tuition thinking these students could afford a higher price. In addition, as explained above, institutions increased the amount of institution-based aid they gave out when federal student loan aid increased. Institutions often make decisions about tuition and institution-based aid simultaneously. They may choose to increase

tuition for all students, but give more institution-based aid to students who can't afford the higher tuition.

With regard to other sources of institutional wealth, we see that private institutions raise tuition when endowments increase. This could be in part due to the fact that institution-based aid also increases when endowments are higher. The university can increase tuition revenues while using the extra institutional aid to help out students who cannot afford a tuition increase. It could also be a result of demand. The size of an institution's endowment may be an indicator of quality. Thus schools who see an increase in their endowment may also see an increase in demand if students think that the quality of the institution has increased. This increase in demand could drive tuition levels up. I find a positive relationship between endowment and tuition revenues for public institutions only in the models using federal student grant aid. In the other models, I find no significant relationship between endowments and tuition for public institutions.

One would expect that state and local appropriations are used to provide a tuition subsidy, at least at public colleges. However, the coefficient for state and local appropriations is not significant in most of the models for either institution type. The models using federal grant aid show that institutions increase tuition when federal grants and contracts increase. The ability to win federal research contracts may be seen as a signal of institution quality, driving up demand for that institution, and thus allowing the institution to charge higher tuition. The coefficients on federal grants and contracts are not significant in the models using federal loan aid, however. I find no significant relationship between tuition and either state and local grants and contracts or state median income. Private institutions increase tuition when state median

home equity increases, possibly because a rise in median home equity indicates a rise in student ability to pay higher levels of tuition.

6. Discussion

Private institutions raise both tuition revenues and institution-based aid in response to increases in federal student aid. When federal grant aid falls, as it did over most of the sample period, tuition revenues and institution-based aid fall as well. When federal student grant aid is decreased by one dollar per student, private institutions decrease tuition by \$3.24 per student, but only increase decrease institution-based aid by \$1.48. This leaves students with a net tuition decrease of 76 cents¹⁴ for every dollar decrease in federal student aid. So, overall, students at private institutions appear to have benefited from the decrease in federal grant aid. The institutions themselves have lost net revenue as a result of this decrease. They receive \$3.24 per student less in tuition revenues for every dollar decrease in federal grant aid. However, they only save \$1.48 per student by cutting back on institution-based aid, leaving them with a net revenue loss of \$1.76 per student.¹⁵

Students at private institutions may not have benefited from the increases in federal student loan aid over this period. For every dollar increase in federal student loan aid, students at private institutions get a net tuition decrease of 28 cents for every dollar per student increase in

¹⁴ \$0.76 net tuition decrease = \$3.24 gross tuition decrease – \$1.48 institutional grant decrease – \$1.00 federal student grant decrease.

¹⁵ Institution net revenues are directly affected by changes in federal student aid because the federal aid is essentially a transfer from the federal government to the students.

federal loan aid. However, if we assume that students value loan aid at 50 cents on the dollar¹⁶, then they actually face a net tuition increase of 22 cents. Private four-year institutions get increased tuition revenue of \$1.30 per student, but only pay out an additional 58 cents of institution-based aid, giving them a net revenue increase of 72 cents per student for every dollar increase in federal student loan aid.

Between AY1991-92 and AY1995-96, federal student grant aid decreased by an average of \$115 per student at private institutions. Federal student loan aid at these institutions increased by an average of \$1607 per student. Given the responses described above, the results indicate that students at private institutions have seen a net tuition decrease of around \$537 over the period as a result of the changes in federal student aid. However, if students value loans at only 50% of their value, then the decrease becomes a net tuition increase of \$266. Private four-year institutions received an increase in revenue of \$955 per student due to changes in federal student aid.

While the results for private institutions were robust to using imputed endowment vs. only observations with non-missing endowment, the results for public institutions were not. Results using imputed endowment values show that public four-year institutions lower their institution-based aid and increase their tuition revenues when federal grant aid is increased. However, the results are not significant when only observations with non-missing endowment

¹⁶ The assumption that subsidy value of a federal student loan is 50 cents on the dollar is borrowed from Feldstein (1995) and Dick and Edlin (1997). It is likely that the value is even lower than this since much of the increase in student loans over this period came from unsubsidized loans. If the subsidy value is lower than 50% of face value, the average net tuition increase faced by students at private institutions will be higher.

are used. I found no significant effect of changes in federal loan aid on either institution-based aid or tuition revenues.

The first two columns of Table 7 summarize the results described so far. In the table, I assume that changes in institutional aid and tuition resulting from changes in federal aid were zero for public institutions. The numbers for private institutions came from the sample with imputed endowments.¹⁷ The results in the first two columns of Table 7 are averages over all students at that institution type. The actual impact will differ depending on student characteristics.

The rest of Table 7 simulates how students from different income levels may have fared over the period AY1991-92 through AY1995-96 as a result of the changes in federal student aid. Low-income students are defined as those whose family income is less than \$30,000. Middle-income students are defined as those whose family incomes are between \$30,000 and \$100,000. High-income students have family income above \$100,000¹⁸. Since Federal Pell and SEOG grants are targeted towards high-need families, and these families tend to have lower income, I assume that high-income students do not qualify for any federal grant aid¹⁹. However, I allow them to receive some federal loan aid, as many do get student loans to help cover costs of attendance, especially at private institutions. High-income students also receive a small portion of institution-based aid in my simulation, as some institution-based aid is given as merit aid and

¹⁷ The results were similar to those using the sample with only non-missing endowment values.

