UNIVERSITY OF CALIFORNIA, SAN DIEGO

The Economic Impact of Tax-Based Federal Student Aid

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy

in

Economics

by

Nicholas Turner

Committee in Charge:

Professor Julie Cullen, Chair
Professor Nora Gordon
Professor Roger Gordon
Professor Isaac Martin
Professor Hugh Mehan

2010

The Dissertation of Nicholas Turner is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California, San Diego

2010

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I feel fortunate to have received support from numerous faculty members at UCSD. In particular, I would like to thank Professors Julie Cullen, Nora Gordon and Roger Gordon. Julie Cullen is a wonderful advisor and I benefitted enormously from her helpful suggestions and willingness to review numerous drafts of my research. Nora Gordon essentially served as my second primary advisor, and I deeply appreciate all of the time she spent helping my research efforts. I also thank Roger Gordon for his expert advice and guidance.

I am also deeply grateful to Dr. Robert Tannenwald. Bob is undoubtedly the greatest boss that any aspiring economist could ever have, and I appreciate his continued guidance and support. It is because of Bob that I chose to get a doctorate in economics.

Lastly, I owe many thanks to my family. Thanks to Lisa Young for all of her proofreading efforts and for her unwavering support. Thank you to my parents, James and Connie Turner for their unending help and support. I thank my brothers Erik and Todd Turner for their camaraderie. Thanks also to Stephen and Marianne Young for all of their encouragement. And a special thank you to Ben and Mary Longo for taking the time to review and discuss previous drafts of this dissertation.

Chapter 1, in full, has been submitted for publication to the *National Tax Journal*.

Chapter 2, in full, has been submitted for publication to the *American Economic Journal, Applied Economics*.

Chapter 3, in part, is currently being prepared for submission for publication.

VITA

2000	Bachelor of Science, Pennsylvania State University
2001	Legislative Aide, New York State Assembly, Representative Robert K. Sweeney
2003	Master of Arts, Master of Public Policy, Georgetown University
2003	Master of Public Policy, Georgetown University
2003-2005	Policy Analyst and Advisor, New England Public Policy Center, Federal Reserve Bank of Boston
2010	Doctor of Philosophy, University of California San Diego

PUBLICATIONS

"Water, Water Everywhere, Dare I Drink a Drop: Water Conditions in New England." (with Robert Tannenwald). *New England Public Policy Center: Research Report,* Federal Reserve Bank of Boston. No. 05-01. May, 2005.

"Fiscal Capacity in State Fiscal Year 1999." (with Robert Tannenwald). *State Tax Notes,* vol. 36 no.8. May 23, 2005.

"The Economic Performance of the New England States in 2004: An Overview" (with co-authors). *New England Economic Indicators,* Federal Reserve Bank of Boston. May. 2005

"Do New England State and Local Governments Have Too Many Employees, and Are they Overpaid?" (with Matt Quigley). *Fiscal Facts*, Federal Reserve Bank of Boston. 2005.

"Six State Review." *Fiscal Facts,* Federal Reserve Bank of Boston. Summer 2005.

"Across the Region." *Fiscal Facts,* Federal Reserve Bank of Boston. Fall 2004.

"New State Revenue Data are More Timely." *New England Economic Indicators,* Federal Reserve Bank of Boston. May, 2004.

"The Economic Performance of the New England States in 2003: An Overview"(with co-authors). *New England Economic Indicators,* Federal Reserve Bank of Boston. Apr. 2004

"Six-state Review" (with Matt Quigley). *Fiscal Facts,* Federal Reserve Bank of Boston. 2004.

"Owning Up: Poverty Assets and the American Dream*"* vol.7:2. The Georgetown Public Policy Review. 2003.

"Evaluating Education Policy: From Origins to Outcomes*"* vol. 8:1. The Georgetown Public Policy Review. 2002.

ABSTRACT OF THE DISSERTATION

The Economic Impact of Tax-Based Federal Student Aid

by

Nicholas Turner

Doctor of Philosophy in Economics

University of California, San Diego, 2010

Professor Julie Cullen, Chair

Tax-based federal student aid—the Hope Tax Credit, Lifetime Learning Tax Credit and Tuition Deduction—marks a new paradigm for federal aid by offering tax incentives for postsecondary enrollment aimed at the middle-class. In this dissertation, I examine how the programs impact postsecondary enrollment, how colleges and universities respond to the programs, and I explore how taxpayers who are limited to one program select among the three options.

In the first Chapter, I exploit policy-induced variation in tax-based aid eligibility to estimate its casual effect on college enrollment. I find that tax-based aid increases full-time enrollment in the first two years of college for 18-19 year-olds by 2.2 percentage points (6.7 percent). Yet, the enrollment increase comes at a steep price. Between 7 and 13 inframarginal youths are subsidized for each marginal youth that is induced to enroll in college.

In the second chapter, I explore how colleges and universities respond to tax-based federal student aid. I demonstrate the importance of benefit incidence analysis by showing that the intended cost reductions of tax-based federal student aid are substantially offset by institutional price increases. Contrary to the goal of policymakers, I find that tax-based aid crowds out institutional aid dollar-for-dollar. Unfortunately, it is not clear how institutions utilize these captured resources, so that the ultimate incidence of the programs is uncertain.

In the third chapter, I show that roughly one in five taxpayers who are eligible for more than one tax-based federal student aid program, and who are limited to one program per student per year, select a program that offers a smaller reduction in combined federal and state tax liability. I offer three explanations for this pattern of tax-based aid selection, including salience in program value, tax evasion and inertia in program selection.

Collectively, the results from these chapters suggest that the benefits of tax-based federal student aid have come at a heavy price. The modest postsecondary enrollment increase for middle-income youths is achieved via a substantial transfer to colleges and universities, while complexity in program rules introduces substantial frictions for taxpayers.

THE EFFECT OF TAX-BASED FEDERAL STUDENT AID ON COLLEGE ENROLLMENT

Abstract: Tax-based federal student aid—the Hope Tax Credit, Lifetime Learning Tax Credit and Tuition Deduction—marks a new paradigm for federal aid by offering tax incentives for postsecondary enrollment for the middle-class. I exploit policy-induced variation in tax-based aid eligibility to estimate its casual effect on college enrollment. I find that tax-based aid increases full-time enrollment in the first two years of college for 18-19 year-olds by 2.2 percentage points (6.7 percent). Yet, the enrollment increase comes at a steep price. Between 7 and 13 inframarginal youths are subsidized for each marginal youth that is induced to enroll in college.

JEL Codes: I23; I28; H29

I. Introduction

Tax-based federal student aid—the Hope Tax Credit (HTC), the Lifetime Learning Tax Credit (LLTC) and the Tuition Deduction (TD)—offer tax incentives for postsecondary enrollment for the middle class. These programs are a departure in federal student aid policy. Previously, the federal government awarded student aid largely outside the tax code,[1] and primarily targeted lower-income students. First introduced in 1998, tax-based aid has quickly become an important component of federal student aid. In the 2005-2006 academic year, approximately 8.5 million students claimed one of the tax-based aid programs, about 3.4 million more than the number that received Pell Grants (Baum and Steele 2007). In that same year, the price tag of tax-based aid was nearly $6 billion, roughly half the cost of Pell Grants (Baum and Steele 2007). However, the tax-based aid programs are tax expenditures and their costs may grow more rapidly compared to student aid programs that require active government appropriation.[2]

How does tax-based aid affect college enrollment? Given its targeting towards the middle-class, is tax-based aid simply a transfer to students that would have attended college in the absence of the programs? Or, does tax-based aid increase enrollment and/or the amount of education? The enactment and expansion of tax-based aid creates a convenient natural experiment for examining these questions. Policy-induced variation in tax-based aid is plausibly exogenous to unobservable

[1] There are some tax benefits related to higher education including the deduction of student loan interest, the exclusion of taxes on the interest of savings bonds redeemed for educational expenses, and allowing parents to claim personal exemptions for students until age 24.
[2] Pell Grants, which do require active appropriation, are expected to face a $6 billion shortfall in 2009 (Dillon and Lewin 2008).

determinants of college enrollment. In this paper, which is among the first to explore how tax-based aid affects college enrollment, I exploit variation in program eligibility to estimate the intention to treat effect of tax-based federal student aid. This is one of the first studies to measure the enrollment effect of student aid on youths from middle-class families, because most student aid programs target lower-income youths. It is also one of the first to examine a student aid program administered through the federal tax code. This aspect may be especially relevant to policymakers considering the adoption of an IRS-based application for federal student aid (Baum and McPherson 2008; Dynarski 2000).

In the only other work to consider the enrollment effects of tax-based aid, Long (2004a) examines the two the tax credit programs (HTC and LLTC) for an earlier period using a more reduced form approach and interprets her results as showing no enrollment effect. However, her finding could be the result of measurement error of program eligibility, of bias introduced from survey treatment of college students, and also of an econometric error that is common in the applied literature. I improve on this work by implementing a more flexible specification using data that are less likely to result in measurement error of program eligibility and that better characterize the population of college students.

The empirical results of this paper imply that tax-based aid increases full-time enrollment in the first two years of college by about 2.2 percentage points (6.7 percent). Increasing postsecondary enrollment is a goal of federal student aid (Burgdorf and Kostka 2006), and these results suggest that tax-based aid meets this benchmark. However, the enrollment increase comes at a steep price. Assuming

complete take up of tax-based aid among eligible youths, a 7 percent increase in enrollment implies that 93 percent of tax-based aid recipients are students that would have attended college in the absence of the programs. To put it another way, 13 inframarginal youths are subsidized in order to entice one marginal student to enroll in college. Accounting for less than complete take up of the tax-based aid programs (Maag and Rohaly 2007) the results suggest that roughly 7 inframarginal youths are subsidized per marginal enrollment. This represents an important friction that policymakers confront when designing student aid programs to increase postsecondary attendance.[3]

The remainder of the paper proceeds as follows. In the next section, I provide background information on tax-based aid and outline individual responses to the programs. I describe the data and the econometric technique used to identify the enrollment effect of tax-based student aid in the third section. In the fourth section, I present baseline enrollment results as well as a set of further results exploring heterogeneous effects of tax-based aid for certain groups. I also discuss the results from a variety of sensitivity tests. In the last section, I offer a brief conclusion and discuss several avenues for future work.

[3] To the extent that these inframarginal students decrease their debt burden, tax-based aid may meet an important goal of federal student aid (Turner 2010).

II. Tax-Based Federal Student Aid

A. Program Details

In 1997, the Taxpayers' Relief Act introduced the Hope Tax Credit (HTC) and the Lifetime Learning Tax Credit (LLTC). In 2001, the Economic Growth and Taxpayers' Relief and Reconciliation Act added the Tuition Deduction (TD). These policies create discrete changes in aid over time that are plausibly exogenous to unobserved determinants of postsecondary enrollment. Eligibility for tax-based aid is determined by adjusted gross income, tax filing status and enrollment. Only one of the three programs may be claimed per student per year. The HTC offers a maximum award of $1,500 per student and may only be used during the first two years of undergraduate education (Internal Revenue Service [IRS] 1998). The LLTC covers 20 percent of qualified expenses for undergraduate, graduate, vocational and non-degree students. Between 1998 and 2002, the qualified spending limit for the LLTC was $5,000, resulting in a maximum award of $1,000 per return. In 2003, the qualified spending limit increased to $10,000, creating a maximum award of $2,000 per return. Both the HTC and the LLTC are subject to a phase-out for high income tax returns (IRS 1998, 2002, 2003). The TD allows tax filers to deduct 100 percent of the first $3,000 of qualified education expenses.[4] Like the LLTC, the TD is open to most types of students at qualifying educational institutions and is available for an indefinite number of years. The adjusted gross income eligibility range is broader for the TD program as compared to the tax-credit programs, and there is no phase-out region (IRS

[4] The maximum deduction increased in 2004 to $4,000. However, in this paper I use data only through 2003.

2002). Table 1.1 provides details on all three programs. Figure 1.1 shows the maximum value of each of the tax-based aid programs for a joint-filing family of four in various years.

Many scholars (Dynarski and Scott-Clayton 2006; Long 2004a; Hoxby 1998; Kane 1998, 1997) voice concern that tax-based aid benefits students from middle-class families who would have attended college absent the tax-based aid programs. Middle-class targeting is the result of several program features. First, neither the HTC nor the LLTC is refundable, and the TD cannot reduce taxable income below zero. Second, qualified spending for each program is determined net of grants, scholarships and other forms of student aid. As a result, students may not fully benefit from the programs if they have insufficient tax liability or low levels of qualified spending. Third, the adjusted gross income eligibility limits and the phase out range for the tax credits prevent high-income families from benefitting from tax-based aid. Figure 1.1 shows these features. As a result of middle-class targeting, students that are eligible for tax-based aid are unlikely to benefit from other direct federal aid, including Pell Grants or campus-based aid that target lower-income students. Maag and Rohaly (2007) estimate that tax returns with income of at least $40,000 receive about 65-70 percent of the total expenditures for the tax credit programs. In contrast, Mercer (2005) notes that 90 percent of families claiming Pell Grants have income less than $40,000.[5]

[5] Long (2004a) exploits this relationship between tax-based aid and Pell Grants in order to estimate college pricing behavior in response to the tax credit programs. Turner (2010) provides evidence that students who benefit from the introduction of tax-based aid experience relatively small changes in other federal aid for a sample of 4-year schools.

The use of the tax code to determine need and administer student aid also sets tax-based aid apart from traditional student aid. Most federal aid programs require the Free Application for Federal Student Aid (FAFSA), which takes roughly 10 hours to complete for a family that has already prepared its taxes (Dynarski and Scott-Clayton 2006). Dynarski and Scott-Clayton (2008, 2006) and Davis (2002) argue that the complexity of the existing federal aid system imposes a large social cost while adding little information on student ability to pay. Ellwood and Kane (2000) and Dynarski (2000) suggest that this complexity disproportionately affects low-income youth. In contrast to the FAFSA, the application for the HTC or the LLTC requires only one additional form (IRS 8863) after completing the personal income tax return. Prior to 2007, the TD was claimed directly on the 1040 form.[6] The transparent formula for tax-based aid allows students and families to estimate their award prior to making college application decisions, unlike FAFSA-awarded student aid. Results from Bettinger, Long, Oreopoulos, and Sanbonmatsu (2009) suggest that the reduced uncertainty and ease of application for tax-based aid may increase college enrollment.

While applying for tax-based aid is easier compared to traditional FAFSA-based aid, there is mixed evidence on program use. Long (2004a) provides evidence that many parents/guardians were unaware of tax-based student aid and that take-up was less than expected in the first years of the programs. However, the data that she uses may not accurately capture program take up because it queries students about tax-based aid use while it is likely the parent/guardian that claims the program on the tax

[6] The Tax Relief and Healthcare Act of 2006 introduced IRS form 8917 in order to identify the student claiming the deduction and show the computation of the deduction.

return.[7] Maag and Rohaly (2007) use an alternate approach, relying on a simulation using several data sources. They find that program take up for the HTC and LLTC is 63-74 percent, comparable to that found for other programs including Unemployment Insurance, Head Start and the Earned Income Tax Credit (Currie 2006).

B. Student Responses to Tax-Based Aid

It is expected that students respond to tax-based aid along both the extensive and intensive margins. Movement along the extensive margin is driven by a lower total cost of attendance. Along the intensive margin, the propensity to consume more education is driven by the marginal subsidy of the programs, which may be substantial. For example, the marginal subsidy from the HTC is 100 percent for the first $1,000 of education spending and 50 percent for the next $1,000. I measure movement along the intensive margin as a shift towards full-time enrollment away from part-time enrollment.[8]

Studies using natural experiment settings to measure the enrollment effect of student aid provide insight into the expected effect of tax-based aid.[9] Several papers estimate the enrollment effects of the Georgia HOPE scholarship. (The HTC was named after the Georgia HOPE program.) This state administered program is not need-based, similar to federal tax-based aid. Unlike tax-based aid, eligibility for the

---

[7] Long (2004a) examines the National Postsecondary Student Aid Study for the 1999-2000 school year. Response rates for undergraduates asked about tax-based aid use in 1999 are: "Don't know" (9.4 percent); "Yes Hope Tax Credit" (2.7 percent); "Yes Lifetime Learning Tax Credit" (6.2 percent); "No" (35.8 percent); and "Not reached/Missing" (28.8 percent).

[8] It is also possible that students adjust on the intensive margin by selecting more expensive schools. Long (2004b) finds evidence that direct student aid alters enrollment patterns across public and private schools. Data limitations prevent me from exploring this possibility.

[9] There is also substantial work relying on traditional approaches that exploit cross-sectional and/or time-series variation in postsecondary costs (Leslie and Brinkman 1987; Heller (1997).

Georgia HOPE depends on student merit. Cornwell, Mustard, and Sridhar (2006) and Dynarski (2000) find that enrollment increases roughly 0.4-0.5 percentage points for each $100 of HOPE aid, an effect similar to that found in response to Social Security student benefits (Dynarski 2003) and to changes in tuition at public schools (Kane 1994). Various studies find similar effects in the context of other student aid programs in the U.S., including state-based grants (Kane 2003), state merit-based aid (Dynarski 2004) and Pell Grants (Curs, Singell and Waddell 2007). Nielsen, Sorensen and Taber (2008) report a smaller response to student aid among youths in Denmark, relative to enrollment effects found for the U.S., and suggest that this is the result of larger total aid levels for Danish students.

The timing of award receipt sets tax-based aid apart from traditional student aid, and this aspect may affect how students respond to the programs. The benefits from tax-based aid are likely realized when tax returns are received, generally after the payment of educational expenses.[10] In contrast, students receive scholarships, grants and other forms of aid when tuition is paid. The delay in payment of tax-based aid may preclude short-term credit constrained youths from capitalizing on the programs. As a result, tax-based aid may not alter the enrollment decision of marginal youths, but rather may largely serve as a transfer to inframarginal youths.

[10] Tax filers could smooth the impact of the credit by adjusting their withholdings in earlier periods. However, this requires a high level of sophistication, and it is likely that most returns realize the benefits as a lump sum after education costs are paid.

III. Data and Empirical Strategy

A. Analysis Sample from the Survey of Income and Program Participation

To quantify the enrollment effect of tax-based aid, I use data from the U.S. Census Bureau's Survey of Income and Program Participation (SIPP). The SIPP is a nationally representative survey of the United States designed to provide accurate and comprehensive information on income and program use.[11] The SIPP offers several advantages over other datasets. Unlike the October supplement of the Current Population Survey, income data in the SIPP are not categorical, so that program eligibility is likely to be measured with less error using SIPP data. Long (2004a) relies on October Current Population Survey data, and her difference-in-differences estimation strategy that compares eligible students to ineligible students, before the enactment of tax-based aid relative to after, may be plagued by measurement error that biases the effect towards zero. Another benefit of the SIPP is its treatment of college students. Students that are at college remain on their family record and the SIPP continues to collect their information, so that observations of youths may be linked to observations of their parents or guardians.[12] Information on parents/guardians is crucial for determining program eligibility, because in most cases dependent students are claimed on their family tax return.[13] In contrast to the SIPP, the likelihood of observing a student in other surveys, including the Current Population Survey, is

[11] I use cross sectional survey weights to ensure that the SIPP sample mirrors the nation as a whole. I use the weight from an individual's final observation divided by the number of appearances for that individual. This weighting takes into account both sample attrition, by using the final weight, and the frequency of appearance. I repeated the analysis using the cross sectional weight for each observation and the results were similar.

[12] In the SIPP, respondents are asked about parents/guardians until age 19.

[13] Since virtually no students in the data earn enough to cause a (jointly) income maximizing family to have the student file separately, I use family income to determine eligibility.

related to their decision to live at home.[14] Long (2004a) conditions on these living arrangement variables, which may lead to biased estimates (Cameron and Heckman 2001), and also results in a sample that is not nationally representative.

To construct the analysis sample I take the following steps. First, I link observations on college-aged youths to observations on their parents/guardians, removing youths that could not be linked (3.6 percent). Next, because the SIPP are monthly data, I measure enrollment using information from October (fall enrollment) and from March (spring enrollment). (As a robustness check I consider alternate months.) However, I rely on annual income data to determine program eligibility. I also limit the sample to 18-19 year olds to capture college entry and the transition into the second year of college. The data cover the period from January, 1996 through December, 2003.[15] Individuals enter the sample at age 18, and remain until the end of the school year when they are 19 or until the sample period ends. This creates a sample of 23,030 observations for 8,237 youths. Roughly 30 percent of youths in this sample are enrolled full-time in the first two years of college, with 24 percent enrolled in the first year and 6 percent in the second year. Another 2 percent are enrolled part-time in the first two years of college.

Unfortunately, the SIPP does not include data on tax-based aid, or some of the variables needed to determine its value, including taxes owed and education spending. To address these shortcomings of the data, I calculate tax-based aid in the following

[14] The Current Population Survey uses a concept of "usual residence" which should include individuals that refer to the household as their "regular residence," whereas the American Community Survey uses a concept of "current residence" excluding individuals that have been away from the residence for 2 months or more. See Shin (2007) for full details.

[15] Because the coverage of the 1996 and 2001 SIPPs is not continuous, there is a gap in the data between April, 2000 and September, 2000.

manner. First, I use information from the IRS (1998, 1999, 2000, 2001, 2002, 2003) to define the tax-based aid function for each of the three programs. (See Table 1.1 for program details.) The functions depend on income, taxes owed and education spending. I use family income from the SIPP, and I estimate taxes owed and the marginal tax rate using the standard deduction and personal exemptions.[16] To focus on policy-induced variation in tax-based aid eligibility, I abstract from heterogeneity in education spending by calculating the value of tax-based aid at the programs' spending limits.[17] For most of the analysis period, program spending limits are relatively low. Data from the National Postsecondary Student Aid Study suggests that average spending by 18-19 year olds at 4-year schools is at least as large as the programs' limits, although students at 2-year schools have lower levels of spending.[18] (In the fourth section, I discuss the results using an estimation of tax-based aid that includes heterogeneity in education spending based on student characteristics, including differences across school types that may provide a better measure of the tax-based aid subsidy for students at 2-year schools.) Using the programs' limits for education spending, along with data on income and taxes, I apply the tax-based aid function for each program for a given youth. Lastly, as students can claim only one program per year, and I assign the program with the largest value.[19]

---

[16] The value of the HTC and LLTC depends on taxes owed, while the value of the TD depends on the marginal tax rate. Assuming only the standard deduction and personal exemptions results in an upper bound of taxes owed and of tax-based aid.

[17] Even if spending data were available in the SIPP, it is endogenous to the enrollment decision. Turner (2010) addresses this source of endogeneity in a separate context using instrumental variables.

[18] Qualified spending by 18-19 year olds in the 1999-2000 school year was $2,518 (4-year public), $8,307 (4-year private), $470 (2-year public), and in the 2003-04 school year spending was $3,286 (4-year public), $10,510 (4-year private), $644 (2-year public).

[19] In forthcoming work, I examine the frequency and value of mistakes in tax-based aid selection using data from the Internal Revenue Service. While I find evidence that some tax filers do not maximize

A further complication for estimating the value of tax-based aid is the overlap of two school years within a given calendar year. As an example, consider the tax-based aid subsidy for calendar year 2000. This subsidy is based on education spending in both the spring of the 1999-2000 school year as well as fall of the 2000-2001 school year. When assigning the tax-based aid subsidy for a given school year, I do not account for this overlap. For example, when estimating tax-based aid eligibility in October 2000, I abstract from the enrollment in March of 1999. More generally, I assign the entire incentive in each month, an approach that treats the enrollment data as a repeated cross-section. [20] (I cluster the standard errors at the individual level to address serial correlation in enrollment.) This approach is conservative and works against finding a substantive effect of tax-based aid. As a robustness check, I limit the sample to 18 year olds, so that each individual is observed at most twice, and there is no school year overlap for a given calendar year.

Figure 1.2 shows tax-based aid eligibility by adjusted gross income for various years, highlighting the sources of policy-induced variation. Cross-sectional variation arises from program rules that create differences in the subsidy by adjusted gross income, taxes owed and tax-filing status. For example, the dip in Figure 1.2 beginning around $40,000 corresponds to the phase-out range of the tax-credits for non-joint tax returns, while the phase out range for joint returns is evident in the $80,000-$100,000

---

their tax-based aid award, the dollar value of these mistakes is small so that the bias in the subsidy value should be minimal.

[20] I do not split the value of the tax-based aid award across school years within a given calendar year. This requires conditioning on previous enrollment for the later period and will bias the results. For example, a student would receive a partial award in the second period only if they were enrolled in the first period, whereas a student that was not initially enrolled would receive a full award in the second period.

range. The subsidy also varies over time: in 1998 the HTC and LLTC are introduced (top panel); in 2002 the TD extends tax-based aid beyond the phase-out range of the tax credit programs (middle panel); and in 2003 the LLTC increases in generosity (bottom panel).

Table 1.2 shows the average value of tax-based aid, college enrollment, and other student characteristics by adjusted gross income eligibility before and after the introduction of tax-based aid in 1998.[21] The average value of tax-based aid for eligible students in the post period ($1,104) is relatively large compared to other forms of aid and tuition for 18-19 year olds during the 1999-2000 school year (Pell Grants [$506 4-year public schools, $500 4-year private schools, $352 2-year public schools]; federal campus-based aid [$267 4-year public schools, $851 4-year private schools, $55 2-year public schools]; and tuition [2-year schools $1,014, 4-year schools $3,847, 4-year private schools $14,787]).[22] The increase in enrollment for eligible youths following tax-based aid enactment (4.9 percentage points) is larger than that of ineligibles (1.7 percentage points), however the baseline specification does not explicitly include the comparison of eligible and ineligible youths. The average changes in enrollment and tax-based aid for eligible students suggests roughly a 0.4 percentage point increase per $100 of tax-based aid.

Detailed income data in the SIPP make it possible to construct a direct measure of credit constraints using an asset-based sample separation rule. Following work on credit constraints in other contexts (Jacoby 1994; Zeldes 1989), I consider families

[21] Eligible students are those that have positive tax liability and that meet the adjusted gross income limits for 2003-2004. In other words, I consider youths that are never eligible for tax-based aid as ineligible.

[22] I calculated these values using the data analysis system for the National Postsecondary Aid Study.

with a ratio of liquid assets to income less than the 25th percentile as likely to be constrained.[23] The use of a direct measure of credit constraints is a novel addition of this paper, as the literature on postsecondary enrollment largely infers the effect of credit constraints in an indirect manner. Work by Nielsen, Sorensen and Taber (2008) who adopt a similar approach to examine the role of credit constraints on postsecondary enrollment in Denmark is a noTable 1. exception.[24] Leth-Petersen (forthcoming) offers evidence that low-levels of assets reflect binding constraints. Jappelli, Pischke, and Souleles (1998) adopt an innovative measure of credit constraints based on loan refusal, likely a more accurate measure of credit constraints. They show that asset-based separation rules like the one used here lead to a similar categorization of unconstrained individuals as compared to their loan-refusal measure.[25]

B. Econometric Specification for College Enrollment

To estimate the effect of tax-based student aid on postsecondary enrollment I use the following probit model:

(1) $Enrollment_{it} = \Phi(\beta_1 Subsidy_{it} + \beta_2 X_{it} + \varepsilon_{it})$

[23] I use interest income to estimate liquid assets using a 4 percent interest rate. Interest income in the SIPP is the sum of interest from checking, savings and money market accounts, bonds, cash deposits and U.S. government securities. I also considered different interest rates, including different rates for different types of assets.

[24] Nielsen, Sorensen, and Taber (2008) identify observations with liquid assets less than one or two months of income as constrained. Their definitions find between 19 to 40 percent as credit-constrained. I also tried their definition based on monthly income and the results were similar.

[25] They show that only 3 percent of households that were turned down for a loan would be classified as unconstrained using the asset-based separation rule used in Zeldes (1989).

where the subscripts *i* and *t* index individuals and months. $Subsidy_{it}$ measures the value of the available tax-based aid subsidy and is calculated as described earlier.

The subsidy is measured in hundreds of dollars, so that its impact measures the effect of eligibility for $100 of tax-based aid for a student with spending at or above the program limits. This can be interpreted as the effect of increasing the maximum value of tax-based aid by $100, which may be of interest to policymakers who set the statutory limits of tax-based aid. In the primary analysis sample, I remove youths that are never eligible for a tax-based aid award. (I drop youths with no tax liability and also remove youths that do not meet the 2003-04 adjusted gross income requirements.) By excluding ineligible youths, I remove the identification assumption of a shared preexisting time trend in enrollment for eligible and ineligible students. Difference-in-differences estimation, which is commonly used to estimate the enrollment effects of student aid (Cornwell, Mustard, and Sridhar 2006; Long 2004a; Dynarski 2003, 2000), requires this assumption. Compared to this approach, I use a more flexible specification. Identification comes from the intensity of treatment that arises from policy-induced variation in tax-based aid among eligible students, and also from time series variation in program rules that create discrete changes in aid over time, but not from the comparison of eligible and ineligible youths. (As a sensitivity check, I include ineligible youths as a control group.)

In X_{it}, I control flexibly for both time effects and family income to guard against the possibility that the impact of tax-based aid is identified by a non-linear relationship between enrollment and these factors. To account for time trends in enrollment, I include time dummy variables. I control for income using a cubic spline

with three knots. I account for individual and parent/guardian characteristics that may affect student enrollment, including race, age, gender, household type and parent/guardian education level as well as indicator variables for the state of residence. I cluster the standard errors at the individual level to address concerns of serial correlation as suggested by Bertrand, Duflo, and Mullianathan (2004).

To identify the enrollment effect of tax-based aid using Equation (1), a key assumption is that other forms of aid for eligible students are roughly constant over the analysis period. Unfortunately the SIPP does not contain information on student aid awards. However, the targeting of tax-based aid is different than that of other federal programs, so that students eligible for tax-based aid are unlikely to benefit from Pell Grants or federal campus-based aid (Maag and Rohlay 2007; Mercer 2005; Long 2004a). Further, the discrete change in tax-based aid that results from the initial program introduction is substantively larger than that of other federal programs. For example, the average increase in tax-based aid per student that results from the introduction of the HTC and LLTC is roughly $900 in the analysis sample, compared to a $67 dollar increase in Pell Grants and a $140 increase in campus-based aid nationally over the same period.[26]

C. Measuring the Marginal Effect of Interaction Terms in Non-linear Models

Tax-based aid may have a differential effect for some groups of students. To explore this possibility, I use several specifications that include interactions with the

[26] Differences in tax-based aid calculated by author. Differences in Pell Grants and campus-based aid are from Baum and Steele (2007).

subsidy variable. An example of one specification using interaction terms is given in Equation (2).

(2)

$$Enrollment_{it} = \Phi(\beta_1 Constrained_{it} + \beta_2 Subsidy_{it} + \beta_3 Subsidy_{it} * Constrained_{it} + \beta_4 X_{it} + \varepsilon_{it})$$

The marginal effect of the interaction term in Equation (2) measures the differential effect of the subsidy for individuals that are credit constrained, relative to non-constrained youths. Using a Linear Probability Model (LPM), this marginal effect, calculated as the discrete difference (with respect to the constrained variable) of the partial derivative (with respect to the subsidy variable) of enrollment, is β_3. In the non-linear case, this effect is more complicated because it includes derivatives of the non-linear function.[27] Ai and Norton (2003) and Norton, Wang and Ai (2004) note that the applied economics literature has largely interpreted interactions in non-linear specifications incorrectly. Long (2004a) falls into this category by reporting the odds ratio for an interaction term in a difference-in-differences logit model. The odds ratio interpretation does not extend to the case of interaction terms, and her results are insufficient to determine the magnitude or statistical significance of the true interactive effect (Norton, Wang and Ai 2004).[28] I report average marginal effects and calculate

[27] Using a probit, the marginal effect is:
$\frac{\Delta\left(\frac{\partial\Phi(XB)}{\partial Subsidy}\right)}{\Delta Constrained} = (\beta_2 + \beta_3)\varphi(xb_1) - (\beta_2)\varphi(xb_0)$ where $\varphi(\bullet) = \Phi'(\bullet)$, xb_1 (xb_0) note when the binary variable is equal to one (zero).

[28] Puhani (2008) shows that the sign on the coefficient of the interaction term is the same sign as the treatment effect in a non-linear difference-in-differences model.

the associated standard errors, which are robust to correlation at the student level, using the delta method as suggested by Ai and Norton (2003).[29]

IV. Empirical Results

A. Baseline Enrollment Effects of Tax-Based Aid

Tax-based aid meets an important federal student aid goal by increasing college enrollment. Panel A of Table 1.3 shows the baseline results. An increase of $100 of tax-based aid is predicted to increase full-time enrollment in the first two years of college by 0.3 percentage points. Multiplying this effect by the average value of tax-based aid suggests that enrollment increases by 2.2 percentage points (6.7 percent).[30] The enrollment increase does not appear to extend to part-time enrollment. Column (2) of Panel A shows the results for part-time enrollment. Instead, the point estimate implies a decrease in part-time enrollment that may be evidence of a shift away from part-time status towards full-time enrollment. However, the estimate on part-time enrollment is imprecise, so this implication is unclear.[31] Tax-based aid also appears to increase both postsecondary entry and persistence into the second year,

---

[29] The expression for the standard error for the interaction of "subsidy" and "constrained" is: $\frac{\partial}{\partial \beta'}\left\{\frac{\Delta \frac{\partial \Phi(XB)}{\partial Subsidy}}{\Delta Constrained}\right\}\hat{\Omega}_{\beta}\frac{\partial}{\partial \beta}\left\{\frac{\Delta \frac{\partial \Phi(XB)}{\partial Subsidy}}{\Delta Constrained}\right\}$ where $\hat{\Omega}_{\beta}$ is a consistent covariance estimator of $\hat{\beta}$.

[30] These enrollment effects may include students that would otherwise enroll at a later age but enroll earlier to receive a positive award as part of a parent/guardian tax return. I cannot separately identify this effect from enrollment by youths that would otherwise not enroll.

[31] This may also be evidence that fears over increased part-time enrollment for leisure and/or recreation courses may be unwarranted (Hoxby 1998; Kane 1997). However, use of tax-based aid for these reasons is more likely for older students that are not in the analysis sample.

although these estimates are not significant. Successful transition into the second year is a good predictor of later success in college, because a large share of attrition occurs in the first year (Horn 1998; Bradburn 2002). In Panel B of Table 1.3, I report the effect of the subsidy on the first and second years of college separately.

If all youths eligible for tax-based aid avail themselves of the programs, then a 7 percent enrollment increase implies that 93 percent of tax-based aid recipients would have enrolled without the tax-based aid subsidy. In other words, 13 inframarginal youths are subsidized for each marginal youth that is induced to enroll. This finding confirms speculation by Dynarski and Scott-Clayton (2006), Long (2004a) and Kane (1998, 1997) that tax-based aid will mostly serve as a transfer to youths that would have enrolled in the absence of tax-based aid. To put a lower bound on the level of inframarginal subsidization, suppose that program take up is complete among marginal youths but less than complete among inframarginal youths so that the total take up is equal to the lower limit reported by Maag and Rohlay (2007). In this case, the amount of inframarginal subsidization is still high. Roughly 7 inframarginal youths are subsidized per marginal enrollment. To the extent that tax-based aid allows inframarginal students to reduce their student loan amounts, tax-based aid may still meet an important goal of federal student aid.

B. Differential Enrollment Effects of Tax-Based Aid

In this section, I allow for heterogeneous effects of tax-based aid for students that may be credit constrained, by family income levels, and by race/ethnicity. These results rely on the interaction effects discussed in the third section.

Targeting towards the middle-class and the delay in benefit receipt may prevent credit-constrained youths from responding to tax-based aid. Alternatively, for constrained youth that are able to capitalize on the programs, the differential effect of the subsidy may be positive. The effect of short-term credit constraints on postsecondary enrollment has not been resolved in the literature. Lochner and Monge-Naranjo (2008), Ellwood and Kane (2000) and Kane (1995, 1994) argue that credit constraints may impede higher education enrollment for some students. Alternatively, Nielsen, Sorensen and Taber (2008), Cameron and Taber (2004), Carneiro and Heckman (2002), Cameron and Heckman (2001, 1999), and Keane and Wolpin (2001) provide evidence that short-term credit constraints are unimportant.

Unfortunately, the results do not help to clarify the impact of credit constraints on postsecondary enrollment. Using the definitions of credit constraints discussed in section three, I allow for differential effects of the subsidy for individuals that are likely to be constrained. Panel A of Table 1.4 shows these results. The estimate implies a relatively large differential effect of tax-based aid for constrained students, although the estimate is imprecise so that both differential increases and decreases in enrollment for constrained youths are possible. The differential effect of tax-based aid for constrained youths may be biased by measurement error in the constrained variable. Given the ability of asset-based separation rules to properly classify unconstrained observations (Jaappelli, Pischke and Souleles 1998), limiting the sample to these observations may be less worrisome. Using sample splits, I find that the enrollment effects of tax-based aid are comparable across the constrained and unconstrained groups, suggesting that there is not a substantive differential effect of

tax-based aid for constrained students. These results are shown in Panels B and C of Table 1.4.

Differential effects by income may provide insight into the enrollment effects of making tax-based aid refundable. The American Opportunity Tax Credit enacted in 2009 expands eligibility in this manner, offering a partially refundable award. To measure differential effects by income, I interact the value of the subsidy with income tercile dummies of the eligible income range. Panel A of Table 1.5 reports these results. The first income tercile, the low-income group, is omitted so the differential effect is relative to individuals in this group. The estimated differential effects for the second and third terciles on full-time college enrollment are small relative to the effect of the subsidy and are not statistically significant. If youths with insufficient income to capitalize on tax-based aid will respond similarly to youths in the eligible income range, then these results imply that refundable tax-based aid will further increase enrollment. This result may also be evidence that the non-refundable tax-based aid considered here did not exacerbate enrollment gaps across the eligible income range. However, the estimates also allow for substantive differential effects by income consistent with an increasing enrollment gaps across income groups reported by Lochner and Monge-Naranjo (2008).

It is also unclear if tax-based aid exacerbates the enrollment gap between whites and minorities. Previous work on state-based student aid (Dynarski 2004, 2000; Heller 2004) finds differential effects of student aid by race. Possible explanations for these findings include academic requirements of merit-based aid, confounding income effects, and different price sensitivity. The results in Panel B of

Table 1.5 that consider heterogeneous effects of tax-based aid for black and Hispanic youths are imprecise, allowing for both positive and negative differential enrollment effects of tax-based aid relative to white youths.

C. Robustness Checks of the Enrollment Effect of Tax-Based Aid

In this section, I discuss the results from several sensitivity tests. These tests show that the baseline full-time enrollment results are robust to an alternate specification that includes ineligible youths as a control group, to the use of an alternate subsidy that includes student-level heterogeneity in education spending, and to the use of alternate months to measure college enrollment. The enrollment results also persist when the sample is limited to 18 year olds, so that each youth is observed at most twice and there is no school year overlap for a given calendar year. I also find that the results are robust to alternate time and income controls (not shown).[32]

The main results limit the analysis to students eligible for tax-based aid, so that identification does not rely on the comparison of eligible and ineligible youths. Ineligible youths are composed of two distinct groups: those with income that is insufficient to capitalize on the programs; and those with income that exceeds the programs' limits. When both groups are included, the estimated effect of tax-based aid on full-time enrollment is significant and similar to the baseline results. This result is shown in Panel A of Table 1.6. I find similar effects when only one group of ineligible students is included (not shown). However, interpreting results that include

[32] The results are robust to separate time trends by income tercile and also to alternate income controls (cubic and linear spline functions with up to 7 knots).

ineligible youths is more complicated. The implicit comparison of eligible to ineligible youths requires the assumption that these groups were on similar enrollment trends prior to the enactment of tax-based aid. The baseline results, which exclude both ineligible groups, do not require this identification assumption.

In the baseline results, the tax-based aid subsidy abstracts from differences in education spending that also affect the value of tax-based aid. To test the importance of heterogeneity in education spending, I construct an alternate valuation of tax-based aid using a plausibly exogenous simulation of education spending. This approach may offer a better characterization of the tax-based aid award for students at 2-year schools, as it allows for lower levels of education spending. To estimate education spending, I use data from the National Post Secondary Aid Study, because the SIPP does not include information on educational spending. Using spending data for the 1995-96 school year, I estimate qualified education spending as a function of variables that are also available in the SIPP. Using these estimates, I predict spending for observations in the SIPP. (Results are reported in Appendix Table 1.A1.) I adjust these estimates to future years using aggregate data from the National Center for Education Statistics on tuition growth. This approach simulates education spending by holding fixed the determinants of spending from a period before the enactment of tax-based aid, so that the simulation is free from student and/or institutional responses to the programs that may alter education spending in later years. Based on the estimates of qualified education spending, I construct the value of the tax-based aid subsidy as detailed in the third section. This alternate valuation includes the same sources of policy-induced variation in program eligibility as described in the third

section, and also includes cross-sectional variation in education spending based on student characteristics.

The full-time enrollment results using the simulated spending measure of tax-based aid are similar compared to the basic results. The estimated effect on full-time enrollment is roughly 0.4 percentage points per $100 of tax-based aid, implying an increase of 2.4 percentage points (6.4 percent). These results appear in Panel B of Table 1.6. The standard error of this estimate is roughly comparable to the main results, suggesting that the simulation of education spending does not add a relevant source of identifying variation. (Note that the standard errors are clustered at the individual level.)

The baseline results measure enrollment in the academic year using data from the months of October and March. These months are likely to capture fall and spring postsecondary enrollment. In Panel C of Table 1.6, I show the results using the months of September and February. The estimated increase in full-time enrollment in the first two years of college in these two months is 0.3 percentage points per $100 of tax-based aid, identical to the baseline results. I also find similar enrollment effects using other months (not shown).

When calculating tax-based aid eligibility, I abstract from school year overlap within a given calendar year by assigning the entire tax-based aid award in both the fall and the spring of a given school year. In Panel D of Table 1.6, I limit the sample to 18 year olds, so that each individual is observed at most twice and there is no overlap of school years within a given calendar year. For this sample, the estimated

enrollment effect is 0.4 percentage points per $100 of tax-based aid on this sample, similar to the baseline results.

V. Conclusion

A primary goal of federal student aid is to increase postsecondary attendance. Many federal student aid programs, such as Pell Grants and campus-based aid, work towards this goal by targeting lower-income youths and their families. Federal tax-based aid is among the first to target the middle-class, and also one of the first student aid program administered through the federal tax code. In this paper, I estimate the enrollment effects of the tax-based aid programs. The results suggest that tax-based aid increases full-time college enrollment of 18-19 year olds by about 2.2 percentage points (6.7 percent) in response to tax-based aid.

The enrollment increase of tax-based aid appears to come at a heavy price. If tax-based aid take up is complete, then a 7 percent increase in enrollment among eligible youths implies that 93 percent of tax-based aid recipients are students that would have attended college absent the tax-based aid programs. To put it another way, tax-based aid subsidizes 13 students for each marginal student that is induced to enroll. Accounting for less than complete take up of tax-based aid among eligible youths (Maag and Rohaly 2007), the results suggest that about 7 inframagrinal students are subsidized for each marginal student that is induced to enroll. This finding suggests that tax-based aid largely serves as a transfer to middle-income students that would have attended college absent the tax-based aid programs.

The implied price sensitivity of postsecondary enrollment, roughly 0.3 percentage points per $100, is estimated assuming that students realize the full statutory value of their tax-based aid awards. However, the intended cost reduction of tax-based aid may be offset by increases in the price of postsecondary education. In recent work, Turner (2010) finds that 4-year colleges and universities strategically lower school grant aid for students that are likely to benefit from tax-based aid. To the extent that this occurs, the results here are underestimates of the true price sensitivity of enrollment, because students may realize only a partial reduction in their net price for college.

Yet, even if tax-based aid is offset by reductions in school grant aid, enrollment may still increase. Unlike traditional student aid, the transparent formula for tax-based aid gives students and families information on likely aid receipt prior to making application decisions. Further, students and families cannot perfectly observe the offsetting price increase, as there is no information on the counterfactual level of school grant aid that they would have received absent the school response. Recent work (Bettinger, Long, Oreopoulos and Sanbonmatsu 2009; Cellini 2009) suggests that reduced uncertainty about the cost of college and lower transaction costs may increase postsecondary enrollment. Clarifying how information on the cost of postsecondary attendance affects enrollment, as well as how the transaction costs of aid application impact student aid use and subsequent enrollment, are avenues for future research. Other topics to address in future work include examining how tax-based aid impacts the transition from 2-year schools into 4-year schools, the decision

to enroll in public vs. private institutions, and the impact of tax-based aid on degree attainment, possibilities not considered here due to data limitations.

Acknowledgements: I thank Julie Cullen, Nora Gordon, Roger Gordon and Robert Tannenwald for their support and helpful comments. I also benefited from comments received at the U.C.S.D. Applied Seminar and at the 101st annual meeting of the National Tax Association on an earlier draft of this paper. This paper, in full, is under review at the *National Tax Journal*.

References

Ai, Chunrong, and Edward Norton. "Interaction Terms in Logit and Probit Models." *Economics Letters,*Vol. 80, 2003.

Baum, Sandy, and Michael McPherson. "Fulfilling the Commitment: Recommendations for Reforming Federal Student Aid." The Report from the Rethinking Student Aid Study Group, 2008.

Baum, Sandy, and Patricia Steele. "Trends in Student Aid." The College Board, 2007.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullianathan. "How Much ShouldWe Trust Difference in Differences Estimates?" *The Quarterly Journal of Economics,* Vol. 119, No. 1, 2004.

Bettinger, Eric, Bridget Terry Long, Phillip Oreopoulos, and Lisa Sanbonmatsu. "The Role of Information and Simplification in College Decisions: Results from the H&R FAFSA Experiment." *National Bureau of Economic Research Working Paper,* No. 15361, 2009.

Bradburn, Ellen M. "Short-term Enrollment in Postsecondary Education: Student Background and Institutional Differences in Reasons for Early Departure." Washington, D.C.: U.S. Department of Education, National Center for Education Statistics, 2002.

Burgdorf, Barry, and Kent Kostka. "Eliminating Complexity and Inconsistency in Federal Financial Aid Programs For Higher Education Students: Towards a More Strategic Approach." *A National Dialogue: The Secretary of Education's Commission on the Future of Higher Education*, 2006.

Cameron, Stephen, and James Heckman. "The Dynamics of Educational Attainment for Black, Hispanic and White Males." *The Journal of Political Economy,* Vol. 103, 2001.

Cameron, Stephen, and James Heckman. "Can Tuition Policy Combat Rising Wage Inequality?" Financing College Tuition: Government Policies and Educational Priorities. Washington: American Enterprise Institute Press, 1999.

Cameron, Stephen, and Christopher Taber. "Estimation of Educational Borrowing Constraints Using Returns to Schooling." *The Journal of Political Economy,* Vol. 112, 2004.

Carneiro, Pedro, and James Heckman. "The Evidence on Credit Constraints in Post-Secondary Schooling." *The Economic Journal,* Vol. 112, 2002.

Cornwell, Christopher, David Mustard, and Deepa Sridhar. "The Enrollment Effect of Merit Based Financial Aid: Evidence from Georgia's HOPE Program." *Journal of Labor Economics,* Vol. 24, 2006.

Currie, Janet. "The Take-up of Social Benefits" in Auerbach, Alan, David Card, & John Quigley, eds. *Poverty, the Distribution of Income, and Public Policy*. New York: Russell Sage, 2006.

Curs, Bradley, Larry Singell, and Glen Waddell. "Money for Nothing? The Impact of Changes in the Pell Grant Program on Institutional Revenues and the Placement of Needy Students." *Education Finance and Policy,* Vol.2, No. 3, 2007.

Davis, Albert J. "Choice Complexity in Tax Benefits for Higher Education." *National Tax Journal,* Vol. 50, No. 3, 2002.

Dillon, Sam, and Tamar Lewin. "Pell Grants Said to Face a Shortfall of $6 Billion." *The New York Times.* (September 18, 2008).

Dynarski, Susan. "The New Merit Aid" in Hoxby, Caroline, ed. *College Choices: The Economics of Which College, When College, and How to Pay For It.* Chicago: University of Chicago Press, 2004.

Dynarski, Susan. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion." *American Economic Review,* Vol. 93, 2003.

Dynarski, Susan. "Hope for Whom? Financial Aid for the Middle-Class and Its Impact On College Attendance." *National Tax Journal*, Vol. 53, No. 3, 2000.

Dynarski, Susan, and Judith Scott-Clayton. "Complexity and Targeting in Federal Student Aid: A Quantitative Analysis." *National Bureau of Economic Research Working Paper,* No. 13801, 2008.

Dynarski, Susan, and Judith Scott-Clayton. "Simplify and Focus the Education Tax Incentives." *Tax Notes.* June 12, 2006.

Ellwood, David, and Thomas Kane. "Who is Getting a College Education? Family Background and the Growing Gaps in Enrollment." In Danziger, Sheldon and Waldfogel, Jane, eds. *Securing the Future: Investing in Children from Birth to College.* Russell Sage Foundation, New York, 2000.

Glater, Jonathan. 2008. "Student Loans Start to Bypass 2-Year Colleges." *The New York Times.* (June 2, 2008(a)).