¹⁸ These values were chosen to roughly coincide with the breakdown of students in Table 5.1 of McPherson and Schapiro (1998).

¹⁹ Most students with family incomes that high would have EFCs that are too high to qualify for federal grant aid. However, if the family has more than one member in college at the same time, the EFC for each student may be small enough for even a high-income family to qualify for aid.

may go to students who do not necessarily have financial need. I also assume that low-income students receive the bulk of changes in federal student grant aid, that middle-income students receive roughly half of any increase in federal loan aid, and that low- and middle-income students receive roughly the same amount of institution-based aid overall²⁰. Further research into how student aid was actually distributed across students from different income groups would help to more precisely answer the question of how students are affected by the changes in federal aid

Low-income students are likely the main beneficiaries of increases in federal grant aid. Federal Pell and SEOG grants are targeted primarily towards high-need students, who generally tend to also be low-income students. Thus, a dollar decrease in average federal grant aid per student will translate into more than a dollar decrease in federal grant aid for these students. The same can be said for increases in federal loan aid since federal subsidized loans are targeted at high-need students. Since much institution-based aid is likely distributed on a need-basis, low-income students also likely receive more than the average institution-based aid per student. As a result, low-income students were affected more than the average student by the changes in both federal grant aid and federal loan aid over the period studied. As shown in the last row of Table 7, the bottom line is that low-income students saw a large decrease in net tuition over the period. Even when we assume loans are valued at 50%, low-income students receive a net tuition decrease due to the changes in federal student aid of \$557 at public institutions and \$1145 at private institution.

²⁰ Lower-income students generally have higher overall financial need than middle-income students, but they also tend to receive more grant aid from the federal and state governments. Thus the amount of need left over

Middle-income students qualify for little federal grant aid due to their EFCs being too high. However, middle-income students generally qualify for loan aid. In fact, the increases in borrowing limits and expansion of loan programs were largely targeted towards middle-income students. These students may also be eligible for some institutional aid if federal aid is not enough to cover all the costs of attendance. This is more likely to be true at private institutions because they have higher tuition levels. As seen in Table 7, middle-income students at private institutions likely saw a decrease in net tuition between AY1991-92 and AY1995-96. However, most of this was due to the increase in federal student loans. If students value these loans at 50 cents on the dollar, then middle-income students actually suffered a net tuition increase of \$273 over that period.

High-income students don't qualify for increases in federal aid, but still must pay the increased tuition. They also may not receive much institution-based aid if the institution disburses aid based on need.²¹ Hence, they pay the increase in tuition with little benefit of extra aid. As seen in Table 7, the increase in federal student loan aid over the period studied was larger than the decrease in federal student grant aid, causing tuition levels to increase overall.

Table 7 also shows the change in net revenue that institutions receive from each type of student. The changes in federal student aid over the period studied increased net revenues for private institutions. This is because, though they raised both institution-based aid and tuition in response to the changes in federal aid, they raised tuition revenues by a larger amount. As one

after federal grant aid is considered may be similar between low- and middle-income students.

²¹ Though, according to a recent article in *Time* (Seaman (2001)), more institutional scholarships are being awarded to high-ability students who don't necessarily need them, leaving less institutional aid available for truly needy students.

would expect, private institutions increased net revenue from higher-income students the most since they tend to give these students a relatively small amount of institution-based aid. Private institutions had only a very small increase in revenues from low-income students, as they need larger amounts of institution-based aid to be able to afford the increases in tuition.

In summary, the federal student aid does not crowd out institution-based aid. For private institutions, I instead find a positive relationship between federal student aid and institution-based aid for private four-year postsecondary institutions. I also find a positive relationship between federal student aid and tuition revenues for private four-year schools. Overall, my results indicate that the changes in federal student grant and loan aid observed in the first half of the 1990s tended to decrease net tuition for low-income students. Thus the government's goal of increasing access for these students seems to have been furthered by the changes in federal aid. However, if we assume that students value loan aid at 50% or less, then middle- and high-income students actually faced a net tuition increase at private institutions over this period. This may cause fewer middle-income students to attend private institutions. The results also indicate that, overall, private institutions more than captured all of the increase in federal loan aid per student in the form of higher revenues. Private institutions were able to raise tuition by \$1.30 for every dollar increase in federal loan aid. They also lowered tuition due to the decrease in federal grants. However the increase in federal loans was much larger than the decrease in federal grant aid, leaving institutions with an average net increase in revenues of \$955 per student.

7. Conclusion

Using changes in the federal student aid laws, I created a credible instrument for federal financial aid received by a postsecondary education institution. Using this instrument and

detailed data on the actual amounts of federal student grant and loan aid received by each institution, I was able to estimate the effect that different types of federal student aid have on grant aid funded from those institutions' own funds. I find that private four-year institutions will decrease tuition revenues by \$3.24 per student and decrease institution-based aid by \$1.48 per student in response to a dollar per student decrease in federal grant aid. This leaves students with a net tuition decrease of \$0.76 and the institutions with a net revenue loss of \$1.76 per student. In response to a dollar per student increase in federal student loan aid, I find that private institutions increase tuition revenues by \$1.30 per student and increase institution-based aid 58 cents per student, leaving private institutions with a net revenue increase of 72 cents per student. If we assume students value student loans at 50 cents on the dollar, then students at private four-year institutions just about break even on average, facing a rise of \$1.30 in tuition costs and receiving an increase in aid valued at \$1.29. I find no consistent significant reaction to federal student aid by public four-year institutions.