Glater, Jonathan. "A Lender Halts U.S. Backed Student Loans." *The New York Times.* (February 28, 2008(b)).

Heller, Donald. "State Merit Scholarship Programs and Racial Inequality" in Heller, Donald and Patricia Marin, eds. *The Civil Rights Project*, Harvard University, 2004.

Heller, Donald. "Student Price Response in Higher Education: An Update to Leslie and Brinkman." *The Journal of Higher Education,* Vol. 68, No. 6, 1997.

Horn, Laura J. "Stopouts or Stayouts? Undergraduates Who Leave College in their First Year." Washington, DC: U.S. Department of Education, NCES 1999-087, 1998.

Hoxby, Caroline M. "Tax Incentives for Higher Education" in James Poterba, ed., *Tax Policy And the Economy*. Cambridge, Mass.: MIT Press, 1998.

Internal Revenue Service. "Tax Benefits for Education: Publication 970." 1998-2003.

Jappelli, Tullio, Jorn-Steffan Pischke, and Nicholas S. Souleles. "Testing for Liquidity Constraints in Euler Equations with Complementary Data Sources." *The Review of Economics and Statistics*, Vol. 80, No. 2, 1998.

Jacoby, Hanan. "Borrowing Constraints and Progress Through School: Evidence from Peru." *The Review of Economics and Statistics,* Vol. 76, No. 1, 1994.

Kane, Thomas. "A Quasi-Experimental Estimate of the Impact of Financial Aid on College-Going." *National Bureau of Economic Research Working Paper 9703*, 2003.

Kane, Thomas. "Savings Incentives for Higher Education." *National Tax Journal*, Vol. 51. No. 3, 1998.

Kane, Thomas. "Beyond Tax Relief: Long Term Challenges to Financing Higher Education." *National Tax Journal*, Vol. 50. No. 2, 1997.

Kane, Thomas. "Rising Public College Tuition and College Entry: How Well Do Public Subsidies Promote Access to College?" *National Bureau of Economic Research Working Paper,* No. 5164, 1995.

Kane, Thomas. "College Entry by Blacks Since 1970: The Role of College Costs, Family Background, and the Returns to Education." *Journal of Political Economy,* Vol. 102, 1994.

Keane, Michael, and Kenneth Wolpin. "The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment." *International Economic Review,* Vol. 42, No. 4, 2001.

Leslie, Larry, and Paul Brinkman. "Student Price Response in Higher Education." *Journal of Higher Education*, Vol. 58, No.18, 1987.

Leth-Petersen, Soren. Forthcoming. "Intertemporal Consumption and Credit Constraints: Does Total Expenditure Respond to an Exogenous Shock to Credit?" *American Economic Review.*

Lochner, Lance, and Alexander Monge-Naranjo. "The Nature of Credit Constraints and Human Capital." *National Bureau of Economic Research Working Paper,* No. 13912, 2008.

Long, Bridget Terry. "The Impact of Federal Tax Credits for Higher Education" inHoxby, Caroline, ed. *College Choices: The Economics of Which College, When College, and How to Pay For It.* Chicago: University of Chicago Press, 2004(a).

Long, Bridget Terry. "Does the Format of a Financial Aid Program Matter? The Effect of State In-Kind Tuition Subsidies." *The Review of Economics and Statistics,* Vol. 86, No. 3, 2004(b).

Maag, Elaine, and Jeffrey Rohaly. "Who Benefits from the Hope and Lifetime Learning Credit?" Tax Policy Center, Urban Institute and Brookings Institution, 2007.

Nielsen, Helena, Torben Sorensen, and Christopher Taber. "Estimating the Effect of Student Aid on College Enrollment: Evidence from a Government Grant Policy Reform." *National Bureau of Economic Research Working Paper,* No. 14535, 2008.

Norton, Edward, Hua Wang, and Chunrong Ai. "Computing Interaction Effects and Standard Errors in Logit and Probit Models." *The Stata Journal,* Vol. 4, No. 2, 2004.

Puhani, Patrick. "The Treatment Effect, the Cross Difference, and the Interaction Term in Nonlinear "Difference-in-Differences" Models." *IZA Discussion Paper Series* No. 3478, 2008.

Shin, Hyon. "Comparison of Estimates on School Enrollment from the ACS and the CPS." Population Division U.S. Census Bureau, 2007.

Turner, Nicholas. "Who Benefits from Federal Student Aid? The Economic Incidence of Tax-Based Aid." UC San Diego: Department of Economics, UCSD. Retrieved from: http://www.escholarship.org/uc/item/7g0888mj, 2010.

Zeldes, Stephen. "Consumption and Liquidity Constraints: An Empirical Investigation." *Journal of Political Economy,* Vol. 97, No. 2, 1989.

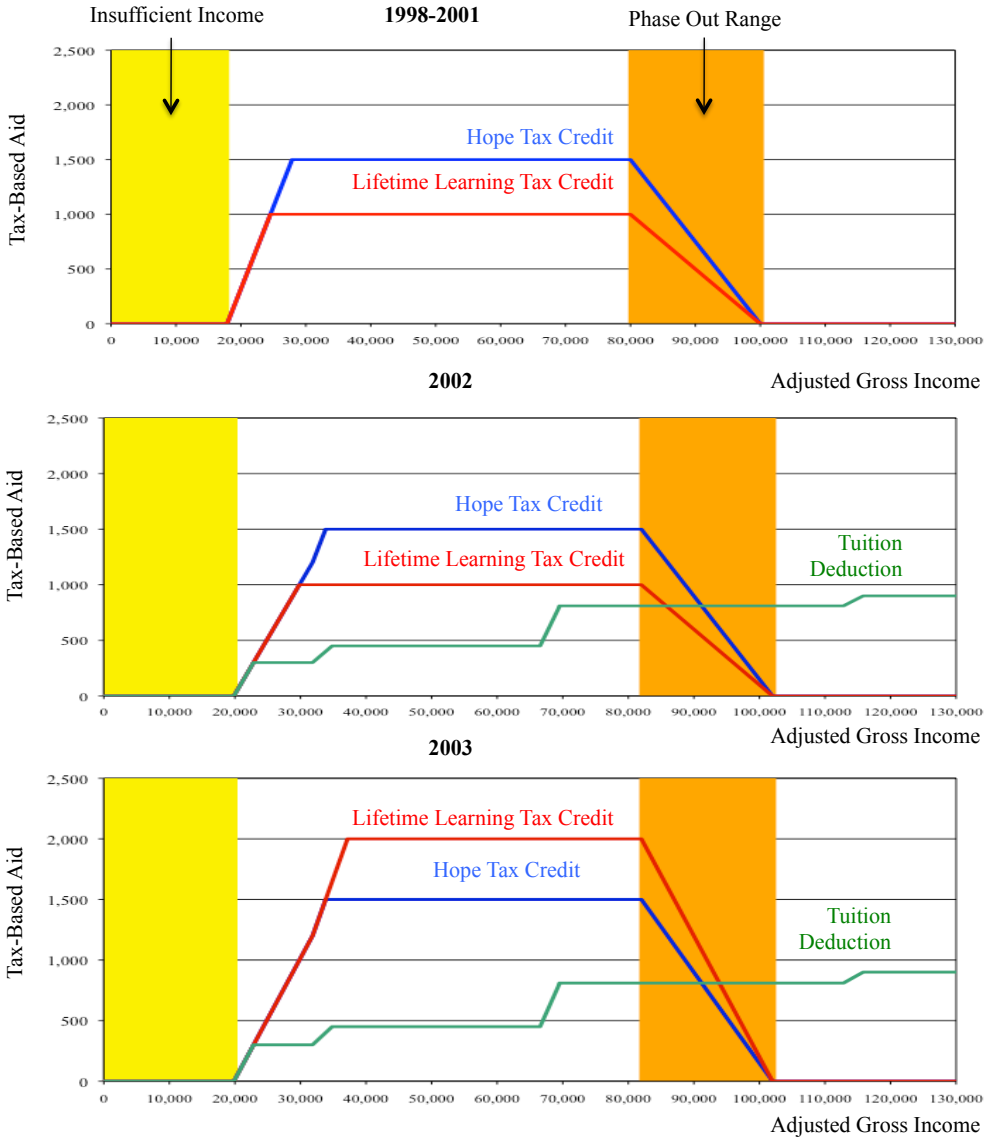


Figure 1.1
Maximum Tax-Based Aid by Adjusted Gross Income, Joint-Filing Married Family of Four with one College Student in Various Years

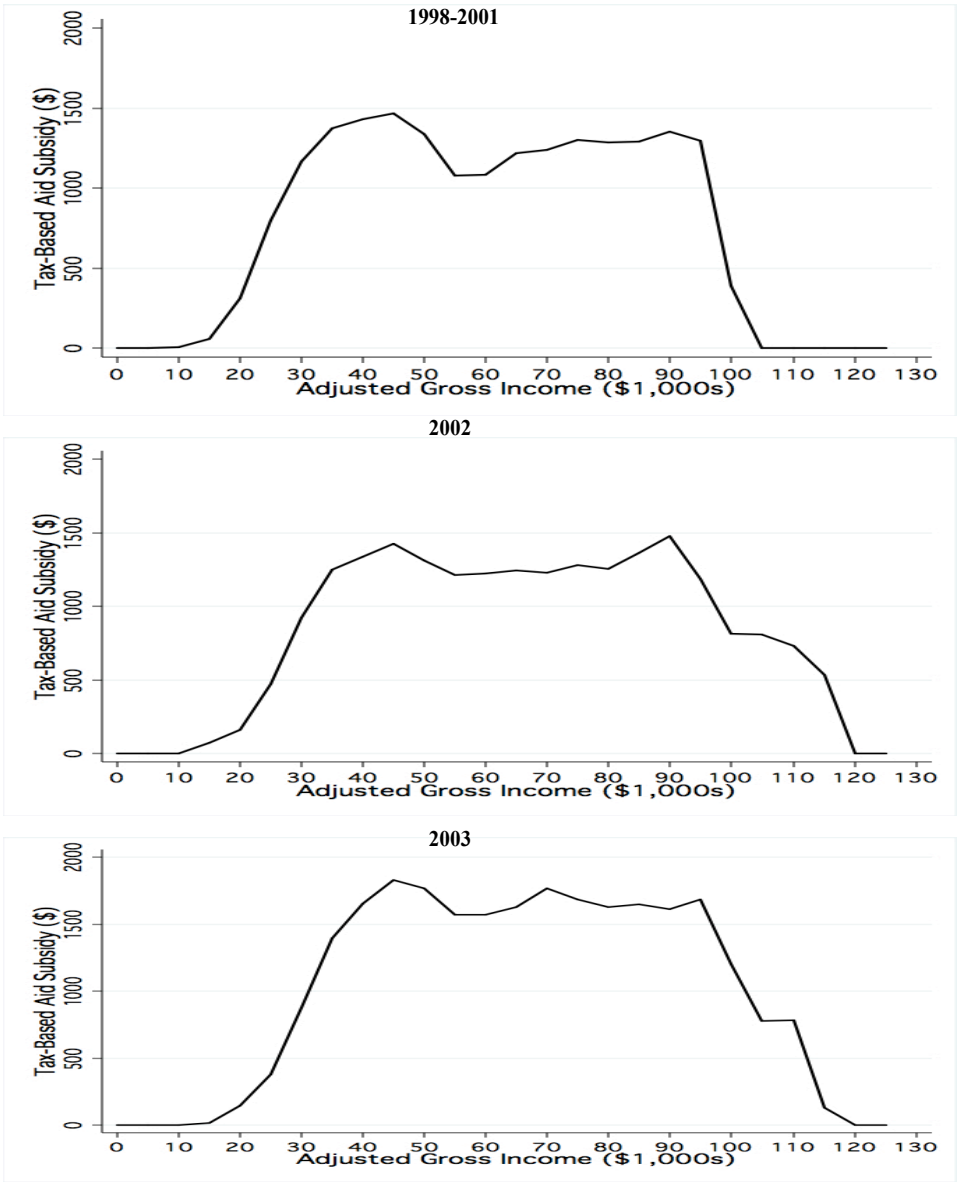


Figure 1.2
Average Tax-Based Aid Eligibility by Adjusted Gross Income, Various Years

Table 1.1
Tax-Based Aid Program Details, 1998-2003

	Hope Tax Credit (HTC)	Lifetime Learning Tax Credit (LLTC)	Tuition and Fees Deduction (TD)
Expenses Covered	Tuition and required fees at an educational instituion eligible for Department of Education student aid programs. Expenses covered do not include medical expenses, room and board, transportation, insurance, scholarships, Pell Grants or any other tax free funds used to pay education expenses.		
Adjusted Gross Income Eligibility	1998-2001: Full credits for single (joint) returns less than $40,000 ($80,000). Credits linearly phased out for single (joint) returns until $50,000 ($100,000). 2002: Limits changed to $41,000 ($82,000) and $51,000 ($102,000) for single (joint) returns. 2003: Limits changed to $83,000 and $103,000 for joint returns.		Single filiers with less than $65,000. Married couples must file a joint return less than $130,000.
Amount	100 percent of first $1,000 plus 50 percent of the next $1,000 of qualified education spending. Max credit $1,500 per student.	1998-2002: 20 percent of first $5,000. Max credit $1,000 per return. 2003: 20 percent of first $10,000. Max credit $2,000 per return.	100 percent of first $3,000 of qualified education spending per return.
Recipient Eligibility	Only available for two tax years for students in the first two years of postsecondary education. Must be enrolled at least half-time, pursuing a degree or credential and student cannot have a felony drug conviction.	Undergraduate, graduate, vocational education and job skills programs. Available for an indefinite number of years. Lack of a felony drug conviction rule does not apply.	
Start Date	January 1, 1998	July 1, 1998	Janury 1, 2002
Source: IRS Publication 970 "Tax Benefits for Education" Various Years.			

Table 1.2

Differences in Enrollment, Tax-Based Aid and Student Characteristics by Program Eligibility and Start Date

	Before Tax-Based Aid		After Tax-Based Aid	
	Ineligible	Eligible	Ineligible	Eligible
Enrollment				
Full-time	22.5	28.7	24.2	33.6
First Year	17.0	22.8	19.6	26.6
Second Year	5.5	5.9	4.6	7.0
Part-time	1.6	2.5	1.0	2.8
Tax-Based Aid				
Subsidy	0	0	0	1,104
Student Characteristics				
Black	22.8	13.6	24.6	14.2
Hispanic	23.1	14.4	22.1	15.4
Female	50.6	47.2	48.9	48.0
Age 18	74.5	77.6	75.9	74.3

Data from the 1996 and 2001 Core Wave files of the Survey of Income and Program Participation.
All dollar values are in constant ($1996).
Tax-Based Aid became effective January 1, 1998.
Eligibility is based on adjusted gross income using 2003 program rules. See text for details.

Table 1.3
Estimated Enrollment Effects of Tax-Based Student Aid

	(1)	(2)
Panel A: College Enrollment Effects		
Enrollment Level	Years 1 & 2 Undergraduate	
Dependent Variable	Full-time	Part-time
Subsidy	0.320	-0.023
	(0.141)	(0.036)
Wald Chi^2	1,128	371
Pseudo R^2	0.145	0.075
Sample Size	18,990	18,990
Mean Dependent Variable	32.31	2.90
Mean Subsidy	6.76	6.76
Panel B: Individual Year Effects		
Enrollment Level	1st Year of College	2nd Year of College
Dependent Variable	Full Time	Full Time
Subsidy	0.235	0.088
	(0.129)	(0.059)
Wald Chi^2	627	1,469
Pseudo R^2	0.090	0.224
Sample Size	18,990	18,990
Mean Dependent Variable	25.20	7.11
Mean Subsidy	6.76	6.76

The average marginal effects from a probit analysis are reported in percentage points per $100 of subsidy.
The value of the subsidy is measured in hundreds of dollars.
Standard errors are calculated using the delta method and are robust to correlation at the student level.
Control variables include dummy variables for race, Hispanic, gender, married, age, state of residence, parent/guardian education, household type and month and a spline function of income (3 knots).
Data from the 1996 and 2001 core wave files of the Survey of Income and Program Participation.

Table 1.4
Estimated Enrollment Effect of Tax-Based Student Aid and Credit Constraints

	(1)
Enrollment Level	Years 1 & 2 Undergraduate
Dependent Variable	Full-time
Panel A: Differential Effects of Credit Constraints	
Subsidy	0.337
	(0.143)
Subsidy*Constrained	0.263
	(0.174)
Constrained	-2.786
	(1.805)
Wald Chi^2	1,136
Pseudo R^2	0.142
Sample Size	18,990
Mean Dependent Variable	32.31
Mean Subsidy	6.76
Panel B: Constrained Youths	
Subsidy	0.286
	(0.181)
Wald Chi^2	686
Pseudo R^2	0.158
Sample Size	9,479
Mean Dependent Variable	32.73
Mean Subsidy	6.70
Panel C: Unconstrained Youths	
Subsidy	0.369
	(0.174)
Wald Chi^2	731
Pseudo R^2	0.142
Sample Size	9,511
Mean Dependent Variable	31.88
Mean Subsidy	6.83

The average marginal effects from a probit analysis are reported in percentage points per $100.
The value of the subsidy is measured in hundreds of dollars.
Constrained equals one for youths with a ratio of liquid assets to income below the 25th percentile.
Standard errors are calculated using the delta method and are robust to correlation at the student level.
Control variables include dummy variables for race, Hispanic, gender, married, age, state of residence, parent/guardian education, household type and month and a spline function of income (3 knots).
Data from the 1996 and 2001 core wave files of the Survey of Income and Program Participation.

Table 1.5
Estimated Differential Enrollment Effect of Tax-Based Student Aid by Income and Race/Ethnicity

Enrollment Level	Years 1 & 2 Undergraduate
Dependent Variable	Full-time
Panel A: Income Interactions	
Subsidy	0.309
	(0.142)
Subsidy*Middle Income	-0.083
	(0.211)
Subsidy*High Income	-0.008
	(0.218)
Middle Income	1.079
	(2.997)
High Income	4.046
	(4.256)
Wald Chi^2	1,147
Pseudo R^2	0.142
Panel B: Race/Ethnicity Interactions	
Subsidy	0.319
	(0.141)
Subsidy*Black	0.199
	(0.237)
Subsidy*Hispanic	-0.216
	(0.249)
Black	-1.338
	(2.046)
Hispanic	-3.779
	(2.415)
Wald Chi^2	1,130
Pseudo R^2	0.142
Sample Size	18,990
Mean Dependent Variable	32.31
Mean Subsidy	6.76

The average marginal effects from a probit analysis are reported in percentage points per $100.
The value of the subsidy is measured in hundreds of dollars.
Standard errors are calculated using the delta method and are robust to correlation at the student level.
Middle Income and High Income are indicator variables defined by the 2nd and 3rd income terciles of the eligible income range.
Control variables include dummy variables for race, Hispanic, gender, married, age, state of residence, parent/guardian education, household type and month and a spline function of income (3 knots).
Data from the 1996 and 2001 core wave files of the Survey of Income and Program Participation.

Table 1.6
Robustness Checks of Enrollment Effect of Tax-Based Student Aid

	(1)
Enrollment Level	Years 1 & 2 Undergraduate
Dependent Variable	Full-time
Panel A: Ineligibles as Control Group	
Subsidy	0.266
	(0.112)
Pseudo R^2	0.159
Sample Size	23,175
Mean Dependent Variable	30.72
Mean Subsidy	5.52
Panel B: Simulated Spending Subsidy	
Subsidy	0.357
	(0.153)
Pseudo R^2	0.146
Sample Size	18,990
Mean Dependent Variable	32.31
Mean Subsidy	5.77
Panel C: Alternate Enrollment Months	
Subsidy	0.288
	(0.119)
Pseudo R^2	0.132
Sample Size	18,990
Mean Dependent Variable	31.11
Mean Subsidy	6.77
Panel D: Eighteen Year Olds	
Subsidy	0.372
	(0.169)
Pseudo R^2	0.132
Sample Size	10,971
Mean Dependent Variable	29.77
Mean Subsidy	7.31

The average marginal effects from a probit analysis are reported in percentage points per $100.
The value of the subsidy is measured in hundreds of dollars.
Panel A includes all ineligible observations.
Panel B uses the tax-based aid subsidy based on simulated spending. See Section 4.3.
Standard errors are calculated using the delta method and are robust to correlation at the student level.
Control variables include dummy variables for race, Hispanic, gender, married, age, state of residence, parent/guardian education, household type and month and a spline function of income (3 knots).
Data from the 1996 and 2001 core wave files of the Survey of Income and Program Participation.

Table 1.A1
Predicting Qualified Education Spending, 1995-96 School Year

Table 1.A1 *Predicting Qualified Education Spending, 1995-1996 School Year*			
	SIPP	NPSAS	Estimates
	(1)	(2)	(3)
Qualified Undergraduate Spending	-	3,524	3,111
Student Characteristics			
Female	0.47	0.48	11.86
			(107.74)
Married	0.02	0.03	-210.65
			(150.93)
Black	0.16	0.10	-268.37
			(210.97)
Asian	0.04	0.05	262.01
			(268.72)
Hispanic	0.17	0.10	-172.71
			(304.62)
Family Income	53,033	53,681	0.037
			(0.003)
Parent Education Level			
High School	0.29	0.20	368.22
			(193.90)
Vocational	0.07	0.16	14.20
			(292.87)
Some College	0.22	0.20	518.03
			(214.95)
BA/BS or more	0.20	0.32	1035.67
			(214.95)
Wald F			33.22
R^2			0.22
The dependent variable is tuition and fees minus all grants for the 1995-1996 school year. The model also includes indicators for Census region of residence that are jointly significant. Data in column (1) from the U.S. Department of Education, National Center for Education Statistics, 1995-1996 National Postsecondary Student Aid Study. Data in column (2) is from the Survey of Income and Program Participation.			

WHO BENEFITS FROM STUDENT AID?

THE ECONOMIC INCIDENCE OF TAX-BASED FEDERAL STUDENT AID

Abstract: Federal benefit programs are designed to aid targeted populations. Behavioral responses to these programs may alter the incidence of their benefits, a possibility that receives less attention in the literature compared to tax incidence. I demonstrate the importance of benefit incidence analysis by showing that the intended cost reductions of tax-based federal student aid are substantially offset by institutional price increases. Contrary to the goal of policymakers, I find that tax-based aid crowds out institutional aid dollar-for-dollar. Unfortunately, it is not clear how institutions utilize these captured resources, so that the ultimate incidence of the programs is uncertain.

JEL Codes: I22, I28, H22

Behavioral responses to government programs may undermine their intended effects, and as a result, alter their designed welfare implications. For this reason, tax incidence, which examines where the burdens of taxation ultimately fall, receives much attention in the literature (Jonathan Gruber 1997; Don Fullerton and Gilbert Metcalf 2002; Jeffrey Kubik 2004). The study of benefit incidence of government programs is less common. For example, until recently the assumption that the Earned Income Tax Credit benefits recipients had never been tested. Alexander Leigh (2004) and Jesse Rothstein (2010) address this omission, and find substantial erosion of benefits for nominal recipients via reduced wages in the labor market. These results suggest that the efficacy of benefit programs depends crucially on the extent of offsetting price changes. This paper adds to the benefits incidence literature by modeling and quantifying the institutional response to tax-based federal student aid.

Funding for federal student aid, over $660 billion between 1998 and 2006,[1] is based on the assumption that students and families claiming the programs are the economic beneficiaries. The existing literature finds that student aid increases enrollment (Larry Leslie and Paul Brinkman 1987; Dennis Heller 1997; David Ellwood and Thomas Kane 2000; Susan Dynarski 2000, 2003; Nicholas Turner 2009), but how effectively these programs do so depends on the degree to which there are offsetting price changes. Yet, the literature examining the institutional price response to student aid is limited and generally focuses on tuition effects at the school level. The use of tuition increases to appropriate the benefits of federal student aid is referred to as the

[1] Expenditures are in 2006 dollars and include grants, student loans and tax-based aid (Sandy Baum and Patricia Steele 2007).

Bennett Hypothesis, named after former Education Secretary William Bennett.[2] Bridget Terry Long (2006, 2008) and Stanley Ikenberry (1997) discuss the existing work on the Bennett Hypothesis and note that there is weak empirical evidence supporting its validity.[3]

One possible explanation for these inconclusive findings is that instead of increasing tuition, schools may appropriate the benefits of federal student aid by strategically reducing institutional grant aid. I refer to this possibility as the price-discrimination Bennett Hypothesis. Unlike tuition increases that affect all students, the reduction of institutional aid allows schools to realize financial gains from increases in federal student aid while ensuring that no student is made worse off. The strategic use of institutional aid also avoids the highly visible and unpopular process of increasing tuition.[4] Both policymakers and financial aid administrators are aware of the possibility that institutional aid will be replaced by tax-based aid. Former Education Secretary Richard Riley sent a letter to presidents of colleges and universities declaring that the goal of tax-based aid is to, "…provide additional help for families to pay for college and not simply substitute for existing sources of financial assistance" (Richard Riley 1998).

---

[2] William Bennett (1987) made his original argument in the context of federal loan programs. Following Larry Singell and Joe Stone (2007) and Caroline Hoxby (1998), I use a broad interpretation of the Bennett Hypothesis that includes the appropriation of any external student aid program using tuition increases.

[3] Long (2004) finds limited support for the Bennett Hypothesis in response to two tax-based aid programs. Contrary to the Bennett Hypothesis, Long (2003) and Benjamin Scafidi, Ross Rubenstein, Amy Schwartz and Gary Henry (2007) report price decreases in the context of the Georgia Hope Scholarship. Michael McPherson and Morten Shapiro (1991) and Singell and Stone (2007) report conflicting patterns of changes in tuition across public and private schools in response to federal grant programs. Singell and Stone (2007) and Michael Rizzo and Ronald Ehrenberg (2003) report opposite findings on the effect of out-of-state tuition at public schools.

[4] This is an especially complicated process for public schools. Only 16 states give schools the authority to raise tuition, while the legislature, a state agency or a system board sets tuition in the remaining states (Michael Mumper and Melissa Freeman 2005). McPherson and Shapiro (1998) note that there is substantial pressure to limit tuition increases at private schools, and in earlier work (1991), suggest that the goal of maintaining an economically diverse applicant pool moderates tuition increases.

In response, some financial aid administrators pledged that students would receive the full benefits of tax-based aid (Stephen Burd 1998). However, others argued for the need to incorporate tax-based aid awards in the calculation of institutional aid. One such director noted, "…families that receive $1,500 from the federal government are better off than those that don't. And I don't think that I can ignore that" (Burd 1998).[5]

Despite the awareness that institutions may decrease aid, rather than increase tuition, in response to increases in external aid, Long (2003) and Michael McPherson and Morten Shapiro (1991) are the only papers that explicitly raise this possibility. They document student aid incidence at the school level and reach different conclusions on whether external aid is a substitute for institutional aid.[6] Yet, the use of school-level data prevents Long (2003) and McPherson and Shapiro (1991) from determining *which* students are impacted by the institutional response. The flexibility of student-level data allows me to add to this work by addressing several questions. First, do colleges and universities selectively lower institutional grant aid *for students that benefit from tax-based aid*? Second, how do students who experience these aid declines cope? Due to a likely time delay in benefit receipt of tax-based aid, a reduction in institutional aid may cause students to borrow more in order to offset their short-term unmet need.

To estimate student-level effects, I exploit policy-induced variation in all three tax-based aid programs, the Hope Tax Credit, the Lifetime Learning Tax Credit and the Tuition Deduction, using data from the National Center on Education Statistics. The

[5] $1,500 is the maximum value of the Hope Tax Credit, and was the maximum tax-based aid award when the statement was made in 1998.

[6] Long (2003) reports that merit-based aid substitutes for institutional aid at private colleges in Georgia in the 1990s, whereas McPherson and Shapiro (1991) find that federal grant aid complements institutional aid for private schools in an earlier period for a nationally representative sample.

primary analysis sample includes students enrolled at 184 4-year schools during the 1995-96, 1999-2000 and 2003-04 school years. I estimate the intention to treat effects of tax-based aid using instrumental variables to address the endogeneity of education spending and school fixed-effects to control for unobserved heterogeneity in student aid practices across institutions.

Contrary to the goal of policymakers, who sought to increase postsecondary access for eligible students by lowering the cost of enrollment, I find that the institutional price response fully counteracts the intended cost savings of tax-based aid. Students appear to increase loans in response to the reduction of institutional aid, suggesting that tax-based aid falls short of an important federal aid goal to reduce student indebtedness (Barry Burgdorf and Kent Kostka 2006). These results imply that students eligible for tax-based aid may not be the economic beneficiaries of the programs. To determine the ultimate incidence of tax-based aid, I consider two ways in which institutions might utilize the captured resources. One, that institutions redirect aid towards students that are ineligible for tax-based aid, or two, that institutions channel the resources into other expenditures, such as capital improvements or faculty/staff salaries. Unfortunately, these results are largely uninformative (see the Appendix for further discussion) so that the incidence of tax-based aid is uncertain. However, I offer an important first step in establishing the incidence of tax-based aid by demonstrating that eligible students and their families do not directly benefit from tax-based aid in the manner envisioned by policymakers. The literature finds evidence of similar unintended offsetting effects in other contexts, including public health insurance (David Cutler and Jonathan Gruber 1996) and intergovernmental grants (James Hines

and Richard Thaler 1995; Nora Gordon 2004; Katherine Baicker and Nora Gordon 2006).

The remainder of this paper proceeds as follows. Section I provides information on the tax-based aid programs and the process of packaging student aid. In Section II, I develop a theoretical model of the institutional response to increases in federal student aid. Section III discusses the empirical specifications and results. Section IV concludes.

I. The Basics of Federal Student Aid

I.A. Tax-Based Federal Student Aid

Tax-based aid programs provide a convenient natural experiment for examining the impact of federal aid on college pricing. Program implementation and changes in program generosity create discrete changes in aid for eligible students over time. In 1997, the Taxpayers' Relief Act introduced the Hope Tax Credit and the Lifetime Learning Tax Credit. In 2001, The Economic Growth and Tax Relief Reconciliation Act added a third program, the Tuition Deduction. Between 1998 and 2006 these three tax-based aid programs cost over $41 billion and were claimed by more than 54 million students and their families (Baum and Steele 2007).

Eligibility for tax-based aid is determined by adjusted gross income, tax-filing status and enrollment. Only one program may be claimed per student per year. The Hope Tax Credit covers 100 percent of the first $1,000 and 50 percent of the next $1,000 of qualified expenses and may only be used during the first two years of undergraduate education (Internal Revenue Service [IRS] 1998). The Lifetime

Learning Tax Credit covers 20 percent of qualified expenses for all years of postsecondary study for most students. Between 1998 and 2002, the qualified spending limit was $5,000, and in 2003, it increased to $10,000 (IRS 1998, 2003). The Tuition Deduction allows tax filers to deduct 100 percent of the first $3,000 of qualified education expenses,[7] and has a broader eligibility range compared to the Hope Tax Credit and Lifetime Learning Tax Credit (IRS 2002). Applying for tax-based aid is relatively easy once the tax return is prepared.[8] Elaine Maag and Jeffrey Rohaly (2007) report that program take up is 63-74 percent, comparable to that found for other programs including Unemployment Insurance, Head Start and the Earned Income Tax Credit (Janet Currie 2006).[9] Table 1 describes the programs in greater detail.

In contrast to federal grant aid, such as Pell Grants and Federal Supplemental Education Opportunity Grants that target relatively low-income students and families, tax-based aid targets middle and upper-middle class families in several ways. First, tax-based aid requires positive tax liability and positive education spending, which is calculated net of other aid programs. Second, the adjusted gross income eligibility limits and phase-out regions of the tax-credit programs limit use to middle and upper-middle income students and families. Figure 2.1, which shows the maximum value of

---

[7] The maximum deduction increased to $4,000 and the adjusted gross income eligibility range expanded in 2004. Because I use data from the 2003-04 school year, I calculate the Tuition Deduction based on the 2003 program rules, which were in place for the first half of that school year. This is done because the data do not include payment date, and only expenses paid after January 1, 2004 are affected by the program changes.

[8] Turner (2009) discusses the relative ease of tax-based aid application compared to the Free Application for Federal Student Aid (FAFSA) required by most forms of student aid.

[9] Long (2004) provides evidence that many parents/guardians were unaware of tax-based aid and that take-up was less than expected in the first years of the programs. However, the National Postsecondary Student Aid Study data that she uses may not accurately capture program take up. More than one-third of respondents in the 1999-2000 survey replied "don't know" or "not reached/missing" when asked about tax-based aid use.

tax-based aid for a joint-filing married family of four, highlights these features. The enrollment of middle and upper-middle income recipients is likely to be less price sensitive compared to the lower-income population targeted by traditional student aid (Heller 1997; Ellwood and Kane 2000), which may make institutional aid substitution more likely. The timing of award receipt also sets tax-based aid apart from traditional forms of student aid. Benefits from tax-based aid are likely realized when tax returns are received, generally after educational expenses are paid.[10] As a result, if schools substitute tax-based aid for their own sources of aid, students will face a temporary increase in unmet financial need.

I.B. Tuition Discounting and Financial Aid Packaging

Tuition discounting, or price discrimination, is accomplished through the practice of financial aid packaging, defined as the, "…process of awarding aid without exceeding the student's financial need…" (Federal Student Aid Handbook 2007 [Vol.3, 113]). Colleges and universities devote substantial resources towards this practice. In 1995, the tuition discount rate, defined as the ratio of school grant aid to tuition and fees, at 4-year public schools was 11.7 percent, increasing to 14.7 percent by 2005 (Sandy Baum and Lucie Lapovsky (2006). Similarly, the discount rate increased at 4-year private schools from 23.8 percent to 33.5 percent over the same period (Baum and Lapovsky 2006).

[10] Tax filers could smooth the impact of the credit by adjusting their withholdings in earlier periods. However, this requires a high level of sophistication, and it is likely that most returns realize the benefits as a lump sum after education costs are paid.

The timing of the packaging process gives institutions the ability to appropriate the benefits of tax-based aid by repackaging student aid. First, the financial aid administrator receives the Free Application for Federal Student Aid (FAFSA) and calculates the expected family contribution. Next, using the expected family contribution, eligibility for Pell Grants is determined. Third, federal campus-based aid is awarded, which includes work study, Supplemental Education Opportunity Grants and Perkins loans. Fourth, the administrator adds institutional aid. Lastly, eligibility for Stafford loans is assigned to cover any remaining unmet need and/or to finance the expected family contribution.

From the FAFSA, the financial aid administrator can determine eligibility and award size for tax-based aid.[11] Given this information, the administrator can substitute tax-based aid for other sources of aid. The Federal Student Aid Handbook (2007) notes that the standard response to increased external aid is to, "…adjust non-federal awards, if necessary, to ensure that the student's financial need is not exceeded" (Vol. 3, 114). It is unlikely that tax-based aid will have a large impact on Pell Grants and federal campus-based aid, due to limited overlap in eligibility with these programs. Maag and Rohaly (2007) estimate that tax returns with income of at least $40,000 receive about 65-70 percent of the total expenditures for the tax credit programs. In contrast, Charmane Mercer (2005) notes that 90 percent of families claiming Pell Grants have income less than $40,000. However, the impact on institutional aid may be substantial.

[11] See Worksheet B in the 1999-2000 FAFSA or Worksheet C in the 2003-04 FAFSA. Many schools require supplemental student aid application forms. The Survey of Undergraduate Financial Aid Policies, Practices and Procedures reports that 62 percent of private 4-year schools and 28 percent of 4-year public schools required an additional form in the 1999-2000 school year. While these additional forms may be used to assign institutional aid, only information in the FAFSA can be used to assign federal aid.

McPherson and Shapiro (1998) speculate that institutional aid may be reduced dollar-for-dollar in response to tax-based aid.

Figure 2.2 suggests that colleges and universities respond to tax-based federal student aid by lowering institutional grant aid for eligible students, consistent with the price-discrimination Bennett Hypothesis. The top panel shows the changes in institutional grant aid and tax-based aid by income group, between the 1999-2000 and 1995-96 school years. The changes in tax-based aid in this panel reflect the introduction of the programs, whereas the changes in the bottom panel reflect the expansion of the programs between the 2003-04 and 1999-2000 school years. The pattern of institutional aid decreases is less clear in the bottom panel, however many income groups that gain from the expansion of tax-based aid also experience offsetting reductions in institutional grant aid. Figure 2.2 also suggests that schools may redistribute aid towards students that do not benefit from tax-based aid. For example, in the top panel of Figure 2.2 the only income groups that experience an increase in institutional aid are those with income that exceeds tax-based aid program limits. The next section proposes a theoretical model of institutional pricing behavior that predicts institutional aid decreases for eligible students and allows for institutional aid redistribution towards ineligible students.

II. Model of Institutional Pricing Behavior

In this section, I develop a model of institutional behavior that characterizes the pricing response of colleges and universities to changes in federal aid, providing a theoretical basis for the price-discrimination Bennett Hypothesis. The diverse set of

goals pursued by universities, including instruction, research, and community outreach, make the determination of an institutional objective function difficult.[12] I specify a school objective function that flexibly incorporates both institutional enrollment goals as well as the desire by institutions to increase resources for prestige maximization.[13] There are two student types, defined as eligible for tax-based aid (i=1) and ineligible for tax-based aid (i=2). The enrollment of each student type directly enters the objective function, allowing schools to care about both total enrollment as well as the mix of student types. The model also accounts for the desire by schools to increase expenditures on prestige increasing activities, such as faculty salaries, capital improvements, and research by including a prestige good in the objective function.

$$\max_{p_1, p_2, Z} U = U[E_1(p_1, f_1, Z), E_2(p_2, f_2, Z), Z] \tag{1}$$

Colleges and universities maximize the school utility function in Equation (1) subject to the zero-profit constraint in Equation (2) by selecting the net price they receive from each student type, tuition minus institutional aid, (p_1, p_2) and the level of a prestige good (Z).

$$I + \sum_{i=1}^{2} p_i E_i(p_i, f_i, Z) - C\left(\sum_{i=1}^{2} E_i(p_i, f_i, Z)\right) - Z = 0 \tag{2}$$

[12] Charles Clotfelter (1999) and Gordon Winston (1999) suggest that the standard profit maximization model does not fit colleges and universities. Estelle James (1990; 1978) argues that prestige maximization is an important goal, and Long (2003) suggests that colleges and universities maximize revenue for use in prestige increasing areas. Michael Rothschild and Lawrence White (1995) and James (1990) include enrollment in the objective function, suggesting that unlike profit maximizing firms, schools take into consideration the purchasers of their product. McPherson and Shapiro (1991) argue that institutions also consider the relative mix of enrollment.

[13] The model builds on the frameworks developed by Scafidi, Rubenstein, Schwartz and Henry (2007) and Janet Netz (1999).

Enrollment for student type i $E_i(p_i, f_i, Z)$ is a decreasing function of the net price received by schools[14] (p_i), and an increasing function of tax-based aid (f_i) and the prestige good (Z). The budget constraint balances income from other sources, such as endowment income, (I) and enrollment revenues with the cost of enrollment and the prestige good. The cost of enrollment, which includes instruction and the provision of other student services, is an increasing function of total enrollment.

The first-order condition for the net price of student type i (p_i) given in Equation (3) predicts that schools select the optimal net price by equating the marginal utility cost and the marginal financial benefit of a price increase.

$$(3) \qquad \left(\frac{\partial U}{\partial E_i}\right)\left(\frac{\partial E_i}{\partial p_i}\right) + \lambda\left[E_i + p_i\left(\frac{\partial E_i}{\partial p_i}\right) - \left(\frac{\partial C}{\partial (E_1 + E_2)}\right)\left(\frac{\partial E_i}{\partial p_i}\right)\right] = 0$$

The marginal utility cost to schools is captured in the first term, reflecting the cost to the school objective function of increasing p_i. This cost is equal to the value schools place on enrollment (the marginal utility of enrollment of type i) times the reduction in enrollment that results from an increase in net price. The terms multiplied by the Lagrange multiplier (λ) represent the marginal financial benefit to schools from increasing p_i, which has three components. Holding enrollment constant, schools gain revenue equal to enrollment of student type i (first term). Accounting for the reduction in enrollment that follows from an increase in the net price, schools lose revenue in proportion to the price (second term), and gain revenue from the lower financial costs of

[14] This assumption imparts market power to schools. Given the excess enrollment demand that persists in equilibrium and examples of price fixing by select institutions (Netz 1999), there is reason to believe that the postsecondary market is not perfectly competitive. Schools may derive market power by offering a differentiated product and from the high transaction cost of transferring for continuing students.

enrollment (third term). Equation (3) deviates from the standard profit maximization condition by the inclusion of the marginal utility cost term. If the marginal utility cost is zero, then the optimal net price is determined by setting the marginal financial benefit equal to the marginal financial cost.

Following an increase in tax-based aid, Equation (3) predicts that the net price will increase for eligible students for two reasons.[15] First, if schools have diminishing marginal utility of enrollment, then the marginal utility cost is lower. Second, the marginal financial benefit increases, as schools gain from imposing a higher net price across a larger number of eligible students. Together, these factors unambiguously predict a price increase. The marginal utility cost term of the model allows for heterogeneity in the price response across eligible students based on institutional selectivity and/or student quality. The enrollment goals of selective intuitions may be different than less selective institutions. Selective institutions are more likely to face capacity constraints and may be willing to impose a larger price increase, compared to less selective schools that may want to simply increase overall enrollment. Also, if schools place greater weight on high ability students in the objective function then the marginal cost of a price increase is larger for these students, as compared to lower ability students with a smaller objective function weight. As a result, the model predicts a smaller price increase for these students.

[15] This can also be seen by applying the implicit function theorem to the Equation (3). This result assumes that the cross-partial derivative of enrollment with respect to tax-based aid and net price is roughly equivalent to the second partial derivative of enrollment with respect to net price. The model can allow for price decreases if enrollment costs are very concave, and the level of enrollment is less than the enrollment effect of tax-based aid. This situation is unlikely to hold in practice, because it would require tax-based aid to more than double the original student population.

In the case of ineligible students, Equation (3) allows for both price increases and decreases in response to tax-based aid. Intuitively, schools trade off the desire to have a diverse enrollment with the financial gain from a price increase. This reflects the conflicting effects of the marginal utility cost and marginal financial benefit to schools of a price increase. Regardless of the sign, the model predicts that the price effect for ineligible students will be bounded above by the price increase for eligible students.[16] Intuitively, the magnitude of the institutional response depends in part on the enrollment effect of tax-based aid, which is positive only for eligible students. This differential response implies that schools will adjust the net price they receive using institutional aid, as predicted by the price-discrimination Bennett Hypothesis.

III. Empirical Strategy and Results

III.A. Analysis Sample

To test the implications of the model presented in Section II, I use data from the National Postsecondary Aid Study (NPSAS) published by the National Center for Education Statistics. These data provide student-level information on financial aid, student and parent characteristics, and institutional detail. Using samples from the 1995-96, 1999-2000 and 2003-04 school years, I analyze 184 4-year schools with 74,275 undergraduate students aged 18-24. To construct the analysis sample I limit the

[16] This holds as long as the marginal utility and marginal enrollments of each student type are roughly comparable. Empirical work (Ellwood and Kane 2000; Heller 1997; Leslie and Brinkman 1987) on the price sensitivity of enrollment suggests that the difference across eligible and ineligible students is unlikely to be large enough to make the marginal enrollment portion of this assumption unrealistic.

data in two ways. First, I drop students with invalid grade level responses.[17] The value of tax-based aid depends on grade level (the Hope Tax Credit is available only during the first two years of college), so including these observations adds measurement error. I also limit the sample to the 184 schools that appear in each of the NPSAS files, ensuring that the sample of schools is balanced over time.[18] (As a robustness check, I analyze an unbalanced panel of 348 schools and 118,367 students.)

The NPSAS does not include information on the value of tax-based aid, or reliable information on program use. To address this shortcoming of the data, I estimate the value of the tax-based aid in the following way. First, I use IRS rules (1998, 2002, 2003) to define the formulas for the Hope Tax Credit, the Lifetime Learning Tax Credit and the Tuition Deduction, which depend on education spending, adjusted gross income and taxes owed. The NPSAS contains data on family income and education spending, defined as tuition minus student aid. In calculating taxes owed, I assume that only the standard deduction and personal exemptions are claimed. Using these values of income, education spending, and taxes owed, I apply the tax-based aid formulas to estimate the value of each of the three tax-based aid programs for a given student. Students can claim at most one program per year, so for students that are eligible for multiple programs, I assign the program with the largest value.[19]

---

[17] Invalid grade responses include both observations with missing data and those that skipped the survey question. Roughly 5 percent of students have invalid grade responses.

[18] In the 1995-96 NPSAS sample there are 443 4-year schools. The mix of public and private schools, average school size and institutional selectivity is roughly comparable in the analysis sample compared to the 443 schools in the 1995-96 NPSAS.

[19] Using data from the IRS, I find that not all returns select the program that offers the largest value. However, the dollar amount of the loss incurred from these selections is small, so the effect on the subsidy variable should be minimal. Turner (2010) explores this behavior building on the models of tax salience developed in Raj Chetty, Adam Looney and Kory Kroft (2009) and Amy Finkelstein (2009).

Figure 2.3 shows the average value of the eligible tax-based aid award by adjusted gross income for the 1999-2000 and 2003-04 school years. Cross-sectional variation in the subsidy arises from differences in qualified education spending, differences in adjusted gross income, and from program rules that define eligibility. These sources of variation are evident across the panels in Figure 2.3. For example, the dip around $40,000 corresponds to the phase-out region for non-joint returns, while the decline beginning around $80,000 corresponds to the phase-out range for joint returns. Time-series variation comes from the enactment of the tax-credit programs in 1998, and from the increase in the value of the Lifetime Learning Tax Credit and introduction of the Tuition Deduction between the 1999-2000 and 2003-04 school years.

Table 2 shows the mean values of various measures of student aid, including tax-based aid, and student demographic variables by institution type. As expected, there are substantial differences in tuition and aid across public and private institutions. Average annual tuition at private schools ($18,290) is more than four times that of public schools ($4,411).[20] Institutional aid for private schools ($6,082) is also larger compared to public schools ($691). Yet, because of program rules that limit qualified education spending, substantial differences in tuition and institutional aid do not translate into large differences in tax-based aid. For public schools, average tax-based aid ($498) is comparable to that of private schools ($535). The average tuition discount rates for public and private schools in the analysis sample, 13 and 31 percent respectively, are similar to the estimates from Baum and Lapovsky (2006), who report estimates for a nationally representative sample of schools over a similar period.

[20] All dollar amounts are in 2003 dollars.

III.B. Measuring the Price-Discrimination Bennett Hypothesis

The price-discrimination Bennett Hypothesis predicts that institutions strategically reduce institutional aid to capture the benefits of tax-based aid. To explore this possibility, I exploit policy-induced variation in the value of tax-based aid using Equation (4):

$$(4) \qquad InstitutionalAid_{ijt} = \beta_1 TBA_{it}\left(S_{ijt}, I_{it}, \tau_{it}\right) + \beta_2 X_{ijt} + \alpha_j + \varepsilon_{ijt}$$

where *i, j, t* index individuals, schools and years respectively. The key independent variable is tax-based (*TBA*), which is a function of education spending (*S*), adjusted gross income (*I*) and taxes (τ) as described in Section III.A. When estimating Equation (4), I limit the sample by removing students that are never eligible based on the 2003-04 program rules,[21] so that variation in tax-based aid comes from policy changes, from differences in education spending and differences in income, but not from the comparison of eligible and ineligible students. Including ineligible students may overstate the magnitude of the institutional response to tax-based aid if schools simultaneously lower institutional aid for eligible students and increase institutional aid for students that are ineligible for tax-based aid. (In Appendix Table A2, I report the results when both eligible and ineligible students are included.) The parameter β_1 measures the impact of eligibility for one dollar of tax-based aid on institutional aid. An estimate of -1 for β_1 implies dollar-for-dollar aid substitution, while $\beta_1 < 0$ is consistent with the price-discrimination Bennett Hypothesis.

[21] I include only observations with positive tax liability that meet the adjusted gross income limits based on the 2003-2004 program rules. See Figure 2.1.

A primary concern with ordinary least squares estimation of Equation (4) is the possibility that tax-based aid and institutional aid are jointly determined, because tax-based aid is a function of education spending. Holding all else equal, if spending is below the programs' limits, an increase in education costs, such as a reduction in institutional aid, will increase the value of tax-based aid. (Table 1 reports the programs' limits). To address this source of bias, I instrument for tax-based aid using two separate approaches. In each case, I generate an instrument by calculating the value of the tax-based aid using a plausibly exogenous value of education spending in order to isolate policy-induced variation in tax-based aid eligibility.[22]

In the first approach, I instrument using the value of tax-based aid calculated at the programs' spending limits. The value of tax-based aid is constant for qualified spending that exceeds these limits, so that this instrument is unaffected by an institutional response that increases spending. Equation (5) gives the first-stage equation:

$$(5) \qquad TBA_{it}\left(S_{ijt}, I_{it}, \tau_{it}\right) = \gamma_1 TBA_{it}\left(S_{\max t}, I_{it}, \tau_{it}\right) + \gamma_2 X_{ijt} + \alpha_j + \varepsilon_{ijt}$$

where $S_{\max t}$ is the maximum spending limit in year *t*. This instrument contains variation at the individual-year level that results from program rules and differences in income, but uses a constant level of qualified spending across all schools and students.