The results indicate that between AY1991-92 and AY1995-6, the changes in federal student aid lowered net tuition for low-income students. Net tuition was also lowered for middle-income students at public institutions. Net tuition increased for high-income students, and possibly for middle-income students at private institutions as a result of the federal aid changes. Private institutions were able to capture some of the increase in federal aid in the form of increased net revenues per student by raising tuition revenues more than institution-based aid. No consistent significant reaction to federal student aid was found for public four-year institutions. In general, it appears that the changes in federal student aid worked to help increase access to a higher education for low-income students, but at some cost to students of higher income.

References

- Craig, Steven G., and Robert P. Inman. 1989. "Federal Aid and Public Education: An Empirical Look at the New Fiscal Federalism." *The Review of Economics and Statistics* 71: 284-90.
- Cutler, David M. and Jonathan Gruber. May 1996. "Does Public Insurance Crowd Out Private Insurance?" *The Quarterly Journal of Economics*: 391-430.
- Dick, Andrew W. and Aaron S. Edlin. 1997. "The implicit taxes from college financial aid." *Journal of Public Economics* 65: 295-322.
- Dynarski, Susan M. 1999. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion." Working Paper 7422. Cambridge, Mass: National Bureau of Economic Research.
- Feldstein, Martin. 1978. "Effect of a Differential Add-On Grant; Title I and Local Education Spending." *Journal of Human Resources* 13: 443-58.
- _____. June 1995. "College Scholarship Rules and Private Saving." *The American Economic Review* 85(3): 552-566.
- _____. 2000. "Hope for Whom? Financial Aid for the Middle Class and Its Impact on College Attendance." Working Paper 7756. Cambridge, Mass: National Bureau of Economic Research.
- Kane, Thomas J. 1995. "Rising Public College Tuition and College Entry: How Well Do Public Subsidies Promote Access to College?" Working Paper 5164. Cambridge, Mass.: National Bureau of Economic Research.
- _____. 1999. "The Price of Admission: Rethinking How Americans Pay for College." Brookings Institution.
- McPherson, Michael S., and Morton Owen Schapiro. 1991a. "Does Student Aid Affect College Enrollment? New Evidence on a Persistent Controversy." *American Economic Review* 81: 309-18.
- _____. 1991b. *Keeping College Affordable: Government and Educational Opportunity*. Brookings Institution.
- _____. 1998. *The Student Aid Game: Meeting Need and Rewarding Talent in American Higher Education*. Princeton University Press.
- McPherson, Michael S., Morton Owen Schapiro, and Gordon C. Winston. 1993. *Paying the Piper: Productivity, Incentives, and Financing in U.S. Higher Education*. Univ. of Michigan Press.
- Savoca, Elizabeth. 1991. "The Effect of Changes in the Composition of Financial Aid on College Enrollments." *Eastern Economic Journal* 17(1): 109-121.
- Seaman, Barrett. 2001. "How Much for That Student?" *Time*, April 20.

Schwartz, J. Brad. 1985. "Student Financial Aid and the College Enrollment Decision: the Effects of Public and Private Grants and Interest Subsidies." *Economics of Education Review* 4(2): 129-144.

because there appeared to be variation in the endowment values by class of institution, especially in the private sector. Using the institutions with non-missing endowment values, I ran regressions of the form:

$$\text{Endow}_i = \beta_0 + \beta_1 \text{carnegie}_i + \beta_2 \text{medinc}_i + \varepsilon_i$$

Where:

Endow_i = endowment value for institution i

carnegie_i = set of dummy variables for each Carnegie classification (Research Universities I & II, Doctoral Universities I & II, Masters (Comprehensive) Universities & Colleges I & II, Bachelors (Liberal Arts) Colleges I & II)

medinc_i = median income in state where institution i is located.

These regressions had an R^2 of around 0.10 to 0.15 for the public four-year institutions and around 0.45 to 0.50 for private four-year institutions. The fit was better for the private institutions because they had more variation by classification than did the public institutions. This explains why the regression results using the imputed values are closer to the results using only non-missing data for private institutions than for public institutions.

Table 1

Descriptive statistics for selected years

(in \$ per student)

	AY1992-93		AY1993-94		AY1995-96	
	mean	std dev	mean	std dev	mean	std dev
tuition revenues	3,116	1,413	3,178	1,439	3,395	1,521
federal grant aid	511	348	454	362	432	295
federal loan aid	1,238	904	1,772	1,247	2,249	1,377
institutional aid	254	318	245	314	293	357
endowment value	2,278	7,903	2,422	8,271	2,802	9,472
state & local approp	6,260	9,146	6,250	9,097	6,337	8,476
fed grts & contracts	1,542	4,493	1,530	4,373	1,622	4,457
s&l grts & contracts	487	1,555	538	1,965	963	6,121
enrollment	9,922	13,114	9,555	12,874	9,564	12,794
N	465		514		511	
tuition revenues	9,746	4,237	10,003	4,345	10,694	4,362
federal grant aid	605	432	531	552	483	326
federal loan aid	2,203	1,324	3,064	3,309	3,718	2,371
institutional aid	2,071	1,546	2,224	1,681	2,561	1,889
endowment value	22,597	447,674	23,165	74,903	25,024	49,882
state & local approp	61	290	59	1,201	52	335
fed grts & contracts	872	3,419	911		929	3,726
s&l grts & contracts	472	872	454		464	698
enrollment	2,230	3,041	2,231	2,784	2,298	3,041
N	988		1,000		985	

Source: Author's calculations using IPEDS data.

Table 2: OLS and Fixed Effect Models

Dependent variable: institution-based grant aid
(in \$ per student)

sector model	Public Four-Year			Private Four-Year		
	1	2	3	1	2	3
federal student grant aid	-0.027 (0.022)	0.001 (0.017)	0.012 (0.017)	-0.502 (0.061)***	1.05 (0.058)***	1.23 (0.067)***
endowment	0.012 (0.002)***	0.008 (0.002)***	0.008 (0.002)***	0.017 (0.001)***	0.007 (0.001)***	0.006 (0.001)***
state & local appropriations	-0.002 (0.002)	0.003 (0.002)	0.002 (0.003)	0.148 (0.118)	0.057 (0.078)	0.083 (0.078)
federal grants & contracts	0.004 (0.003)	-0.018 (0.004)***	-0.020 (0.004)***	-0.037 (0.007)***	-0.009 (0.010)	-0.015 (0.010)
state & local grants/contracts	0.007 (0.007)	0.008 (0.005)	0.007 (0.005)	0.069 (0.027)**	-0.078 (0.017)***	-0.071 (0.018)***
state median income	0.007 (0.002)***	0.001 (0.001)	0.006 (0.002)***	0.013 (0.007)*	-0.007 (0.005)	-0.005 (0.005)
state median home equity	-0.002 (0.0003)***	-0.0006 (0.0003)**	-0.002 (0.0004)***	0.001 (0.001)	0.004 (0.001)***	0.005 (0.001)***
constant	92.36 (58.48)	192.55 (46.47)***	154.17 (53.98)***	1396.06 (215.44)***	1128.59 (163.28)***	992.29 (166.15)***
Adj. R ²	0.065	0.128	0.163	.255	0.360	0.386
#institutions	453	453	330	939	939	881
#obs	2221	2221	1594	4654	4654	4258
federal student loan aid	0.051 (0.008)***	0.012 (0.005)**	0.014 (0.006)**	0.023 (0.012)*	0.022 (0.009)**	0.011 (0.009)
endowment	0.013 (0.002)***	0.000 (0.001)	0.003 (0.002)*	0.018 (0.001)***	0.009 (0.001)***	0.009 (0.001)***
state & local appropriations	-0.006 (0.001)***	0.003 (0.001)**	0.004 (0.002)	0.050 (0.108)	0.084 (0.080)	0.117 (0.081)
federal grants & contracts	0.003 (0.002)	-0.010 (0.004)***	-0.015 (0.004)***	0.037 (0.007)***	-0.001 (0.011)	-0.006 (0.011)
state & local grants/contracts	0.000 (0.002)	0.003 (0.001)***	-0.001 (0.002)	0.050 (0.027)*	-0.053 (0.018)***	-0.040 (0.018)**
state median income	0.009 (0.002)***	0.002 (0.001)	0.006 (0.002)***	0.025 (0.007)***	-0.012 (0.005)**	-0.010 (0.005)**
state median home equity	-0.002 (0.0003)***	-0.0006 (0.0003)**	-0.002 (0.0004)***	0.001 (0.001)	0.003 (0.001)***	0.003 (0.001)***
constant	-15.22 (50.01)	175.17 (43.66)***	124.10 (52.23)**	569.62 (200.28)***	1897.78 (163.54)***	1922.68 (165.79)***
Adj. R ²	0.134	0.124	0.153	0.246	0.315	0.336
# institutions	473	473	345	947	947	887
# obs	2317	2317	1665	4693	4693	4287
year fixed	Yes	Yes	Yes	Yes	Yes	Yes
institution fixed	No	Yes	Yes	No	Yes	Yes

model 1: missing endowments were imputed, no institution fixed effects

model 2: missing endowments were imputed, includes institution fixed effects

model 3: record with missing endowments not used, includes institution fixed effects

Table 3: OLS and Fixed Effect Models

Dependent variable: tuition revenues

(in \$ per student)