[22] Jeffrey Wooldridge (2002) refers to this as a generated instrument, and shows that estimates using generated instruments are consistent and reach valid inferences. This approach is similar to Gordon Dahl and Lance Lochner (2008) who replace an endogenous input in the Earned Income Tax Credit schedule to isolate policy-induced variation. It is also similar to Caroline Hoxby and Ilyana Kuziemko (2004) who use pre-period school district characteristics in the contemporaneous school aid formula to isolate policy-induced variation from a school finance equalization in Texas and refer to their approach as simulated instrumental variables following Currie and Gruber (1996).

As a second approach, I use an instrument that includes variation in education spending by student characteristics for each school. This instrument relies on a plausibly exogenous level of spending that is simulated for later periods based on the determinants of spending in the 1995-96 school year. Spending in 1995-96 should be unaffected by the endogenous response expected after the enactment of tax-based aid. To construct this instrument, I first estimate spending in the 1995-96 school year as a function of student income and demographic characteristics for each school *j*, using Equation (6).[23]

(6)

$$S_i = \lambda_{j1} black_i + \lambda_{j2} hispanic_i + \lambda_{j3} income_i + \lambda_{j4} age_i + \lambda_{j5} female_i + \lambda_{j6} dependent_i + \varepsilon_i$$

Next, I use the parameter estimates from Equation (6) to predict qualified spending for students in later periods at the same school (in real terms).[24] From this simulation, I calculate the instrument as the value of tax-based aid that a given student would have received if the pattern of qualified spending were held constant from the 1995-96 school year. Equation (7) gives the first stage equation.

$$(7) \qquad TBA_{it}\left(S_{ijt}, I_{it}, \tau_{it}\right) = \gamma_1 TBA_{it}\left(\hat{S}_{ijt}, I_{it}, \tau_{it}\right) + \gamma_2 X_{ijt} + \alpha_j + \varepsilon_{ijt}$$

$TBA_{it}\left(\hat{S}_{ijt}, I_{it}, \tau_{it}\right)$ is the subsidy based on simulated qualified spending, where $\hat{S}_{ijt}$ is simulated spending defined by Equation (6). This instrument contains variation at the individual-year level that results from program rules and differences in income, and also

[23] I rely on a parsimonious specification due to sample size considerations.

[24] I use the CPI-U to adjust dollar amounts to 2003 dollars. I also used both the Higher Education Cost Adjustment (HECA) published by the State Higher Education Executive Officers Association and the Higher Education Price Index (HEPI) reported in Paul Lingenfelter, Hans L'Orange, Susan Winter, and David Wright (2004) to adjust qualified spending, and the results were similar.

includes variation in spending both across schools and within schools based on income-demographic groups.

A key assumption of the estimation strategy is that the tax-based aid variable is not simply identified from an underlying relationship between institutional aid and income. To guard against this possibility, I flexibly control for income in X_{ijt} using a cubic spline function with five knots. Figure 2.4 shows the relationship between institutional aid and income in the 1995-96 school year using a similar spline function. For public schools, Figure 2.4 suggests that the pre-existing relationship between institutional aid and income is substantively different than the non-linear relationship between tax-based aid and income shown in Figure 2.3. For private schools, where the underlying relationship between income and institutional aid is non-linear, this implication is less clear. However, for both public and private schools, the estimated effect of tax-based aid is identified, in part, from the differences in the non-linear relationships shown in Figures 3 and 4. To test the robustness of the estimates, I consider different income controls, including alternate spline function specifications and higher-order polynomial functions of income. I also control for the key determinants used in calculating tax liability, including the amount of taxes owed, family composition, number of family members and dependency status.

As control variables, I include sources of aid that the financial aid administrator is likely to treat as given when making institutional aid decisions, based on the timeline discussed in Section I. These include Pell Grants, federal campus-based aid and state aid. I also include school-year averages of these variables to address the possibility that changes in these programs for other students at a given school affect the institutional

response to tax-based aid. A second assumption of the identification strategy is that these other sources of aid are relatively stable during the analysis period. Average changes in Pell Grants, campus-based aid and state aid for eligible students are small compared to the average change in tax-based aid, suggesting that this assumption holds.[25] As a robustness check of the baseline results, I remove students who may have experienced changes in state aid based on the timing of state-level merit-based aid programs. These results are discussed in Section III.E.

To address time effects, I include indicator variables for the 1999-2000 and 2003-04 school years, and I allow for different time trends based on institutional selectivity by interacting year indicator variables with variables for selectivity. I also include controls for student, parent and institutional characteristics that may affect the receipt and value of institutional aid such as student race, age, gender, parent/guardian education and Census division of residence. To control for unobserved heterogeneity in student aid practices across schools, I include school fixed effects. I also cluster the standard errors at the school level, to allow for arbitrary correlation in the error terms between observations, both across different students and across different school years, at a given school.[26]

III.C. Baseline Results for the Price-Discrimination Bennett Hypothesis

The empirical estimates imply that colleges and universities completely offset the intended cost reduction of tax-based aid by reducing institutional grant aid. Table 3

[25] For example, between the 1995-96 and1999-2000 school years the average changes for eligible students were: Pell Grants ($46), campus-based aid (-$81), state aid ($14), tax-based aid ($754).
[26] Gabor Kezdi (2004) shows that cluster robust standard errors allow for accurate inference when the number of clusters exceeds 50, a condition met here.

presents the estimates of the effect of tax-based aid for eligible students. Columns (1) - (3) show the results for public schools, while the results for private schools appear in Columns (4) - (6). Panel A shows the baseline results for institutional grant aid. At public schools, the estimated decrease in institutional aid is $1.16 per $1.00 of tax-based aid using the maximum spending instrument, $1.08 using the simulated spending instrument, and $1.04 using ordinary least squares (OLS). For private schools, the estimated effects are a reduction of $1.45, $1.20, and $1.85 respectively. For both school types, I cannot rule out the possibility that $\beta_1 = -1$ using either instrument or OLS. This implication is consistent with a dollar-for-dollar reduction of institutional grant aid.

Students appear to finance the institutional aid reduction, in part, through increased student loans.[27] These results appear in Panel B of Table 3. Increased borrowing may result from the short-term increase in unmet need in the period after paying education costs but before receipt of the federal tax return. Total loan amounts may also increase if program take up is less than complete, as the results here represent the intention-to-treat effect of tax-based aid. Total loan amounts, including federal Stafford loans and private loans, are estimated to increase between $0.41 to $0.50 per $1.00 of tax-based aid at public schools using the instrumental variables and by $0.60 using OLS. At private schools, loans are estimated to increase by $0.48 to $0.55 per

[27] These loan effects may be counteracted if continuing students use their tax-based aid to finance education in subsequent years and therefore reduce their borrowing. To test this possibility, I estimated the effect of tax-based aid on total loans for first-year students and students in their second year and beyond separately. Equal borrowing effects across years could not be ruled out. Instead of reducing loans in subsequent years, students and families may use their tax-based aid to finance consumption or pay back loans from previous years. Just under one-third of respondents in the Survey of Consumers report that they will "mostly save" their tax refunds from 2008 and 2001 (Matthew Shapiro and Joel Slemrod 2009, 2003).

$1.00 using the instrumental variables, and by $0.69 using OLS. Although not reported in Table 3, a breakdown of loan types suggests the majority of increased borrowing is from subsidized Stafford loans, the most favorable loan option.

The two instrumental variables perform well in both Panels A and B. (The F-test on the restriction that the excluded instrument is zero is at least 887 in Table 3.) The strength of the instruments is a result of the limited scope for endogeneity, occurring only when actual spending is less than the programs' limits. For example, using the instrument based on maximum spending, the first-stage regression holds as an identity for students with qualified spending at or above the programs' limits. Roughly 60 percent of public school students and 80 percent of private school students have spending in this range. The differences between the fixed-effects OLS estimates and the corresponding instrumental variables estimates suggest that the limited endogeneity results in a sleight bias of the OLS estimates.[28] However, I cannot reject a cluster robust test of endogeneity (at the 5 percent level) for one instrument in the case of public schools and for either instrument for private schools.[29] Therefore, I rely on the instrumental variable estimates to address the endogeneity of education spending.

The increased precision of the instrument based on maximum spending implies that the simulation of education spending does not add a relevant source of identifying variation. (Note that the standard errors are clustered at the school level.) This

[28] To the extent that education spending is endogenous, OLS will overestimate the impact of tax-based aid. For example, in Panel A, education spending and institutional grant aid are negatively related and education spending and tax-based aid are positively related over the endogenous range of spending. Removing this source of bias will decrease the absolute value of the OLS estimates.

[29] I test for endogeneity by calculating the C statistic, also known as the difference in Sargan statistic. In the case of one endogenous regressor and the null hypothesis of exogeneity, this statistic is distributed chi-square (1). Hyashi (2000) shows that this statistic is equivalent to the Hausman test under conditional homoskedasticity. In Panel A, the values of the C statistics for public (private) schools are 16.99 (16.34) for the maximum spending instrument and 1.10 (9.02) for the simulated spending instrument.

difference in precision may reflect heterogeneity in the institutional response based on students' spending. For students with spending at or above the programs' limits, tax-based aid is maximized, and the reduction in institutional aid has no effect on their tax-based aid. In contrast, for students spending less than the maximum, schools may reduce institutional aid more than dollar-for-dollar so that the tax-based aid programs are maximized. Using sample splits based on simulated education spending, I find some evidence of a heterogeneous institutional response consistent with this pattern (not shown). However, the differences in the institutional responses are small relative to the effects reported in Table 3, and are insignificant. The results in Table 3 are robust to alternate income controls, including cubic and linear splines with up to 7 knots (the baseline specification uses a cubic spline with 5 knots), and also to higher-order polynomial functions of income (not shown). This suggests that the effect of tax-based aid is not simply identified from an underlying relationship between income and institutional aid.

III.D. Further Results for the Price-Discrimination Bennett Hypothesis

In this Section, I show that institutions reduce both non need-based and need-based institutional grant aid in response to tax-based aid. I also provide evidence that the complete offset of tax-based aid persists across institutions of different selectivity, and across students of different ability.

In the baseline results, institutional grant aid includes both non need-based and need-based institutional grants. As shown in Panel A of Table 4, institutions appear to reduce both of these components in response to tax-based aid. Non need-based aid

includes merit-based aid as well as other grant aid awarded for circumstances not related to financial need. Due to data limitations, I cannot separately consider merit-based aid. (Merit-based aid is not included as a separate category for the 1995-96 school year in the NPSAS.) The larger reduction in non need-based aid, relative to need-based aid, may be a result of the greater discretion institutions have in awarding non need-based grant aid. The reduction in need-based aid may reflect the belief by institutions that tax-based aid increases student ability to pay (McPherson and Shapiro 1998). However, the differences in non need-based and need-based aid should be interpreted with caution. The definition of what constitutes need-based aid varies across schools (Baum and Lapovsky 2006) and may even change over time for a given school.

The reduction of institutional grant aid holds for both more selective and less selective institutions. Panel A of Table 5 shows the results based on institutional selectivity.[30] The point estimates suggest that the reduction in institutional aid is larger at more selective institutions, compared to less selective ones. This may reflect the market structure for selective schools. If more selective institutions have fewer direct competitors and/or larger excess demand for enrollment, compared to less selective institutions, then the price response should be relatively larger at more selective institutions. However, the differences in the estimated effects across school types are not significant so that these implications are unclear.

[30] Institutional selectivity is defined by NPSAS categories. Most selective includes "most" and "very" selective, while less selective includes "moderately" and "minimally" selective as well as "open admissions." There are very few "open admissions" schools and the results are the same if these schools are removed.

The reduction of institutional grant aid does not vary by student ability. Using SAT scores to determine student ability, I define above (below) average students as those with combined math and verbal SAT scores that are above (below) the average scores at their school in a given school year. Unfortunately, in the NPSAS many student records do not include valid SAT scores. Roughly 55 percent of students in the analysis sample have valid scores, and I am forced to condition the sample to these students in order to explore student ability implications.[31] The results in Panel B of Table 5 suggest there are not heterogeneous effects of tax-based aid across student ability, and I cannot reject the possibility that tax-based aid is entirely offset for both high ability and low ability students.

III.E. Robustness Checks of Price-Discrimination Bennett Hypothesis Results

In this section, I demonstrate the robustness of the baseline results in Panel A of Table 3.[32] First, I address the possibility that changes in state-level policies bias the results. Second, I show that the results hold for a larger sample of students from an unbalanced panel of schools. Third, I address sample selection effects that may result from the enrollment effect of tax-based aid.

In the basic specification, I control for sources of aid that are assigned prior to institutional aid, including Pell Grants, federal campus-based aid and state aid. This approach assumes that the value of these programs is roughly constant for eligible

[31] Using a specification similar to Equation (4) but with an indicator variable for valid SAT scores as the dependent variable, I find no evidence of a substantive or significant relationship between having valid SAT scores and tax-based aid, suggesting that tax-based aid does not affect SAT reporting. Missing SAT scores appears to be distributed evenly across grade level and public and private school types.
[32] The student loans results are also robust to additional analyses considered here.

students between the 1995-96 and 2003-04 school years. As noted earlier, changes in Pell Grants and campus-based aid are roughly constant for eligible students over this period. However, during the analysis period, several states enacted changes to race-based admission and aid policies. Additionally, several states initiated merit-based aid programs during this period. The average increase in state aid for eligible students is $110 in states enacting merit-based aid compared to $8 for students in the remaining states between 1999-2000 and 1995-96. Concurrent changes in state-level policies could bias the estimated effect of tax-based aid if schools respond to changes in state-based aid programs. Although not reported, I find little evidence that institutional aid responded to changes in state aid in the analysis sample. One reason for this finding may be the difficulty in determining which students experience increases in state aid. Changes to state-based programs could still bias the effect of tax-based aid by altering the composition of enrolled students. To further explore these possible sources of bias, I estimate the effect of tax-based aid after removing states that enacted substantive policy changes.

Panel A of Table 6 reports the results after removing three states (CA, MI, TX)[33] that experienced major changes to race-based policies.[34] The results obtained on this limited sample are similar to those reported in Table 3, and suggest that large-scale changes to race-based admissions and aid policies in three populous states do not affect

[33] In 1996 the Fifth Circuit Court of Appeals handed down the *Hopwood v. University of Texas* decision and California passed Proposition 209. Also in 1996, a lawsuit was filed in Michigan challenging race-based admissions. In 2003, after several lower court rulings and appeals in this lawsuit, *Grutter v. Bollinger,* the Supreme Court ruled that race could be used as a "plus factor" in the admission decision, but it can't be the only factor schools consider, and schools can't have a quota system for race.

[34] This step removes 6 public schools, and 6,405 students at public schools from the analysis sample. The number of private schools does not change, although I do remove 2,526 private school students with legal residence in these states because the policy changes may affect their matriculation decisions (the results are unchanged if I instead remove only students that attend institutions in these states).

the baseline results. Using sample splits based on minority status and also on gender, I also find that the effect of tax-based aid on institutional aid is similar across these sample splits (not shown). In Panel B of Table 6, I remove 10 states (FL, KY, LA, MD, MI, NV, NM, SC, TN, WV) that enacted merit-based aid programs during the analysis period.[35] The similarity of the results from this limited sample, compared to the baseline results, imply that the introduction of merit-based aid in these states does not impact the baseline results.

In Panel C of Table 6, I estimate the basic specification on a larger sample of students from an unbalanced panel of 4-year schools. I construct the panel by including schools that appear in the NPSAS in the 1995-96 school year and at least one of the later school years (1999-2000 and 2003-04). This panel includes 348 schools (198 public and 150 private) and a total of 100,459 eligible students. The estimated impact of tax-based aid on this sample is similar compared to the baseline results in Panel A of Table 3, as dollar-for-dollar reductions in institutional grant aid cannot be rejected for either school type or either instrument. The similarity of these results suggests that the balanced panel requirement for the primary analysis sample does not create an anomalous collection of schools.[36] Estimated student loan effects from the unbalanced panel of schools (not shown) are also similar compared to Table 3.

---

[35] See Dynarski (2004) Table 2.1. Removing these states results in 3 fewer public schools and 6,861 fewer students at public schools. The number of private schools is unaffected, although I remove 2,569 private school students with legal residence in these states. I also tried removing an additional three states that enacted merit-based aid programs in an earlier period (AR, GA, MS) and the results were similar to those in Panel B.

[36] In Panel C of Table 6, the changes in tax-based aid are different across schools coming from the introduction and expansion of tax-based aid, just the introduction of tax-based aid, or the average of the introduction and expansion of tax-based aid. In contrast, in Table 3, changes in tax-based aid are the result of the introduction and expansion of the programs for each school, as a result of the balanced panel.

If tax-based aid affects the sample of enrolled students, then the estimated effect of tax-based aid may also reflect compositional changes. To the extent that students sort into schools based on the lowest net price (into schools that offset their tax-based aid the least), the bias from a changing composition of enrolled students works against finding a substantive effect. Alternatively, if students select different schools than they would have absent the tax-based aid programs and if these schools are less likely to offer less institutional aid, then the bias is towards negative one. To address these sources of compositional bias, I control for a rich set of student and parent/family controls in the baseline specification (student demographic variables [race, age gender, dependency status], parent characteristics [education level, marital status] and family size). If the effect of these control variables is changing over time due to compositional effects of tax-based aid, then omitting them from the analysis may lead to a different estimated effect of tax-based aid. In Panel D of Table 6, I remove these controls. The similarity of the results in Panel D of Table 6, compared to the baseline results, may be interpreted as evidence that sample selection does not affect the baseline results. I find further evidence that tax-based aid does not affect the composition of enrolled students using a school-year level analysis that estimates the effect of tax-based aid on the share of eligible students (not shown).

IV. Conclusion

I demonstrate the importance of benefit incidence analysis by showing that the intended cost reductions of tax-based federal student aid are fully counteracted by reductions in institutional grant aid. The results suggest that students cope with this

reduction of institutional support by increasing student loan amounts. Together, these findings imply that students eligible for tax-based aid are not directly benefitting from the programs in the sense of realizing a lower cost of postsecondary attendance. Rather, they may be evidence that institutions and the student loan industry realize financial gains from tax-based aid at the expense of eligible students and families.

The results here suggest several areas for future work. First, it is unclear how institutions utilize the captured resources. Clarifying this aspect of the institutional response is a necessary step for determining the ultimate incidence of tax-based aid. For example, eligible students may partially benefit from tax-based aid if institutions devote the captured resources to increasing education quality, providing student services, or other expenditures valued by students. Second, the results suggest that institutions may also offset the intended cost reduction of other direct student aid programs targeting middle-income students and families, such as the recently enacted American Opportunity Tax Credit.[37] Yet, it is not clear if the crowd out of institutional aid similarly undermines traditional student aid programs targeting lower-income students. To the extent that the reduction of institutional grant aid holds for other forms of student aid, previous studies may have underestimated the price sensitivity of postsecondary enrollment by presuming greater than achieved cost reductions. More generally, the results underscore the need for further consideration of benefit incidence in the context of other government benefit programs. Another area for future work is to fully incorporate behavioral responses in the design of optimal benefit programs. This

[37] The American Opportunity Tax Credit was enacted as part of the American Recovery and Reinvestment Act. It expands the generosity and eligibility of the Hope Tax Credit for two years beginning in 2009.

line of research could help policymakers craft programs that are less susceptible to offsetting behavioral responses, such the offsetting price responses found here.

Acknowledgements: This paper, in full, is under review at the *American Economic Journal, Economic Policy*.

NOT FOR PUBLICATION

Appendix

The colleges and universities in the analysis sample are not-for-profit institutions, suggesting that the reduced institutional support for eligible students will be translated into increases in other expenditures. I consider both the possibility that aid is redirected towards students that are ineligible for tax-based aid, and also towards other institutional expenditure categories. Unfortunately, these results are largely inconclusive. In this section, I discuss the approaches and results of these inquiries.

A.I. Measuring Institutional Aid Redistribution

An increase in institutional aid for ineligible students may be evidence that schools redistribute institutional aid. I consider this possibility by estimating how much of the total institutional aid withheld from eligible students is redistributed to ineligible students using Equation (8).

$$(8) \qquad InstitutionalAid_{ijt} = \pi_1 \left(\frac{\sum_{i \in j}^{Enrollment_t} TBA_{it}\left(S_{ijt}, I_{it}, \tau_{it}\right)}{IneligibleEnrollment_{jt}} \right) + \pi_2 X_{ijt} + \alpha_j + \varepsilon_{ijt}$$

X_{ijt} contains similar controls as in Equation (6). The key independent variable is $\left(\frac{\sum_{i \in j}^{Enrollment_t} TBA_{it}\left(S_{ijt}, I_{it}, \tau_{it}\right)}{IneligibleEnrollment_{jt}} \right)$, the total value of tax-based aid, per ineligible student,

received at school *j* in year *t*. It represents the total amount of institutional aid available for redistribution if schools reduce institutional aid dollar-for-dollar with the tax-based aid. The parameter π_1 measures the share of this total that is redistributed. A positive estimate for π_1 in Equation (8) combined with a negative estimate of β_1 in Equation (4) is consistent with the redistribution of institutional aid away from eligible students towards ineligible students. Complete redistribution is implied by $\pi_1 = 1$ and $\beta_1 = -1$.

Total tax-based aid per ineligible student may be endogenous in Equation (8) for several reasons. First, similar to the case of eligible students, qualified spending may be endogenous. School-wide changes in institutional aid could affect both the tax-based aid of eligible students, through qualified spending, and the institutional aid of ineligible students. Second, enrollment may be affected by institutional aid redistribution, so that the number of ineligible students and the total value of tax-based aid at a given school may both be endogenous. To address these concerns, I exploit the timing of tax-based aid implementation to generate plausibly exogenous instruments. In place of contemporaneous values of spending and enrollment, I use values from the 1995-96 school year. This approach isolates the policy-induced variation in the tax-based aid function while holding fixed the composition of students from the 1995-96 school year. Spending and enrollment in this year should be free from the endogenous responses expected in later periods. Paralleling the approach for eligible students, I also estimate the total value of tax-based aid based on maximum spending. Equation (9) gives the first-stage regression using the IV based on actual spending in the 1995-96 school year:

(9)

$$\left(\frac{\sum_{i \in j}^{Enrollment_t} TBA_{it}\left(S_{ijt}, I_{it}, \tau_{it}\right)}{IneligibleEnrollment_{jt}} \right) = \gamma_1 \left(\frac{\sum_{i \in j}^{Enrollment_{96}} TBA_{it}\left(S_{ij96}, I_{i96}, \tau_{i96}\right)}{IneligibleEnrollment_{j96}} \right) + \gamma_2 X_{ijt} + \alpha_j + \eta_{ijt}$$

where $\left(\frac{\sum_{i \in j}^{Enrollment_{96}} TBA_{it}\left(S_{ij96}, I_{i96}, \tau_{i96}\right)}{IneligibleEnrollment_{j96}} \right)$ is the total value of the tax-based aid received at school *j* in year *t* based on the enrollment characteristics in the 1995-96 school year.

I also explored the possibility that schools translate large total tax-based aid receipt into increased expenditures in other categories. Unfortunately, the NPSAS has little information on other types of expenditures and changes in accounting practices during the analysis period make expenditures from other sources difficult to compare across years (Susan Budack 2000; IPEDS Data Center; Jane Wellman, Donna Desrochers and Coleen Lenihan 2008). For categories that may be comparable, I linked the NPSAS data to expenditure data from the Integrated Postsecondary Education Data System (IPEDS) from the National Council of Education Statistics at the school-year level to estimate if schools translate large total tax-based aid receipt into increases in other expenditures. These estimates are imprecise, and combined with the data quality concerns, offer little insight into this possibility.

A.II. Institutional Aid Redistribution Results

The redistributive results for ineligible students are largely inconclusive because the approach suffers from weak instruments. As shown in Panel A of Table A1, neither of the instruments perform well in the first stage. (F-tests on the restriction that the instrument is zero in the first stage range from 2.01 to 6.52.) The weakness of the instrument may be the result of the limited sources of variation in total tax-based aid at the school-year level after including both school fixed effects and flexible time controls. In Panel B, I replace the time controls (year indicator variables and interactions of year indicators with indicator variables for institutional selectivity) with a squared time trend. When this step is taken, the instrument performs better in the first stage, although it is still weak for private schools. (Making this replacement has no effect on the results for eligible students.) At public schools, the estimates in Panel B suggest at most a modest amount of redistribution. A necessary condition for complete redistribution, $\pi_1 = 1$, is unlikely in this case. However, as these results are not robust to the flexible time controls in Panel A, the redistributive consequences are unclear even for public schools.