sector model	Public Four-Year			Private Four-Year		
	1	2	3	1	2	3
federal student grant aid	-0.589 (0.083)***	0.257 (0.040)***	0.200 (0.038)***	-2.90 (0.140)***	1.96 (0.128)***	2.39 (0.094)***
endowment	0.069 (0.006)***	0.025 (0.005)***	0.029 (0.005)***	0.034 (0.001)***	0.011 (0.002)***	0.009 (0.001)***
state & local appropriations	-0.004 (0.007)	-0.010 (0.005)*	0.019 (0.006)***	1.461 (0.268)***	-0.096 (0.173)	-0.266 (0.110)**
federal grants & contracts	0.102 (0.010)***	0.031 (0.010)***	0.036 (0.009)***	0.012 (0.015)	0.060 (0.023)***	0.043 (0.015)***
state & local grants/contracts	0.052 (0.026)**	0.021 (0.012)*	0.012 (0.011)	0.458 (0.062)***	0.092 (0.038)**	0.075 (0.025)***
state median income	0.077 (0.007)***	-0.001 (0.003)	-0.001 (0.004)	0.038 (0.016)**	-0.015 (0.010)	-0.012 (0.007)*
state median home equity	-0.003 (0.001)**	-0.004 (0.001)***	-0.001 (0.001)	0.031 (0.002)***	0.004 (0.002)*	0.006 (0.001)***
constant	456.16 (218.42)**	2791.69 (109.22)***	2,871.35 (119.05)***	6982.64 (490.91)***	8195.04 (361.54)***	7991.11 (234.37)***
Adj. R ²	0.322	0.514	0.555	0.374	0.285	0.520
# institutions	453	453	330	939	939	881
# obs	2221	2221	1594	4654	4654	4258
federal student loan aid	0.614 (0.028)***	0.128 (0.012)***	0.151 (0.013)***	0.522 (0.028)***	0.256 (0.020)***	0.209 (0.013)***
endowment	0.037 (0.004)***	0.009 (0.003)***	0.008 (0.004)**	0.041 (0.001)***	0.017 (0.002)***	0.015 (0.001)***
state & local appropriations	-0.028 (0.004)***	0.003 (0.003)	0.001 (0.005)	0.727 (0.247)***	-0.024 (0.174)	-0.167 (0.115)
federal grants & contracts	0.028 (0.008)***	0.016 (0.008)*	0.008 (0.008)	0.013 (0.015)	0.066 (0.023)***	0.054 (0.015)***
state & local grants/contracts	-0.023 (0.008)***	-0.003 (0.002)*	-0.016 (0.004)***	0.299 (0.062)***	0.116 (0.038)***	0.121 (0.026)***
state median income	0.099 (0.006)***	-0.002 (0.003)	-0.003 (0.004)	0.124 (0.016)***	-0.014 (0.010)	-0.015 (0.007)**
state median home equity	-0.001 (0.001)	-0.004 (0.001)***	-0.001 (0.001)	0.032 (0.002)***	0.004 (0.002)	0.004 (0.002)***
constant	-1144.69 (181.63)***	2869.07 (103.18)***	2,881.94 (115.42)***	991.89 (457.48)**	8738.72 (352.96)***	9062.19 (235.79)***
Adj. R ²	0.372	0.522	0.570	0.362	0.277	0.478
# institutions	473	473	345	947	947	887
# obs	2317	2317	1665	4693	4693	4287
year fixed	Yes	Yes	Yes	Yes	Yes	Yes
institution fixed	No	Yes	Yes	No	Yes	Yes

model 1: missing endowments were imputed, no institution fixed effects

model 2: missing endowments were imputed, includes institution fixed effects

model 3: record with missing endowments not used, includes institution fixed effects

Table 4: First Stage Instrumental Variables

(in \$ per student)

sector model	Public Four-Year			Private Four-Year		
	1	2	3	1	2	3
Dependent Variable = federal student grant aid						
home equity X after AY1992-93	0.0010 (0.0005)**	0.0007 (0.0002)***	0.0004 (0.0003)*	0.0004 (0.0004)	0.002 (0.0001)***	0.001 (0.0001)***
endowment	-0.009 (0.001)***	0.000 (0.003)	0.0001 (0.003)	-0.001 (0.0001)***	0.002 (0.0003)***	0.002 (0.0002)***
state & local appropriations	-0.008 (0.002)***	0.014 (0.003)***	0.018 (0.003)***	0.033 (0.028)	0.040 (0.019)**	0.039 (0.018)**
federal grants & contracts	0.001 (0.003)	-0.004 (0.005)	-0.004 (0.006)	-0.001 (0.002)	0.008 (0.003)***	0.008 (0.002)***
state & local grants/contracts	-0.007 (0.007)	0.012 (0.006)*	0.012 (0.007)*	0.042 (0.006)***	0.027 (0.004)***	0.026 (0.004)***
state median income	-0.024 (0.002)***	-0.002 (0.002)	-0.003 (0.002)	-0.02 (0.002)***	-0.004 (0.001)***	-0.003 (0.001)***
state median home equity	0.0001 (0.0004)	-0.003 (0.0004)***	-0.002 (0.001)***	-0.001 (0.0003)***	-0.0006 (0.0003)**	-0.001 (0.0002)***
constant	1399.94 (50.29)***	714.93 (55.83)***	629.11 (76.73)***	1422.64 (48.57)***	737.49 (40.02)***	721.16 (36.40)***
Adj. R ²	0.171	0.148	0.121	0.146	0.287	0.311
# institutions	453	453	330	939	939	881
# observations	2221	2221	1594	4654	4654	4258
Dependent Variable = federal student loan aid						
home equity X after AY1992-93	0.001 (0.001)	0.0001 (0.001)	-0.0005 (0.001)	0.006 (0.002)***	0.004 (0.001)***	0.004 (0.001)***
endowment	-0.023 (0.003)***	0.007 (0.005)	0.039 (0.007)***	-0.005 (0.001)***	-0.006 (0.002)***	-0.006 (0.002)***
state & local appropriations	0.041 (0.003)***	-0.020 (0.005)***	-0.024 (0.009)***	0.245 (0.131)*	-0.040 (0.130)	-0.107 (0.131)
federal grants & contracts	0.107 (0.006)***	0.129 (0.014)***	0.151 (0.015)***	0.016 (0.008)**	0.036 (0.017)**	0.033 (0.017)*
state & local grants/contracts	0.014 (0.006)**	-0.005 (0.003)*	0.017 (0.007)**	0.067 (0.033)**	0.102 (0.029)***	0.070 (0.030)**
state median income	-0.004 (0.005)	-0.007 (0.005)	-0.009 (0.007)	-0.027 (0.008)***	-0.036 (0.008)***	-0.033 (0.008)***
state median home equity	-0.006 (0.001)***	-0.002 (0.001)	0.0002 (0.002)	0.001 (0.002)	-0.007 (0.002)***	-0.007 (0.002)***
constant	1326.33 (136.48)***	1516.90 (172.08)***	1420.04 (214.36)***	3107.22 (246.02)***	3937.83 (265.41)***	3852.15 (270.06)***
Adj. R ²	0.528	0.677	0.685	0.145	0.557	0.567
# institutions	473	473	345	947	947	887
# observations	2317	2317	1665	4693	4693	4287
year fixed	Yes	Yes	Yes	Yes	Yes	Yes
institution fixed	No	Yes	Yes	No	Yes	Yes

model 1: missing endowments were imputed, no institution fixed effects

model 2: missing endowments were imputed, includes institution fixed effects

model 3: record with missing endowments not used, includes institution fixed effects

Table 5: Second Stage Instrumental Variables

Dependent variable: institution-based grant aid

(in \$ per student)

sector model	Public Four-Year			Private Four-Year		
	1	2	3	1	2	3
federal student grant aid	-0.4220 (0.56)	-0.577 (0.274)**	-0.421 (0.482)	6.42 (8.27)	1.48 (0.322)***	1.45 (0.344)***
endowment	0.009 (0.005)*	0.008 (0.003)***	0.008 (0.003)***	0.026 (0.011)**	0.006 (0.001)***	0.005 (0.001)***
state & local appropriations	-0.005 (0.005)	0.010 (0.005)**	0.009 (0.009)	0.375 (0.354)	0.045 (0.079)	0.076 (0.079)
federal grants & contracts	0.004 (0.003)	-0.020 (0.005)***	-0.022 (0.005)***	-0.028 (0.017)*	-0.012 (0.011)	-0.017 (0.011)
state & local grants/contracts	0.004 (0.008)	0.014 (0.007)**	0.012 (0.008)	-0.224 (0.354)	-0.089 (0.019)***	-0.077 (0.020)***
state median income	-0.002 (0.013)	0.0002 (0.002)	0.005 (0.002)*	0.152 (0.167)	-0.005 (0.005)	-0.004 (0.005)
state median home equity	-0.002 (0.0005)***	-0.002 (0.001)***	-0.003 (0.001)**	0.009 (0.011)	0.005 (0.001)***	0.005 (0.001)***
constant	634.77 (769.39)	623.71 (211.36)***	431.00 (314.40)	-8369.83 (11674.33)	756.53 (320.34)**	804.56 (328.15)**
Adj R ²					0.352	0.384
# institutions	453	453	330	939	939	881
# observations	2221	2221	1594	4654	4654	4258
federal student loan aid	-0.542 (1.568)	-3.300 (17.19)	3.71 (54.10)	0.435 (0.328)	0.579 (0.178)***	0.563 (0.191)***
endowment	-0.001 (0.036)	0.024 (0.123)	-0.140 (2.10)	0.020 (0.002)***	0.012 (0.002)***	0.011 (0.002)***
state & local appropriations	0.018 (0.065)	-0.062 (0.338)	0.094 (1.32)	-0.052 (0.146)	0.122 (0.109)	0.189 (0.111)*
federal grants & contracts	0.066 (0.168)	0.418 (2.222)	-0.572 (8.15)	-0.043 (0.009)***	-0.021 (0.016)	-0.024 (0.016)
state & local grants/contracts	0.008 (0.022)	-0.015 (0.095)	-0.065 (0.935)	0.022 (0.038)	-0.109 (0.030)***	0.079 (0.028)***
state median income	0.006 (0.006)	-0.020 (0.115)	0.041 (0.512)	0.037 (0.012)***	0.011 (0.010)	0.011 (0.010)
state median home equity	-0.005 (0.009)	-0.007 (0.035)	-0.002 (0.012)	-0.0005 (0.002)	0.008 (0.002)***	0.008 (0.002)***
constant	760.07 (2054.52)	5214.27 (26157.15)	-5,122.25 (76761.04)	-640.86 (988.11)	-478.71 (790.20)	-369 (821.79)
Adj. R ²				0.058	0.557	
# institutions	473	473	345	947	947	887
# observations	2317	2317	1665	4693	4693	4287
year fixed	Yes	Yes	Yes	Yes	Yes	Yes
institution fixed	No	Yes	Yes	No	Yes	Yes

model 1: missing endowments were imputed, no institution fixed effects

model 2: missing endowments were imputed, includes institution fixed effects

model 3: record with missing endowments not used, includes institution fixed effects