I find little support for the possibility that institutions redistribute the captured aid using an alternate approach, where I estimate the baseline specification on the full sample of students. In this case, β_1 represents the average of the effect on eligible students and the effect on ineligible students. If institutions redistribute aid towards ineligible students, then β_1 should be larger in magnitude on the full sample, as compared to the sample of eligible students. Yet, as shown in Table A2, the estimated

effects of tax-based aid on the full sample are smaller compared to the results in Table 3, although equal effects cannot be ruled out.

References

Baicker, Katherine, and Nora Gordon. 2006. "The Effect of State and Local Finance Reform on Total Local Resources," *Journal of Public Economics*, 90: 1519-1534.

Baum, Sandy, and Michael McPherson. 2008. "Fulfilling the Commitment: Recommendations for Reforming Federal Student Aid," The Report from the Rethinking Student Aid Study Group.

Baum, Sandy, and Patricia Steele. 2007. "Trends in Student Aid 2007," The College Board.

Baum Sandy, and Lucie Lapovsky. 2006 "Tuition Discounting: Not Just a Private College Practice," The College Board, 2006.

Bennett, William. February 18, 1997. "Our Greedy Colleges," *The New York Times*.

Budack, Susan. 2000. "IPEDS Finance Data Comparisons Under the 1997 Financial Accounting Standards for Private, Not-for-Profit Institutes: A Concept Paper," National Center for Education Statistics Working Paper No. 2000-1.

Burd, Stephen. January 9, 1998. "Some Private Colleges May Cut Awards to Students Receiving Hope Scholarships," *The Chronicle of Higher Education.*

Burgdorf, Barry, and Kent Kostka. 2006. "Eliminating Complexity and Inconsistency in Federal Financial Aid Programs For Higher Education Students: Towards a MoreStrategic Approach," *A National Dialogue: The Secretary of Education's Commission on the Future of Higher Education*.

Chetty, Raj, Adam Looney, and Kory Kroft. 2009. "Salience and Taxation: Theory and Evidence," *American Economic Review*, 99: 1145-1177.

Clotfelter, Charles. 1999. "The Familiar but Curious Economics of Higher Education: An Introduction to a Symposium," *The Journal of Economic Perspectives*, 13: 3-12.

College Board & National Association of Student Financial Aid Administrators, "Financial Aid Professionals at Work in 1999-2000: Results from the Survey of Undergraduate Financial Aid Policies, Practices and Procedures," The College Board, 2002.

Currie, Janet. 2006. "The Take-up of Social Benefits" in Auerbach, Alan, David Card, & John Quigley, eds. *Poverty, the Distribution of Income, and Public Policy*. New York: Russell Sage.

Currie, Janet and Jonathan Gruber. 1996. "Saving Babies: The Efficacy and Cost of Recent Changes in the Medicaid Eligibility of Pregnant Women," *Journal of Political Economy*, 12: 1263–1296.

Cutler, David M., and Jonathan Gruber. 1996. "Does Public Insurance Crowd Out Private Insurance?" *Quarterly Journal of Economics*, 111: 391-403.

Dahl, Gordon, and Lance Lochner. 2008. "The Impact of Family Income on Child Achievement: Evidence from the Earned Income Tax Credit," NBER Working Paper No. w14599.

Dynarski, Susan. 2004. "The New Merit Aid, " in *College Choices: The Economics of Which College, When College, and How to Pay For It,* Caroline M. Hoxby, ed. (Chicago, IL: University of Chicago Press, Chap. 3).

Dynarski, Susan. 2003. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion," *American Economic Review*, 93: 279-288.

Dynarski, Susan. 2000. "Hope for Whom? Financial Aid for the Middle-class and Its Impact On College Attendance," *National Tax Journal*, 53: 629-662.

Ellwood, David, and Thomas Kane. 2000. "Who is Getting a College Education? Family Background and the Growing Gaps in Enrollment," in *Securing the Future: Investing in Children from Birth to College,* Sheldon Danziger and Jane Waldfogel, eds. (New York, NY: Russell Sage Foundation).

Federal Student Aid Handbook, 2007-2008 (Indexed Version), Information for Financial Aid Professionals, U.S. Department of Education. http://www.ifap.ed.gov/fsahandbook/0708FSAIndexedHBook.html

Finkelstein, Amy. 2009. "EZ-Tax: Tax Salience and Tax Rates," *Quarterly Journal of Economics,* 124: 969-1010.

Fullerton, Don, and Gilbert Metcalf. 2002. "Tax Incidence," in *Handbook of Public Economics, Volume 4*, Alan J. Auerbach and Martin Feldstein, eds. (New York: North-Holland Chap. 26, 1787–1872).

Gordon, Nora. 2004. "Do Federal Grants Boost School Spending? Evidence from Title I," *Journal of Public Economics,* 88: 1771-1792.

Gruber, Jonathan. 1997. "The Incidence of Payroll Taxation: Evidence from Chile," *Journal of Labor Economics*, 15: S72–S101.

Hayashi, Fumio. 2000. "Econometrics," (Princeton, NJ: Princeton University Press).

Heller, Dennis. 1997. "Student Price Response in Higher Education: An Update to Leslie and Brinkman," *The Journal of Higher Education,* 68: 624-659.

Hines, James R., and Richard H. Thaler. 1995. "The Flypaper Effect," *The Journal of Economic Perspectives*, 9: 217-226.

Hoxby, Caroline. 1998. "Tax Incentives for Higher Education," in *Tax Policy and the Economy,* James Poterba, ed. (Cambridge, MA: MIT Press).

Hoxby, Caroline M., and IIyana Kuziemko. 2004. "Robin Hood and His Not So Merry Plan," NBER Working Paper No. w10722.

Ikenberry, Stanley. 1997. "Testimony Presented by Stanley O. Ikenberry, President, American Council on Education." (http://waysandmeans.house.gov/legacy/fullcomm/105cong/3-5-97/3-5IKEN.HTM).

Integrated Postsecondary Education Data System Data Center. "IPEDS Finance Data FASB and GASB What is the Difference?" Downloaded June 1, 2009. (http://nces.ed.gov/ipeds/factsheets/fct_ipeds_finance_03072007_1.asp)

Internal Revenue Service, 1998-2003. "Tax Benefits for Education: Publication 970."

James, Estelle. 1990. "Decision Processes and Priorities in Higher Education," in *The Economics of American Universities: Management, Operations, and Fiscal Environment,* Stephen Hoenack, and Eileen and Collins, eds. (Albany, NY: State University of New York Press).

James, Estelle. 1978. "Product Mix and Cost Disaggregation: A Reinterpretation of the Economics of Higher Education," *The Journal of Human Resources,* 13: 157-186.

Lingenfelter, Paul, Hans L'Orange, Susan Winter, and David Wright. 2003. "State Higher Education Finance FY2003," A Project of the State Higher Education Executive Officers.

Kezdi, Gabor. 2004. "Robust Standard Error Estimation in Fixed-Effects Panel Models," *Hungarian Statistical Review*, Special English Volume, 9: 95-116.

Kubik, Jeffrey. 2004. "The Incidence of Personal Income Taxation: Evidence from the Tax Reform Act of 1986," *Journal of Public Economics*, 88: 1567–1588.

Leigh, Alexander. 2004. "Who Benefits from the EITC? Incidence Among Recipients, Coworkers and Firms," SSRN Working Paper No. 473445.

Leslie, Larry, and Paul, Brinkman. 1987. "Student Price Response in Higher Education," *Journal of Higher Education*, 58: 181-204.

Long, Bridget Terry. 2008. "What is Known About the Impact of Financial Aid? Implications for Policy," National Center for Postsecondary Research Working Paper.

Long, Bridget Terry. 2006. "College Tuition Pricing and Federal Student Aid: Is There a Connection?" Testimony before the U.S. Senate Committee on Finance.

Long, Bridget Terry. 2004. "The Impact of Federal Tax Credits for Higher Education," in *College Choices: The Economics of Which College, When College, and How to Pay For It,* Caroline M. Hoxby, ed. (Chicago, IL: University of Chicago Press, Chap. 4).

Long, Bridget Terry. 2003. "The Connection between Government Aid and College Pricing," *Journal of Student Aid*, 33: 1045-1066.

Maag, Elaine and Jeffrey Rohlay. 2007. "Who Benefits from the Hope and Lifetime Learning Credit?" Tax Policy Center, Urban Institute and Brookings Institution.

McPherson, Michael, and Morten Schapiro. 1998. "The Student Aid Game" (Princeton, N.J.: The Princeton University Press).

McPherson, Michael, and Morten Schapiro. 1991. "The Effect of Government Financing on the Behavior of Colleges and Universities," in *Keeping College Affordable*, Brookings Institution.

Mercer, Charmane. 2005. "Federal Pell Grants, Implications for Increasing Maximum Awards," CRS Report for Congress, RL32923.

Mumper, Michael, and Melissa Freeman. 2005. "The Causes and Consequences of Public College Tuition Inflation," in *Higher Education: Handbook of Theory and Research,Volume 20,* John C. Smart ed. (Springer: UK).

Netz, Janet. 1999. "Non-Profits and Price Fixing: The Case of the Ivy League," Purdue University Working Paper.

Riley, Richard. December, 1998. "Letter to Presidents on Hope Scholarship and Lifetime Learning Tax Credits," Posted by the National Association of Student Financial Aid Administrators, ANN-98-16.

Rizzo, Michael, and Ronald Ehrenberg. 2004. "Resident and Non-Resident Tuition at Flagship State Universities," in *College Choices: The Economics of Which College, When College, and How to Pay For It,* Caroline M. Hoxby, ed. (Chicago, IL: University of Chicago Press, Chap. 8).

Rothschild, Michael, and Lawrence White. 1995. "The Analytics of Higher Education and Other Services in Which the Customers are Inputs," *The Journal of Political Economy,* 103: 573-586.

Rothstein, Jessee. 2010. "Is the EITC Equivalent to an NIT? Conditional Cash Transfers and Tax Incidence," *American Economic Journal: Economic Policy*, 2: 177-208.

Scafidi, Benjamin, Ross Rubenstein, Amy Schwartz, and Gary Henry. 2007, "Merit-Based Financial Aid and College Tuition: The Case of the Georgia Hope Scholarships," Mimeo.

Shapiro, Matthew, and Joel Slemrod. 2009. "Did the 2008 Tax Rebate Stimulate Spending?" NBER Working Paper No. 14753.

Shapiro, Matthew, and Joel Slemrod. 2003. "Did the 2001 Tax Rebate Stimulate Spending? Evidence from Taxpayer Surveys," *Tax Policy and the Economy*, 17: 83-109.

Singell, Larry, and Joe Stone. 2007. "For Whom the Pell Tolls: Market Power, Tuition Discrimination, and the Bennett Hypothesis," *Economics of Education Review*, 26: 285-295.

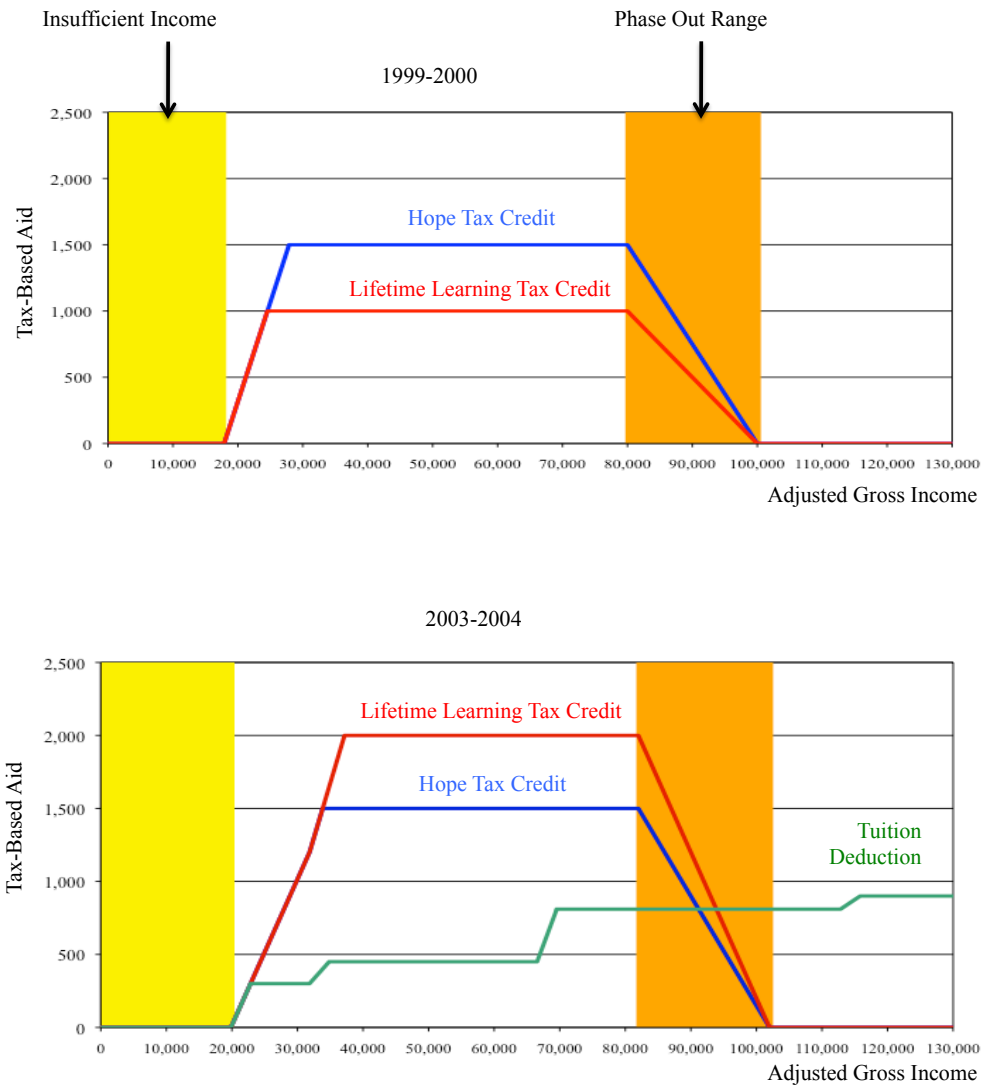
Turner, Nicholas. 2009. "The Effect of Tax-Based Federal Aid on College Enrollment," University of California San Diego Working Paper No. 2009-01.

Turner, Nicholas. 2010. "Why Don't Taxpayers Maximize their Tax-Based Student Aid Awards? Tax Salience, Tax Evasion and Inertia in Selection of Tax-Based Federal Student Aid," Unpublished Doctoral Thesis Chapter. (http://econ.ucsd.edu/~niturner/research.html)

Wellman, Jane, Donna Desrochers, and Coleen Lenihan. 2008. "The Growing Imbalance: Recent Trends in Postsecondary Education Finance," *A Report of the Delta Cost Project, Technical Appendix*.

Winston, Gordon. 1999. "Subsidies, Hierarchy and Peers: The Awkward Economics of Higher Education," *The Journal of Economic Perspectives*, 13: 13-36.

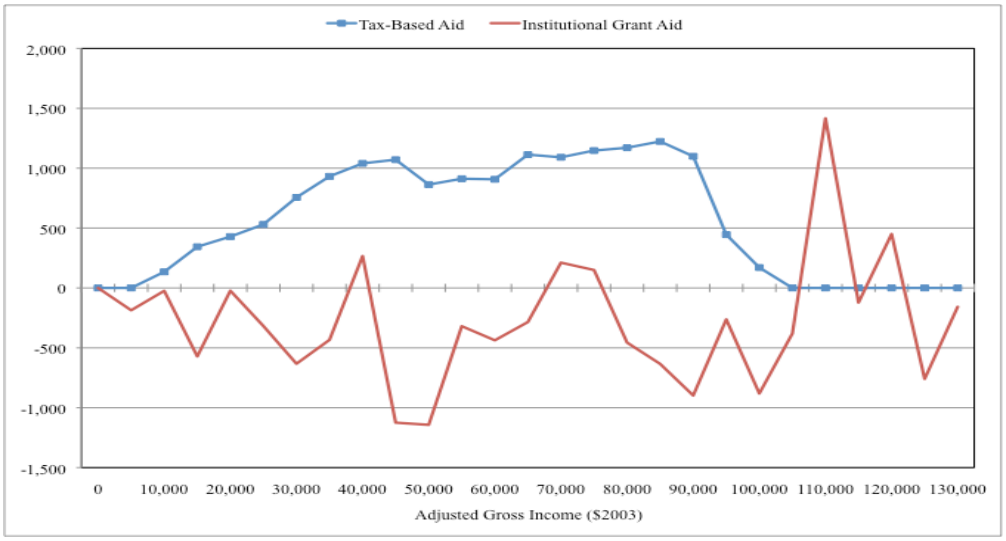
Wooldridge, Jeffrey. 2002. "Econometric Analysis of Cross Section and Panel Data" (Cambridge, MA: The MIT Press).



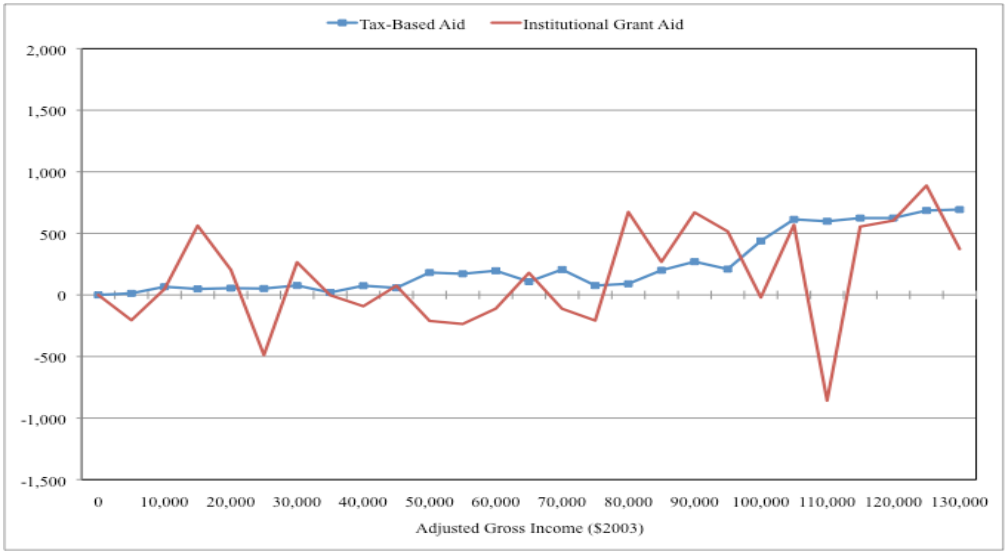
Notes: Tax filing status and family size determine tax liability. Tax liability is estimated using only standard deduction and personal exemptions. See Section I.A for a description of tax-based aid awards.

Figure 2.1
Maximum Tax-Based Aid for Joint-Filing Married Family of Four with one College Student

Changes 1999-2000 and 1995-96 School Years

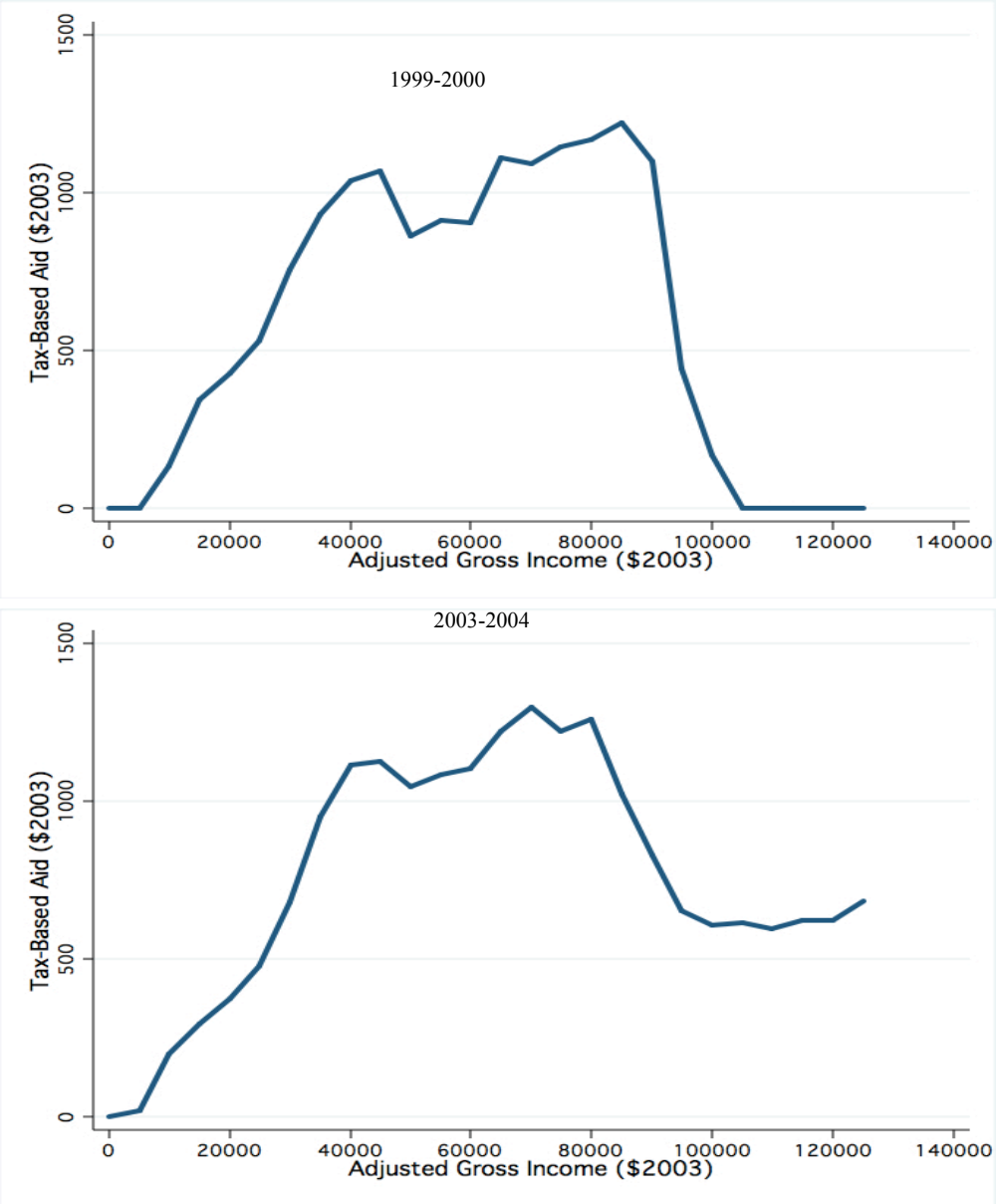


Changes 2003-04 and 1999-2000 School Years



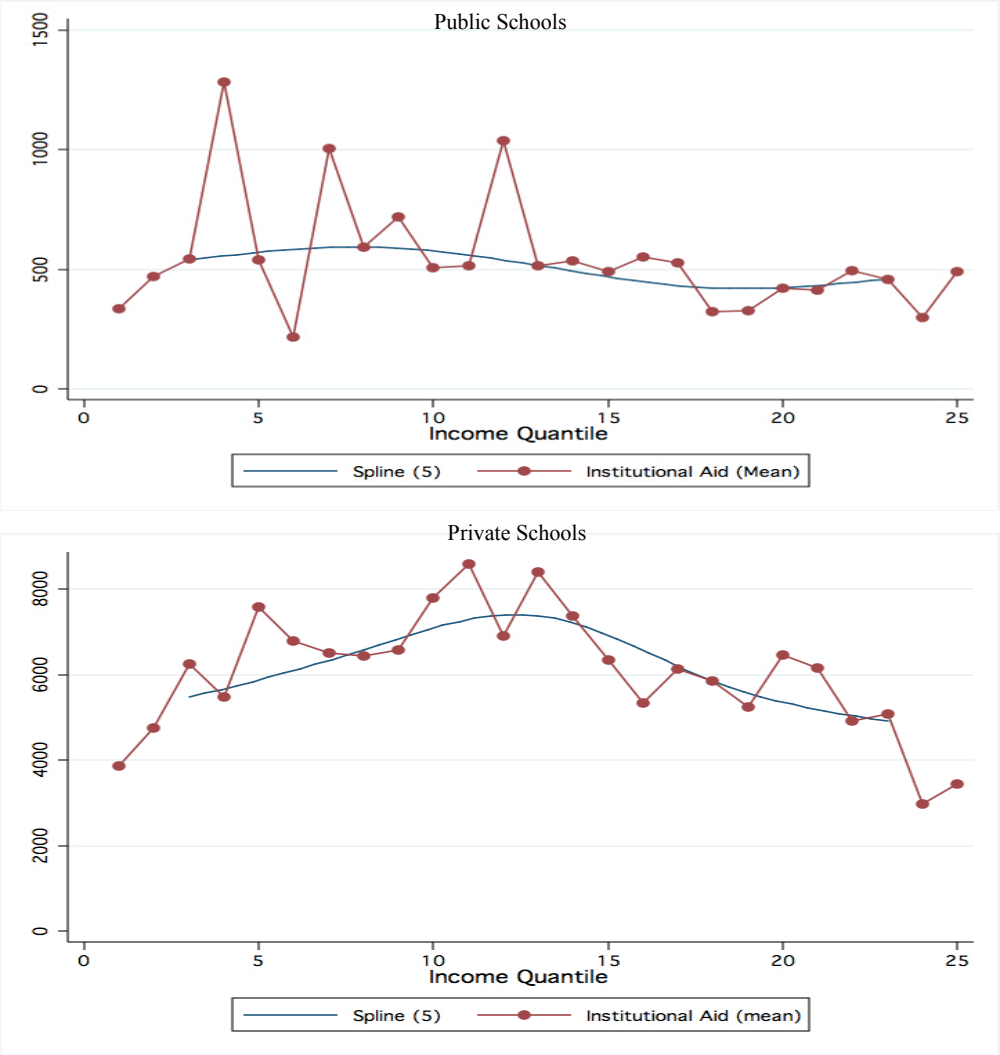
Notes: The value of tax-based aid is calculated from program rules (IRS 970) and income and education spending data from the NPSAS. Institutional aid is from the NPSAS data.. See Section III.A for details.