Table 6: Second Stage Instrumental Variables

Dependent variable: tuition revenues
(in \$ per student)

sector model	Public Four-Year			Private Four-Year		
	1	2	3	1	2	3
federal student grant aid	3.96 (3.01)	2.21 (0.750)***	0.473 (0.915)	40.78 (45.71)	3.24 (0.716)***	3.58 (0.493)***
endowment	0.110 (0.029)***	0.025 (0.007)***	0.029 (0.005)***	0.092 (0.061)	0.008 (0.003)***	0.007 (0.002)***
state & local appropriations	0.032 (0.026)	-0.035 (0.012)***	-0.024 (0.017)	2.92 (1.96)	-0.132 (0.176)	-0.301 (0.113)***
federal grants & contracts	0.098 (0.015)***	0.039 (0.014)***	0.037 (0.010)***	0.072 (0.094)	0.050 (0.024)**	0.035 (0.015)**
state & local grants/contracts	0.082 (0.045)*	0.001 (0.018)	0.009 (0.015)	-1.39 (1.96)	0.059 (0.043)	0.044 (0.029)
state median income	0.185 (0.072)**	0.004 (0.005)	-0.0002 (0.005)	0.917 (0.923)	-0.007 (0.011)	-0.006 (0.007)
state median home equity	-0.005 (0.003)**	0.003 (0.003)	0.0004 (0.002)	0.086 (0.059)	0.006 (0.002)**	0.008 (0.002)***
constant	-5773.94 (4133.85)	1338.45 (579.00)**	2696.92 (596.62)***	-54,653 (64,530)	7,081 (712.74)***	6,991 (470.90)***
Adj. R ²		0.000	0.541		0.269	0.502
# institutions	453	453	330	939	939	881
# observations	2221	2221	1594	4654	4654	4258
federal student loan aid	5.55 (11.46)	12.18 (62.42)	-7.58 (113.10)	2.78 (1.05)***	1.30 (0.363)***	1.42 (0.346)***
endowment	0.150 (0.262)	-0.077 (0.447)	0.308 (4.38)	0.053 (0.006)***	0.022 (0.003)***	0.022 (0.003)***
state & local appropriations	-0.231 (0.473)	0.240 (1.23)	-0.188 (2.75)	0.168 (0.464)	0.048 (0.221)	-0.010 (0.201)
federal grants & contracts	-0.502 (1.230)	-1.541 (8.07)	1.170 (17.03)	-0.022 (0.029)	0.030 (0.032)	0.015 (0.028)
state & local grants/contracts	-0.091 (0.160)	0.062 (0.343)	0.118 (1.95)	0.145 (0.121)	0.012 (0.061)	0.037 (0.051)
state median income	0.116 (0.047)**	0.077 (0.417)	-0.076 (1.07)	0.187 (0.038)***	0.029 (0.020)	0.031 (0.018)*
state median home equity	0.026 (0.063)	0.020 (0.127)	0.001 (0.025)	0.023 (0.006)***	0.013 (0.004)***	0.015 (0.004)***
constant	-7605.77 (15,011.86)	-15460.09 (94985.55)	13846.8 (160470.6)	-5642.93 (3150.78)*	4,306.96 (1605.78)***	4,026 (1487.25)***
Adj. R ²						
# institutions	473	473	345	947	947	887
# observations	2317	2317	1665	4693	4693	4287
year fixed	Yes	Yes	Yes	Yes	Yes	Yes
institution fixed	No	Yes	Yes	No	Yes	Yes

model 1: missing endowments were imputed, no institution fixed effects

model 2: missing endowments were imputed, includes institution fixed effects

model 3: record with missing endowments not used, includes institution fixed effects

Table 7: Result of Changes in Federal Aid, AY1991-92 to AY1995-96

income range institution type	Average (from regressions)		Low-income \$0-30,000		Middle-income \$30,000-100,000		High-income >\$100,000	
	Public	Private	Public	Private	Public	Private	Public	Private
			30%	20%	55%	50%	15%	30%
% of students in this group (1)								
federal grant aid	\$1.00	\$1.00	\$2.67	\$4.00	\$0.36	\$0.40	\$0.00	\$0.00
institution-based grant aid	\$0.00	\$1.48	\$0.00	\$3.33	\$0.00	\$1.33	\$0.00	\$0.49
tuition	\$0.00	\$3.24	\$0.00	\$3.24	\$0.00	\$3.24	\$0.00	\$3.24
net tuition to student (2)	-\$1.00	\$0.76	-\$2.67	-\$4.09	-\$0.36	-\$1.51	\$0.00	\$2.75
net revenues to institution (3)	\$0.00	\$1.76	\$0.00	-\$0.09	\$0.00	\$1.91	\$0.00	\$2.75
federal loan aid	\$1.00	\$1.00	\$1.33	\$2.00	\$0.91	\$1.00	\$0.67	\$0.33
institution-based grant aid	\$0.00	\$0.58	\$0.00	\$1.31	\$0.00	\$0.52	\$0.00	\$0.19
tuition	\$0.00	\$1.30	\$0.00	\$1.30	\$0.00	\$1.30	\$0.00	\$1.30
net tuition to student	-\$1.00	-\$0.28	-\$1.33	-\$2.01	-\$0.91	-\$0.22	-\$0.67	\$0.77
if loans valued at 50%	-\$0.50	\$0.22	-\$0.67	-\$1.01	-\$0.45	\$0.28	\$0.00	\$1.30
net revenues to institution	\$0.00	\$0.72	\$0.00	\$0.00	\$0.00	\$0.78	\$0.00	\$1.11
federal grant aid	-\$65.00	-\$115.00	-\$173.33	-\$460.00	-\$23.64	-\$46.00	\$0.00	\$0.00
federal loan aid	\$1,095.00	\$1,607.00	\$1,460.00	\$3,214.00	\$995.45	\$1,607.00	\$0.00	\$0.00
institution-based grant aid	\$0.00	\$761.86	\$0.00	\$1,714.19	\$0.00	\$685.67	\$0.00	\$0.00
tuition	\$0.00	\$1,716.50	\$0.00	\$1,716.50	\$0.00	\$1,716.50	\$0.00	\$1,716.50
net tuition to student	-\$1,030.00	-\$537.36	-\$1,286.67	-\$2,751.69	-\$971.82	-\$530.17	\$0.00	\$1,716.50
if loans valued at 50%	-\$482.50	\$266.14	-\$556.67	-\$1,144.69	-\$474.09	\$273.33	\$0.00	\$1,716.50
net revenues to institution	\$0.00	\$954.64	\$0.00	\$2.32	\$0.00	\$1,030.83	\$0.00	\$1,716.50