Figure 2.2
Changes in Tax-Based Aid and Institutional Grant Aid



Notes: The value of tax-based aid is calculated from program rules (IRS 970) and income and education spending data from the NPSAS. See Section III.A for details.

Figure 2.3
Average Tax-Based Aid by Income



Notes: These figures show average institutional aid, and the predicted level of institutional aid using a cubic spline function with five knots, by income quantile. Income quantiles are defined over eligible students (those with positive tax liability and that meet the 2003-04 adjusted gross income limits) for each school type in the 1995-96 school year so that the spline function is fitted to equally sized income groups. This is the same spline function used in Equation (4) that estimates institutional aid effects at the student level.

Figure 2.4
Institutional Aid by Income Quantile (N=25), 1995-96

Table 2.1
Tax-Based Aid Program Details, 1998-2003

	Hope Tax Credit (HTC)	Lifetime Learning Tax Credit (LLTC)	Tution and Fees Deduction (TD)
Expenses Covered	Tuition and required fees at an educational instituion eligible for Department of Education student aid programs. Expenses covered do not include medical expenses, room and board, transportation, insurance, scholarships, and are net of Pell Grants or any other tax free funds used to pay education expenses.		
Adjusted Gross Income Eligibility	1998-2001: Full credits for single (joint) returns less than $40,000 ($80,000). Credits linearly phased out for single (joint) returns until $50,000 ($100,000). 2002: Limits changed to $41,000 ($82,000) and $51,000 ($102,000) for single (joint) returns. 2003: Limits changed to $83,000 and $103,000 for joint returns.		Single filers with less than $65,000. Married couples must file a joint return less than $130,000.
Amount	100 percent of first $1,000 plus 50 percent of the next $1,000 of qualified education spending. Max credit $1,500 per student.	1998-2002: 20 percent of first $5,000. Max credit $1,000 per return. 2003: 20 percent of first $10,000. Max credit $2,000 per return.	100 percent of first $3,000 of qualified education spending per return.
Recipient Eligibility	Only available for two tax years for students in the first two years of postsecondary education. Must be enrolled at least half-time, pursuing a degree or credential and student cannot have a felony drug conviction.	Undergraduate, graduate, vocational education and job skills programs. Available for an indefinite number of years. Lack of a felony drug conviction does not apply.	
Start Date	January 1, 1998	July 1, 1998	Janury 1, 2002
Source: IRS Publication 970 "Tax Benefits for Education" Various Years.			

Table 2.2
Means of Student Aid and Demographic Data by Institutional Control

	Public	Private
Tuition and Student Aid		
Tuition	4,411	18,290
Institutional Aid	691	6,082
Tuition Discount Rate	12.84	30.55
Tax-Based Aid*	498	535
Federal Grant Aid	762	874
Federal Campus-Based Aid	404	1,363
State Aid	531	875
Student and Family Characteristics		
Family Income	58,448	69,196
Dependent Student	83.18	90.27
Age	20.90	20.39
Black	11.80	10.56
Hispanic	7.16	9.79
Female	57.09	56.65
Student Married	3.36	2.55
Number of Students	51,795	22,480
Number of Schools	118	66

Data from the National Postsecondary Student Aid Study (NPSAS) 1995-96, 1999-2000 and 2003-04.
*Tax-Based Aid is calculated as the value of the eligible award. By definition it is equal to zero for the 1995-96 school year. See Section 4.1 details.
All dollar amounts are in 2003 dollars.

Table 2.3

Estimated Tax-Based Aid Effect on Institutional Grant Aid and Student Loans for Eligible Students

	(1)	(2)	(3)	(4)	(5)	(6)
School Type	Public	Public	Public	Private	Private	Private
Estimator	Maximum Spending Instrument	Simulated Spending Instrument	Ordinary Least Squares	Maximum Spending Instrument	Simulated Spending Instrument	Ordinary Least Squares
			Panel A: Institutional Aid			
Tax-Based Aid	-1.158	-1.081	-1.035	-1.449	-1.202	-1.846
	[0.103]	[0.112]	[0.091]	[0.317]	[0.371]	[0.311]
R^2	0.108	0.108	0.109	0.183	0.182	0.189
F (instrument)	6,403	1,188		6,155	887	
			Panel B: Total Loans			
Tax-Based Aid	0.412	0.503	0.598	0.480	0.546	0.694
	[0.100]	[0.138]	[0.090]	[0.162]	[0.194]	[0.154]
R^2	0.140	0.140	0.140	0.108	0.108	0.109
F (instrument)	5,090	1,092		5,436	904	
Sample Size	41,209	41,209	41,209	17,346	17,346	17,346
Number of Schools	118	118	118	66	66	66

The sample is limited to students eligible for tax-based aid.
The estimates use tax-based aid based on maximum spending or on simulated spending as the instrument. See Section 4.2 for details.
The F-test is for the restriction that the excluded instrument is zero.
Control variables include school fixed effects, student characteristics (race, age, gender, dependency status), family income (cubic spline), parent/guardian controls (education and marital status), family controls (size, home Census Division), time (year indicator variables and interactions of year indicators with indicators for institutional selectivity).
Controls are also included for other forms of aid (Pell Grants, federal campus-based aid, state aid) at both the student level and as the school-year average value.
Standard errors, clustered at the school level, are reported in brackets.

Table 2.4
Estimated Tax-Based Aid Effect on Non Need-Based Institutional Grant Aid

	(1)	(2)	(3)	(4)
School Type	Public	Public	Private	Private
Instrument	Maximum Spending	Simulated Spending	Maximum Spending	Simulated Spending
		Panel A: Non Need-Based Institutional Grant Aid		
Tax-Based Aid	-0.736	-0.742	-0.820	-0.756
	[0.084]	[0.088]	[0.249]	[0.257]
R^2	0.080	0.079	0.077	0.077
F (instrument)	6,384	1,184	6,139	919
		Panel B: Need-Based Institutional Grant Aid		
Tax-Based Aid	-0.369	-0.309	-0.601	-0.335
	[0.065]	[0.068]	[0.286]	[0.345]
R^2	0.080	0.080	0.184	0.183
F (instrument)	6,384	1,184	6,139	919
Sample Size	41,053	41,053	17,296	17,296
Number of Schools	118	118	66	66

The sample is limited to students eligible for tax-based aid.
The estimates use tax-based aid based on maximum spending or on simulated spending as the instrument. See Section 4.2 for details.
The F-test is for the restriction that the excluded instrument is zero.
Control variables include school fixed effects, student characteristics (race, age, gender, dependency status), family income (cubic spline), parent/guardian controls (education and marital status), family controls (size, home Census Division), time (year indicator variables and interactions of year indicators with indicators for institutional selectivity).
Controls are also included for other forms of aid (Pell Grants, federal campus-based aid, state aid) at both the student level and as the school-year average value.
Standard errors, clustered at the school level, are reported in brackets.

Table 2.5

Estimated Tax-Based Aid Effect on Institutional Grant Aid by Institutional Selectivity and Student Ability for Eligible Students

	(1)	(2)	(3)	(4)
School Type	Public & Private	Public & Private	Public & Private	Public & Private
Instrument	Maximum Spending	Simulated Spending	Maximum Spending	Simulated Spending
	Panel A: Effects by Institutional Selectivity			
Institutional Selectivity	More Selective	More Selective	Less Selective	Less Selective
Tax-Based Aid	-1.555	-1.192	-0.882	-0.754
	[0.207]	[0.243]	[0.123]	[0.148]
R^2	0.155	0.153	0.079	0.078
F (instrument)	2,251	1,457	6,279	1,112
Sample Size	20,914	20,914	37,641	37,641
Number of Schools	61	61	123	123
	Panel B: Effects by Student Ability			
Student Ability	Above Average	Above Average	Below Average	Below Average
Tax-Based Aid	-1.387	-1.146	-1.149	-0.879
	[0.195]	[0.230]	[0.180]	[0.222]
R^2	0.115	0.115	0.094	0.093
F (instrument)	4,994	1,542	3,696	974
Sample Size	16,605	16,605	16,605	16,605
Number of Schools	175	175	175	175

The sample is limited to students eligible for tax-based aid.
The estimates use tax-based aid based on maximum spending spending as the instrument. See Section 4.2 for details.
The F-test is for the restriction that the excluded instrument is zero.
In Panel A, institutional selectivity is defined by NPSAS categories. Most selective includes "most" and "very" selective, while less selective includes "moderately" and "minimally" selective as well as open admissions. There are very few "open admissions" schools and the results are the same if these schools are removed.
In Panel B, student quality is determined by SAT scores. Above (below) average students are those with a combined math and verbal SAT scores that is above (below) averages scores at their school in a given school year.
Control variables include school fixed effects, student characteristics (race, age, gender, dependency status), family income (cubic spline), parent/guardian controls (education and marital status), family controls (size, home Census Division), time (year indicator variables and interactions of year indicators with indicators for public institutions).
Controls are also included for other forms of aid (Pell Grants, federal campus-based aid, state aid) at both the student level and as the school-year average value.
Standard errors, clustered at the school level, are reported in brackets.

Table 2.6

Robustness Checks of Tax-Based Aid Effect on Institutional Grant Aid for Eligible Students

	(1)	(2)	(3)	(4)
School Type	Public	Public	Private	Private
Instrument	Maximum Spending	Simulated Spending	Spending	Simulated Spending
Panel A: Remove States with Changing Race-Based Aid/Admission Policies				
Tax-Based Aid	-1.107	-1.071	-1.447	-1.307
	[0.117]	[0.126]	[0.354]	[0.380]
Sample Size	34,804	34,804	14,820	14,820
Number of Schools	112	112	66	66
R^2	0.110	0.111	0.191	0.190
F (instrument)	5,023	1,190	6,232	1,023
Panel B: Remove States Introducing Merit-Based Aid				
Tax-Based Aid	-1.195	-1.105	-1.356	-1.099
	[0.117]	[0.130]	[0.278]	[0.335]
Sample Size	34,348	34,348	14,890	14,890
Number of Schools	115	115	66	66
R^2	0.119	0.120	0.182	0.181
F (instrument)	6,073	950	4,768	823
Panel C: Unbalanced Panel of Schools				
Tax-Based Aid	-0.921	-0.839	-1.526	-1.286
	[0.080]	[0.083]	[0.306]	[0.368]
Sample Size	67,086	67,086	33,373	33,373
Number of Schools	198	109	150	150
R^2	0.090	0.091	0.154	0.115
F (instrument)	7,605	2,173	6,491	2,282
Panel D: Remove Parent/Family Controls				
Tax-Based Aid	-1.101	-1.040	-1.526	-1.286
	[0.102]	[0.108]	[0.306]	[0.368]
Sample Size	41,209	41,209	17,346	17,346
Number of Schools	118	118	66	66
R^2	0.084	0.084	0.139	0.138
F (instrument)	6,612	1,421	7,028	850

The sample is limited to students eligible for tax-based aid. The estimates use tax-based aid based on maximum spending or on simulated spending as the instrument. See Section 4.2 for details.
The F-test is for the restriction that the excluded instrument is zero. Standard errors, clustered at the school level, are reported in brackets.
Panel A removes students from 3 states that enacted major changes to race-based admissions/aid policies during the analysis period (CA, MI and TX).
Panel B removes students from 10 states that implemented state level merit-based aid during the analysis period (FL, KY, LA, MD, MI, NV, NM, SC, TN, WV).
Panel C uses an unbalanced panel of schools that appear in the 1995-96 school year and one of the later (1999-2000, 2003-04) school years.
Panel C removes student demographic varaibles and parent/family controls from the primary (balanced panel) sample.
Control variables include school fixed effects, student characteristics (race, age, gender, dependency status), family income (cubic spline), parent/guardian controls (education and marital status), family controls (size, home Census Division), time (year indicator variables and interactions of year indicators with indicators for institutional selectivity).

Table 2.A1
Institutional Aid Redistribution for Ineligible Students

	(1)	(2)	(3)	(4)
School Type	Public	Public	Private	Private
Instrument	Maximum Spending	Simulated Spending	Maximum Spending	Simulated Spending
	Panel A: Flexible Time Controls			
Total Tax-Based Aid	0.147	0.141	1.963	1.751
per Ineligible Student	[0.119]	[0.102]	[1.608]	[1.329]
R^2	0.038	0.033	0.217	0.211
F (instrument)	3.85	6.52	2.03	2.01
Sample Size	10,586	10,586	5,134	5,134
Number of Schools	118	118	66	66
	Panel B: Time Trend Controls			
Total Tax-Based Aid	0.066	0.056	0.737	0.647
per Ineligible Student	[0.067]	[0.044]	[0.415]	[0.348]
R^2	0.031	0.033	0.115	0.137
F (instrument)	11.29	24.61	5.88	5.05
Sample Size	10,586	10,586	5,134	5,134
Number of Schools	118	118	66	66

The sample is limited to students ineligible for tax-based aid.
The instrument uses enrollment from the 1995-96 school year and spending from either the 1995-96 school year (simulated spending), or from program limits (maximum spending). See Section 4.3 for details. The F-test is for the restriction that the excluded instrument is zero.
Panel A includes year indicator variables and interactions of year indicators with indicator variables for institutional selectivity.
Panel B uses a squared time trend.
Control variables include school fixed effects, student characteristics (race, age, gender, dependency status), family income (cubic spline), parent/guardian controls (education and marital status), family controls (size, home Census Division), time (year indicator variables and interactions of year indicators with indicators for institutional selectivity).
Controls are also included for other forms of aid (Pell Grants, federal campus-based aid, state aid) at both the student level and as the school-year average value.
Standard errors, clustered at the school level, are reported in brackets.

Table 2.A2
Estimated Tax-Based Aid Effect on Institutional Grant Aid for All Students

	(1)	(2)	(3)	(4)
School Type	Public	Public	Private	Private
Instrument	Maximum Spending	Simulated Spending	Maximum Spending	Simulated Spending
Tax-Based Aid	-0.894	-0.819	-0.905	-0.685
	[0.083]	[0.089]	[0.235]	[0.278]
R^2	0.081	0.081	0.187	0.186
F (instrument)	8,343	2,003	7,847	1,985
Sample Size	51,795	51,795	22,480	22,480
Number of Schools	118	118	66	66

The sample includes both eligible and ineligible students.
The estimates use tax-based aid based on maximum spending or on simulated spending as the instrument. See Section 4.2 for details.
The F-test is for the restriction that the excluded instrument is zero.
Control variables include school fixed effects, student characteristics (race, age, gender, dependency status), family income (cubic spline), parent/guardian controls (education and marital status), family controls (size, home Census Division), time (year indicator variables and interactions of year indicators with indicators for institutional selectivity).
Controls are also included for other forms of aid (Pell Grants, federal campus-based aid, state aid) at both the student level and as the school-year average value.
Standard errors, clustered at the school level, are reported in brackets.

WHY DON'T TAXPAYERS MAXIMIZE THEIR TAX-BASED STUDENT AID AWARDS? TAX SALIENCE, TAX EVASION AND INERTIA IN SELECTION OF TAX-BASED FEDERAL STUDENT AID

Abstract: Many taxpayers who are eligible for more than one tax-based federal student aid program, and who are limited to one program per student per year, select a program that does not minimize combined federal and state tax liability. In this paper, I analyze a unique panel dataset of individual income tax returns from the U.S. Internal Revenue Service, and offer three explanations for this pattern of tax-based aid selection. First, I show that salience in program value causes some taxpayers to select a program that offers a larger reduction in federal taxes, but a smaller reduction in combined state and federal taxes, compared to the alternate program. Second, I find evidence that many claims are made in order to evade taxes. Third, I show that inertia in program selection causes some taxpayers to default into options offering a smaller reduction in tax liability.

JEL Codes*:* H26, H31, H71

I. Introduction

Standard economic theory posits that agents are fully rational and will perfectly optimize. When selecting a single tax incentive among several options, standard theory predicts that a tax-minimizing agent will select the incentive that offers the largest reduction in tax liability. Given this prediction, use of tax-based federal student aid is puzzling. Taxpayers who are eligible for more than one program, and who are restricted to one program per student each year, often select a program that provides a smaller reduction in tax liability. I find that just over 1 out of 5 taxpayers who are eligible for both the Tuition Deduction and the Lifetime Learning Tax Credit, and who claim one of the programs, do not minimize their combined state and federal tax liability. Figure 3.1 shows the share of claims for each program that is non-minimizing with respect to combined federal and state taxes and the dollar value of the loss from these selections for 2002 to 2007. On average, non-minimizing program selection costs these taxpayers about $75, 18 percent of the value of the tax-minimizing alternative.

In this paper, I consider three explanations for why some taxpayers fail to select the tax minimizing option when deciding between the Lifetime Learning Tax Credit and the Tuition Deduction. First, I consider the possibility that taxpayers myopically optimize with respect to federal taxes, instead of considering combined state and federal tax effects. The impact of tax-based aid on state tax liability is less salient compared to federal tax effects, which may cause taxpayers to omit state tax effects when deciding between the programs. Recent work (Chetty, Looney and Kroft 2009; Finkeltstein 2009) suggests that consumers focus on more salient prices when

making consumption decisions. Results from Chetty (2009), Chetty and Saez (2009) and de Bartolome (1995) imply that informational barriers and saliency effects may cause agents to make non-maximizing decisions. A second explanation for the case of non-minimizing Tuition Deduction use is tax evasion. Unscrupulous taxpayers may have taken advantage of the lack of third party verification of the Tuition Deduction in some years to evade taxes. Previous work finds evidence of tax evasion in the absence of third party verification (Szilagyi 1991; Jeffrey Liebman 2000; Kleven, Knudsen, Kreiner, Pederson and Saez 2010). Tax evasion is an unlikely cause of non-minimizing Lifetime Learning Tax Credit use because this program has always been subject to third party verification. To explore the possibility that tax evasion is responsible for non-minimizing Tuition Deduction use, I exploit the introduction of third party verification for the Tuition Deduction in 2007. The third explanation for non-minimizing program use that I consider is inertia in program selection. Taxpayers may default to previous selections, thus perpetuating non-minimizing decisions. Default behavior may also result in non-minimizing claims if the program that minimized taxes in the prior year is no longer tax minimizing in the current year. Previous studies find evidence of default behavior in employee savings plans (Madrian and Shea 2001; Choi, Laibson, Madrian and Metrick 2003), and personal income tax withholdings (Jones 2010).

I focus on the decision to take the Tuition Deduction versus the Lifetime Learning Tax Credit for several reasons. First, the programs have similar eligibility requirements. A taxpayer selecting the Lifetime Learning Tax Credit can always select the Tuition Deduction and, a taxpayer selecting the Tuition Deduction can

usually opt for the Lifetime Learning Tax Credit. In contrast, the enrollment requirements of these programs are incongruent with the enrollment requirements of other tax-based aid programs such as the Hope Tax Credit. Second, due to data limitations it is difficult to examine if taxpayers selecting the Hope Tax Credit make the optimal program selection.[1]

To explore Lifetime Learning Tax Credit and Tuition Deduction program selection I analyze a panel dataset of individual income tax returns from the Internal Revenue Service (IRS). The analysis sample represents 20.8 million tax returns from 12.8 million unique tax-filing units that claimed either the Tuition Deduction or the Lifetime Learning Tax Credit between 2002 and 2007. I find evidence that the majority of non-minimizing Lifetime Learning Tax Credits are the result of myopic behavior. Nearly 80 percent of Lifetime Learning Tax Credits that do not minimize *combined state and local tax liability* do minimize *federal tax liability*. I find evidence that saliency in federal tax effects drives this pattern. Tax minimizing behavior is more than twice as elastic with respect to federal tax effects than with respect to state tax effects. I also find evidence that many non-minimizing Tuition Deductions are made to evade taxes. The introduction of third party verification in 2007 substantively reduces the number of Tuition Deductions that do not minimize combined state and federal taxes. Consistent with the tax evasion explanation, I find that minimizing

[1] The Hope Tax Credit is available only during the first two years of college, so that a student claiming the Tuition Deduction or the Lifetime Learning Tax Credit may not be eligible for the Hope Tax Credit. As a further complication, the qualified spending limit for the Hope Tax Credit is smaller compared to the other programs and its phase-in rate is larger, so that it is not possible to determine if taxpayers selecting the Hope Tax Credit are minimizing tax liability. See Table 3.1 for full program details, and Section IV for a discussion of valuing alternate programs for students claiming the Tuition Deduction or the Lifetime Learning Tax Credit.

behavior among these taxpayers is less responsive to the gain from minimization. Intuitively, if these claims are made solely to evade taxes, they will be non-responsive to gains realized from switching to the Lifetime Learning Tax Credit, a program that cannot be claimed for evasion. Lastly, I find strong evidence of default behavior among taxpayers. Both minimizing and non-minimizing program selections are carried over into the subsequent year, implying inertia in program selection.

The rest of this paper proceeds as follows. In the next Section, I discuss the basics of tax-based federal student aid. In Section III, I explore how tax saliency, tax evasion and inertia in program selection cause suboptimal program use. In Section IV, I describe the data, detail the econometric technique and results. In Section V, I conclude.

II. Tax-Based Federal Student Aid

A. Program Details

In 1997, the Taxpayers' Relief Act introduced the Hope Tax Credit and the Lifetime Learning Tax Credit. In 2001, The Economic Growth and Tax Relief Reconciliation Act added a third program, the Tuition Deduction. Between the 1998-99 and 2007-08 school years, the three tax-based aid programs cost roughly $61 billion and were claimed by more than 71 million students and their families (Baum, Payea and Steele 2009).

There is substantial overlap in eligibility across the three tax-based aid programs, although taxpayers are limited to one program per student per year. As a result, many taxpayers must choose from among two or three alternatives when

deciding which tax-based aid program to select. Eligibility for tax-based aid depends on both adjusted gross income and enrollment. The tax credits have the same adjusted gross income limits, but different enrollment requirements. The Hope Tax Credit is available only during the first two years of college for full-time students, whereas the Lifetime Learning Tax Credit is available for nearly all postsecondary students. The Tuition Deduction has a more generous adjusted gross income limit compared to the tax credits, and it has a similar enrollment requirement as the Lifetime Learning Tax Credit. As a result, taxpayers that claim a Lifetime Learning Tax credit are always eligible for a Tuition Deduction, and the majority of taxpayers selecting the Tuition Deduction are eligible for the Lifetime Learning Tax Credit.

Tax-based aid targets middle class youths and their families in several ways. First, the adjusted gross income eligibility limits of all three programs focus on the middle class. In the case of the tax-credits, these limits include a phase-out range for higher income returns. Second, tax-based aid requires positive tax liability and positive education spending, which is calculated net of other aid programs. Program values also depend on education spending. The Lifetime Learning Tax Credit is equal to 20 percent of qualified expenses.[2] Between 1998 and 2002, the qualified spending limit was $5,000, and in 2003 it increased to $10,000 (IRS 1998, 2003). The Tuition Deduction allows tax filers to deduct 100 percent of qualified education expenses up to $3,000 in 2002 and 2003 and up to $4,000 beginning in 2004. Table 3.1 provides

[2] In 2005 and 2006 the credit was worth 40 percent of education spending in certain counties in Alabama, Louisiana and Mississippi as part of the Gulf Opportunity Zone program.

details on all three tax-based aid programs, and Figure 3.2 shows the average values of the programs by adjusted gross income.