Source: Author's calculations

Notes:

(1) Author's calculations based on McPherson & Schapiro (1998) Table 5.1

(2) Net tuition to students = tuition - federal aid - institution-based aid

(3) Net revenues to institution = tuition revenue - amt paid in institution-based aid

Assumptions on distribution of student aid:

	Low-income	Middle-income	High-income
Federal grant aid	80%	20%	0%
Federal loan aid	40%	50%	10%
Institution-based grant aid	45%	45%	10%

Figure 1

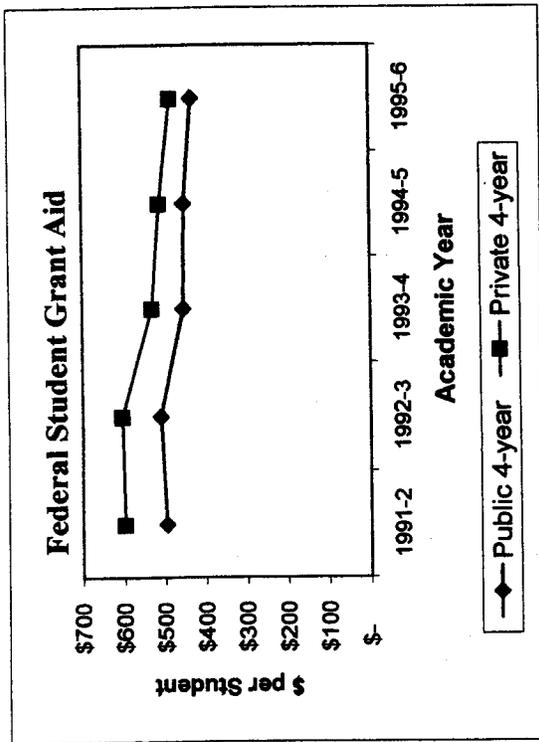


Figure 2

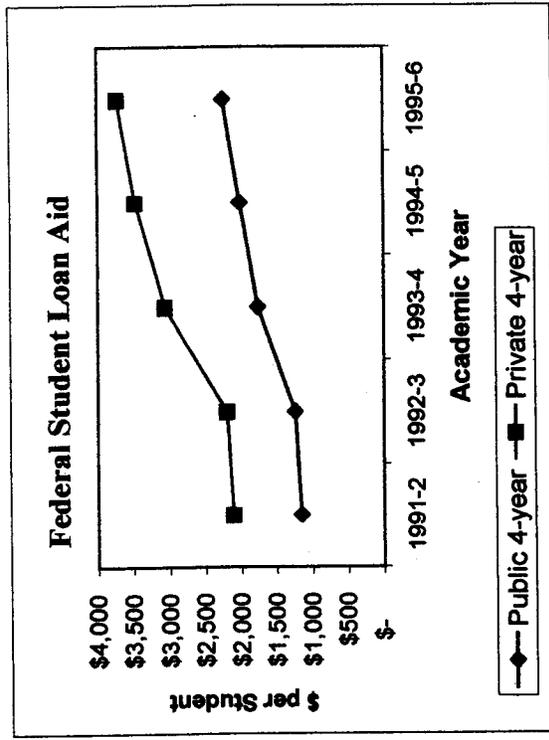


Figure 3

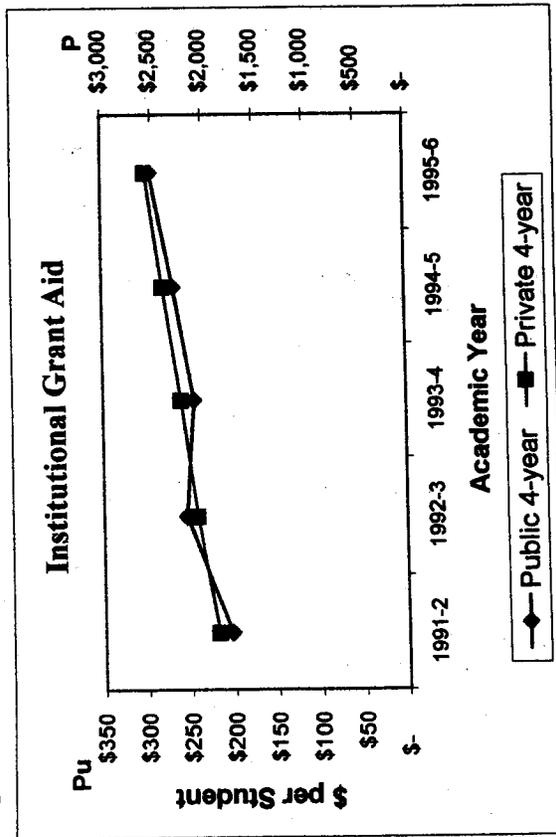


Figure 4