Applying for tax-based aid is relatively easy once the tax return is prepared. The tax credit programs require only one additional form, IRS 8863. This form is shown in Figure 3.3. Between 2002 and 2005, the Tuition Deduction was claimed as an above-the-line deduction on IRS form 1040 or 1040A. Figure 3.4 highlights the deduction on form 1040. In 2006, Congress did not reauthorize the Tuition Deduction until December, after the tax forms and instructions were printed. As a result, taxpayers had to write in "T" on line 35 of the 1040 under the heading "Domestic production activities deduction" in order to claim a Tuition Deduction. This option did not preclude taxpayers from independently claiming a deduction on line 35. Tax return software providers were aware of the law change and allowed taxpayers to take the Tuition Deduction. However, confusion in the application process in this year may have impacted program use. Beginning in 2007, form 8917, shown in Figure 3.5, was required to claim the Tuition Deduction. Low transaction cost for tax-based aid application, consisting of at most one additional tax form, may be responsible for relatively high take up. Elaine Maag and Jeffrey Rohaly (2007) and the Government Accountability Office (2005) report that program take up of the tax credit programs is 63-74 percent.[3] This take up rate is comparable to that found for other tax-based

[3] Long (2004) provides evidence that many parents/guardians were unaware of tax-based aid and that take-up was less than expected in the first years of the programs. However, the National Postsecondary Student Aid Study data that she uses may not accurately capture program take up. More than one-third of respondents in the 1999-2000 survey replied "don't know" or "not reached/missing" when asked about tax-based aid use.

benefit programs such as the Earned Income Tax Credit, or to Unemployment Insurance and Head Start (Janet Currie 2006).

B. Program Selection: Tax Saliency, Tax Evasion, and Inertia in Program Selection

Standard economic theory predicts that taxpayers eligible for both the Lifetime Learning Tax Credit and the Tuition Deduction will select the program that offers the larger reduction in tax liability. Formally, define τ as the (combined state and federal) marginal rate, L_i as the spending limit and C_i the paperwork cost of claiming each program $i=T,L$ for the Tuition Deduction and Lifetime Learning Tax Credit. Let S be the taxpayer's education spending. A taxpayer eligible for both programs faces the decision between the net value of the Lifetime Learning Tax Credit given in Equation (1) and the net value of the Tuition Deduction in Equation (2).

(1) $$L = 0.2 * \min(S, L_L) - C_L$$

(2) $$T = (\tau) * \min(S, L_T) - C_T$$

For simplicity, assume that education spending is less than the limit of the Tuition Deduction so that $S \leq L_T < L_L$ (this issue is discussed further in the empirical section). A taxpayer will select the Tuition Deduction when the predicted tax benefit (the marginal tax rate minus the phase-in rate of the Lifetime Learning Tax Credit) is larger than the difference in the costs of claiming the programs. This condition is given by Equation (3). Alternatively, a taxpayer will select the Lifetime Learning Tax Credit when the tax benefit is less than the difference in costs so that Equation (3) does not hold.

(3) $(\tau - 0.2) * S > C_T - C_L$

There are several reasons why taxpayers may deviate from the predictions of standard economic theory. First, taxpayers may sequentially optimize with respect to federal and state taxes rather than jointly optimizing with respect to combined state and local tax liability. Greater saliency of federal tax effects may drive this pattern. Federal tax effects are the result of an active choice by taxpayers. In contrast, state tax effects are passively incorporated when states use federal adjusted gross income or federal taxable income as a starting point for calculating state tax liability.[4] As a result, some taxpayers may ignore less salient state tax effects when deciding between the programs.[5] For example, some taxpayers may select the Lifetime Learning Tax Credit because it offers a larger reduction in federal tax liability even though the Tuition Deduction offers a larger reduction in combined state and federal tax liability. Equation (4) gives this condition, where τ_F and τ_S are the federal and state marginal tax rates.

(4) $(\tau_F + \tau_S - 0.2) * S > (0.2 - \tau_F) * S > C_T - C_L$

The first inequality in Equation (4) shows that the combined state and federal tax effects of the Tuition Deduction are larger than the federal tax effects of the Lifetime Learning Tax Credit. The second inequality shows that the Lifetime Learning Tax Credit is tax-minimizing when considering only federal tax effects. Tax preparation

[4] The effective state marginal tax rate depends on the transferability of the Tuition Deduction to state taxable income. The Tuition Deduction lowers state taxable income in 31 states. Two states allow the value of the Lifetime Learning Tax Credit against state tax liability. Table A1 shows features of state individual income tax.

[5] Following Finkelstein (2009) and Chetty Looney and Kroft (2009), I define a value as being more salient when it is more visible, or more apparent to the economic agent. In earlier work, Chetty Looney and Kroft (2007) develop a model of bounded rationality in which some agents rationally ignore less salient prices due to cognition costs.

software may contribute to this type of non-minimizing program selection. I find that 2 out of the 3 most popular software programs myopically optimize with respect to federal tax liability rather than with respect to combined state and federal tax liability (see Appendix for details).

One explanation for non-minimizing Tuition Deduction claims is tax evasion. While it is possible that some minimizing Tuition Deduction claims are made for evasion, non-minimizing claims are especially suspect. These returns claim a program that is both less valuable and less salient, compared to the Lifetime Learning Tax Credit. In either case, some taxpayers may have taken advantage of the lack of third party reporting for the Tuition Deduction in order to evade taxes. The literature finds evidence that third party verification has strong effects on tax compliance (Szilagyi 1991; Jeffrey Liebman 2000; Kleven, Knudsen, Kreiner, Pederson and Saez 2010). For many years, third party verification of education expenses claimed in the Tuition Deduction was not possible. Between 2002 and 2006 the Tuition Deduction was an above-the-line deduction (Figure 3.4). Beginning in 2007, form 8917 (Figure 3.5) was required to claim the Tuition Deduction. Since 1998, schools have been required to file form 1098-T that reports the qualified education expenses of enrolled students. Much like a W-2 issued by an employer, the 1098-T is sent to both the taxpayer and to the IRS. Figure 3.6 shows both portions of the 1098-T form. The combination of form 8917 and form 1098-T allows third party verification of the Tuition Deduction by identifying the qualifying student's social security number. The addition of a similar reporting requirement for dependent children in 1986 resulted in 7 million fewer dependents being claimed the following year (Szilagyi 1991). In contrast to the

Tuition Deduction, the tax credits have always been subject to third party verification. In order to claim a Lifetime Learning Tax Credit or a Hope Tax Credit, taxpayers must file form 8863 (Figure 3.3). As a result, it is less likely that some Lifetime Learning Tax Credit claims are made to evade taxes.

Allingham Sandmo (1972) and Yitzhaki (1987) propose models of tax evasion in which taxpayers tradeoff the financial benefits of evasion with the financial costs imposed if evasion is detected. The marginal benefit of evasion is simply the monetary benefit of reduced taxes. The marginal cost depends on the probability of detection, the increase in the likelihood of detection on all the inframarginal units of evasion as well as the financial penalty imposed as a result of evasion. This characterization leads to several empirical predictions for the case evasion using the Tuition Deduction. First, the model predicts less evasion as the probability of detection increases. Following the introduction of form 8917 that added third party verification, the probability of detection will be very high. Kleven, Knudsen, Kreiner, Pederson and Saez (2010) incorporate third party reporting by assigning a higher probability of detection for verifiable income. In this case, the model predicts virtually no evasion in 2007.[6] A second prediction of the model is that evasion will increase as the generosity of the Tuition Deduction increases, provided that some taxpayers are at a corner solution for evasion. The effect of paid tax preparation on tax evasion using the Tuition Deduction is ambiguous. Klepper, Mazur and Nagin (1991) show that paid preparers increase compliance on verifiable items such as wage

[6] I assume that some agents select the Tuition Deduction as a form of tax evasion and that these taxpayers cannot claim the Lifetime Learning Tax Credit because the actual level of qualified spending is zero.

and salary income, but decrease compliance on items that are more difficult to verify such as business expenses.

An additional explanation for non-minimizing use for both the Tuition Deduction and the Lifetime Learning Tax Credit is inertia in program selection. Taxpayers who claim one of the programs in consecutive years may perpetuate their previous selection. Popular online tax preparation software offers the option of populating certain fields in the tax return, which facilitates inertia in program selection. Default behavior may also cause returns that made tax-minimizing selections previously to make non-minimizing selections in the current tax year. For example, changes to program rules, in education spending or in adjusted gross income may cause the previous optimal selection to be suboptimal in the current year. Madrian and Shea (2001) find strong evidence of default behavior for opting into retirement savings plans. In recent work, Jones (2010) finds evidence of default behavior in personal income tax withholdings that results in overpayment of tax liability

IV. Empirical Method

A. Individual Income Tax Return Edited Panel Data

To empirically examine selection of the Lifetime Learning Tax Credit and Tuition Deduction, I use the Individual Income Tax Return Edited Panel Data from the IRS. The Statistics of Income Division prepares these data to facilitate research on the operation of the federal tax code. The full sample covers 1999 to 2007 and represents 127 million tax returns. I limit the sample in several ways. First, I include only the

years 2002-2007 when the Tuition Deduction is available. Second, I limit the sample to tax returns claiming either the Lifetime Learning Tax Credit or the Tuition Deduction during the analysis period. This removes both dependent taxpayers and married couples that file separate returns, as these returns are ineligible for tax-based aid.[7] (See Table 3.1 for eligibility.) Third, I include only taxpayers who do not alter their tax filing status during the analysis period. For instance, I include only joint returns that file jointly in each year of the panel. As noted in Diamond, Rector and Weber (2007), tracking joint returns over time is complicated when taxpayers initially part of a joint return file separately in subsequent years.[8] The resulting analysis sample includes 11,712 tax returns, composed of 7,246 tax units, where a unit is a given set of taxpayers who do not alter their tax filing status. Using sample weights, the returns represent 20.8 million tax returns and 12.8 million unique tax units. I use sample weights to adjust for sample attrition in the panel (Weber 2005).

Table 3.2 shows characteristics of the tax returns in the sample. The (combined) tax-minimizing program for returns in Columns (1) and (2) is the Tuition Deduction and the (combined) tax-minimizing program for returns in Columns (3) and (4) is the Lifetime Learning Tax Credit. Taxpayers in Columns (1) and (4) make the tax-minimizing selection, whereas taxpayers in Columns (2) and (3) do not. The top panel of Table 3.2 shows the value of the program taken and the value of the alternate

[7] This also removes the small number of returns (3 percent) that claim both programs in a given year. Including these returns complicates the analysis, because the value of each program is calculated per return (rather than per student). Also, among these returns it is not possible to identify those incorrectly claiming both programs for a single student from those that properly claim one program per student.
[8] They suggest two options: one, limiting the sample to returns that do not change tax-filing status; tracking the primary taxpayer. Tracking the primary taxpayer may introduce gender bias because the majority of primary taxpayers are male.

program. By definition, the value of the program taken is larger than the alternate program in Columns (1) and (4) and smaller in Columns (2) and (3). The middle panel of Table 3.2 shows features of the tax return. Among taxpayers for whom the Tuition Deduction is the minimizing choice, those that claim the Tuition Deduction have higher adjusted gross income, and are less likely to use the standard deduction or a paid tax preparer, compared to taxpayers opting for Lifetime Learning Tax Credit claim. However, these differences are not significantly different (at the 5 percent level). Taxpayers for whom the Lifetime Learning Tax Credit is the tax minimizing option are similar across many features of the tax return, including adjusted gross income, number of exemptions, and use of the standard deduction. One exception is the use of paid tax preparation. Taxpayers who select a tax-minimizing Lifetime Learning Tax Credit are more likely to use paid tax preparation, compared to those that select a non-minimizing Tuition Deduction. Yet, the difference in paid tax preparation is not significant (at the 5 percent level). The bottom panel of Table 3.2 shows previous tax-based aid use, suggesting a pattern of inertia in program selection. Among taxpayers who select the tax-minimizing program, 33 percent (Column [1]) and 39 percent (Column [4]) also selected the tax-minimizing program in the prior year. Non-minimizing selection is also influenced by previous use. For taxpayers that make a non-minimizing selection, 20 percent (Column [2]) and 23 percent (Column [3]) also selected the non-minimizing program in the preceding year.

Paid tax preparers do no better than self-prepared returns at minimizing tax liability. Table 3.3 shows the value of the loss from non-minimizing program selection over time for both self-prepared returns and taxpayers using paid tax

preparation. The dollar value of non-minimizing choices is similar across self-prepared and paid-prepared returns. Among tax returns that claim a non-minimizing Lifetime Learning Tax Credit, the majority use paid tax preparation. In 2006 and 2007, paid preparers also made the majority of non-minimizing Tuition Deduction claims. This pattern is consistent with findings in two Government Accountability Office reports that examine tax-based aid use and consider only federal tax effects. The first report (2005) finds that paid preparers make about fifty percent of non-minimizing tax-based aid claims. The second report (2006) surveys 9 paid tax preparers and finds that 6 made a non-minimizing tax-based aid selection.

Table 3.4 presents evidence that salience of federal tax effects pushes taxpayers to select the Lifetime Learning Tax Credit, which is often tax minimizing based on federal tax effects. As shown in Panel A, among returns for which the Tuition Deduction is (combined) tax minimizing, roughly 26 percent claim a Lifetime Learning Tax Credit that is minimizing based solely on federal tax effects. In contrast, in Panel B 85 percent of Lifetime Learning Tax Credits that are minimizing based on federal tax effects are also minimizing based on combined tax effects. This pattern is consistent with myopic optimization with respect to federal tax effects that leads to non-minimizing selections in Panel A and minimizing selections in Panel B. Yet, some taxpayers in Table 3.4 exhibit a level of sophistication that is inconsistent with the tax salience explanation. In Panel A, roughly 11 percent of taxpayers are savvy enough to recognize that the Tuition Deduction is the minimizing program despite the

fact that it is non-minimizing with respect to federal tax effects.[9] In contrast, 7 percent of taxpayers select a Lifetime Learning Tax Credit when the program is non-minimizing with respect to either federal or combined tax effects, implying substantial confusion. In Panel B, 14 percent of taxpayers select a Tuition Deduction when it is non-minimizing with respect to either federal or combined tax effects. These returns may be driven both by taxpayer confusion as well as tax evasion.

Figure 3.7 provides additional evidence that some taxpayers claim a Tuition Deduction in order to evade taxes. The top panel shows program use for the both the Tuition Deduction and the Lifetime Learning Tax Credit between 2002 and 2007. Tuition Deduction use is lower in 2006 and in 2007 relative to prior years. It is not clear to what extent the reduction in 2006 is the result of deterrence of tax evasion. Increased visibility of the deduction in that year may have deterred some evaders, although the drop may also be driven by confusion regarding the changed application process. The continued lower use of the Tuition Deduction in 2007 is consistent with tax evasion deterrence. The introduction of IRS form 8917 in that year makes tax evasion via the Tuition Deduction unlikely. Changes in the number of non-minimizing Tuition Deduction claims drive the reduction in total use, as shown in the bottom panel of Figure 3.7. The average number of non-minimizing claims in 2006 and 2007 is roughly one-half the average number of non-minimizing claims in 2002 to 2005. This drop represents nearly 70 percent of the reduction in total Tuition Deduction use in 2006 and 2007 relative to the average use in prior years as shown in

[9] Note that the state tax treatment of federal tax-based aid does not allow for the parallel result in Panel B, as the Tuition Deduction often lowers state taxes whereas the Lifetime Learning Tax Credit does not. See Table 3.A1.

the top panel of Figure 3.7. In contrast, the average number of non-minimizing Lifetime Learning Tax Credit claims in 2006 and 2007 is just 10 percent lower compared to the average number of non-minimizing claims in 2002-2005. If the reduction in Tuition Deduction use in these years is the result of tax evasion deterrence, this pattern implies that tax evasion is concentrated among non-minimizing Tuition Deductions.

B. Econometric Specification

I estimate the determinants of program selection using Equation (5). For the analysis, I split the sample into returns for which the Tuition Deduction is (combined) tax minimizing, and returns for which the Lifetime Learning Tax Credit is (combined) tax minimizing. Certain effects, such as tax evasion and tax saliency, may impact these groups differently so that pooled estimation will not properly identify these effects. Program rules and characteristics of the taxpayer, including education spending, adjusted gross income, and state tax treatment of federal tax-based student aid determine which program is tax minimizing.

$$(5) \qquad P(TBA^{*}=1)_{it} = \beta_1 Gain_{it} + \beta_2 Preparation_{it} + \beta_3 PastTBA_{it} + \beta_5 X_{it} + \varepsilon_{it}$$

The left-hand side of (5) is the probability that a taxpayer selects the minimizing tax-based aid program ($TBA^{*}=1$), where *i* denotes tax unit and *t* year. The first dependent variable is the gain from optimization. It is measured in $100s so that β_1 estimates the increase in the likelihood of selecting the tax minimizing program per $100 of the combined gain from state and federal taxes. For returns that select the tax-minimizing program, the gain is the difference of the program actually taken, versus

the value of the program that could have been taken. In contrast, for returns that are non-minimizing, the gain is equal to the value of the program that could be claimed less the value of the program taken. I calculate the value of the alternate program using the level of spending implied by the program that is claimed. This step may result in an underestimate of the potential Lifetime Learning Tax Credit for taxpayers selecting the Tuition Deduction because the spending limit for the credit is larger compared to the deduction.[10] In calculating the value of the Tuition Deduction, I multiply the deduction by a taxpayer's marginal tax rate.[11] For some specifications, I include separate variables for state and federal tax effects. Greater responsiveness to federal tax effects is consistent with myopic optimization with respect to more salient federal tax effects.

Figure 3.8 shows the distribution of combined state and federal gains from selecting the tax-minimizing program. The top panel shows gains among returns for which the Tuition Deduction is tax minimizing and the bottom panel shows gains among returns for which the Lifetime Learning Tax Credit is tax minimizing. In both cases, gains among taxpayers who minimize their combined state and federal tax liability are on average larger and the distributions of gains have greater variance,

---

[10] For example, a taxpayer deducting $3,000 of spending under the Tuition Deduction may have more than $3,000 of education spending, and some of this additional spending would be eligible for the Lifetime Learning Tax Credit (see Table 3.1 for spending limits). I also considered an alternate estimate by assuming that taxpayers claiming the maximum Tuition Deduction would be eligible for the maximum Lifetime Learning Tax Credit. Roughly 17 percent of taxpayers claiming the Tuition Deduction claim the maximum value. However, the approach mentioned in the text is a more conservative classification of non-minimizing Lifetime Learning Tax Credit claims.

[11] The federal marginal tax rate is available from the IRS data. Less than 3 percent of returns are moved to a lower tax bracket by the deduction. I use information from "The Book of the States" Published by the Council of State Governments and the Tax Foundation's "Tax Data: State Individual Income Tax Rates 2000-2010" to obtain the state marginal tax rate. See Appendix Table 3.A1 for details on state individual income tax.

compared to taxpayers who do not minimize their tax liability. This implies that tax minimization is more likely among taxpayers who realize a larger gain. Figure 3.9 shows the gain from selecting the tax-minimizing program by adjusted gross income. The gain from selecting a tax-minimizing Tuition Deduction increases in adjusted gross income due to the increase in the marginal tax rate (top panel). The gain from selecting a tax-minimizing Lifetime Learning Tax Credit also increases in adjusted gross income, which may be due to larger education spending by higher income taxpayers. Figure 3.9 also shows the frequency of tax-minimizing claims by adjusted gross income.

The tax preparation variable is an indicator that is equal to one for returns that utilize a paid preparer. To examine how prior tax-based aid use impacts current program selection, I also include the indicator variables for tax-based aid use in the previous year including: Hope Tax Credit, Minimizing Lifetime Learning Tax Credit, Non-minimizing Lifetime Learning Tax Credit, Minimizing Tuition Deduction, Non-minimizing Tuition Deduction (no tax-based aid use in the previous year is the omitted category). In X, I control for features of the tax unit that may also affect program selection. I include flexible income controls (cubic spline with 3 knots) to guard against the possibility identification is driven by a non-linear relationship between income and tax-minimization. (As a robustness check, I use alternate income controls.) Figure 3.9 suggests that the frequency of tax-minimizing claims is non-linear over the income distribution. I also control for the number of dependents (indicators for 1, 2, 3+), number of exemptions for children (indicators for 1, 2, 3+), state of residency (indicator variables), tax form (1040 indicator), and the presence of

itemized deductions (indicator). Unfortunately, there is little demographic information for persons included in the tax unit, although I do control for the gender of the primary taxpayer. To address time effects, I use a squared time trend. I also cluster the standard errors at the tax unit level.

C. Empirical Results

Table 3.5 presents the baseline results using a Linear Probability Model (LPM) to estimate Equation (5).[12] Columns (1) and (2) show the results among the sample when the Tuition Deduction is the tax minimizing program and Columns (3) and (4) show results when the Lifetime Learning Tax Credit is the tax minimizing program. In both samples, taxpayers are responsive to the gain from optimization. Taxpayers in Columns (1) and (3) are between 1.4 and 4.9 percentage points more likely to increase optimal behavior in response to a $100 increase in the combined gain from optimization. The lower panel of Table 3.5 presents the corresponding elasticities of these responses. The relatively smaller elasticity in Column (3) is consistent with tax evasion. Taxpayers in Column (3) include those who select a non-minimizing Tuition Deduction. To the extent that these taxpayers claim the Tuition Deduction to evade taxes and are unable to claim a legitimate Lifetime Learning Tax Credit, they should be non-responsive to the gain from switching to the tax-minimizing program. In contrast, taxpayers in Column (1) include those claiming a minimizing Tuition Deduction or a non-minimizing Lifetime Learning Tax Credit. In either case, tax

[12] I plan to use a probit model in subsequent drafts, however I ran into computing constraints. I currently rely on a representative of the IRS to run my analysis code. Once I begin work at the Treasury Department I have access to the data.

evasion is less likely to motivate program selection so that these taxpayers should be more responsive to the gain from tax minimization.

Paid tax preparers decrease the likelihood of tax-minimizing selections in Column (1) but increase the probability of tax-minimizing selections in Column (3). This may be evidence that paid preparers favor the Lifetime Learning Tax Credit over the Tuition Deduction. If non minimizing Tuition Deductions are taken for tax evasion, this finding also suggests that paid tax preparation increases tax compliance. The lower panel of Table 3.5 shows that previous tax-based aid use has a large effect on current program selection. Previous use is measured relative to taxpayers who did not use tax-based aid in the prior year. Both tax minimizing and non-minimizing behavior is likely to be repeated, suggesting strong inertia in program selection. In Column (1), taxpayers who select a Tuition Deduction in the prior period are more likely to select the Tuition Deduction and taxpayers that select the Lifetime Learning Tax Credit are less likely to select the Tuition Deduction. A similar pattern holds in Column (3). The persistence in program selection holds regardless of whether the choice in the prior period was tax minimizing. The transition from the Hope Tax Credit, available only for the first two years of college, into the Tuition Deduction or into the Lifetime Learning Tax Credit also shows evidence of default behavior. Taxpayers who claimed the Hope Tax Credit in the preceding year are more likely to select the Lifetime Learning Tax Credit, both when it is non-minimizing (Column [1]) and when it is minimizing (Column [3]). These taxpayers are likely to view the Lifetime Learning Tax Credit as the default option because it is claimed on the same tax form as the Hope Tax Credit (Figure 3.3).

Differential responsiveness to state and federal gains from tax minimization suggests that taxpayers have greater sensitivity to more salient federal tax effects. In both Columns (2) and (4), minimizing behavior is more elastic in response to federal taxes, as compared state taxes. This finding is consistent with Chetty, Looney and Kroft (2009) who suggest that the after tax price for consumer goods is less salient compared to the net of tax price and find that the price elasticity of demand is larger than the tax elasticity of demand. However, the differences in state and federal elasticities in Table 3.5 may be the result of heterogeneity in the sign of federal and state tax effects. While the combined gain from state and federal tax effects is positive (by definition) in Columns (2) and (4), state and federal tax effects can be positive or negative. In theory, there are three ways that a given program is tax minimizing. One, the federal and state gains are both positive. Two, the federal gain is positive and the state gain is negative. Three, the federal gain is negative and the state gain is positive. However, state tax treatment of the Tuition Deduction and the Lifetime Learning Tax Credit effectively rules out one of these cases for each Column. For Column (2), taxpayers are unlikely to have negative state tax effects, because the Tuition Deduction largely applies to state tax effects whereas the Lifetime Learning Tax Credit does not. Likewise, for Column (4), taxpayers are unlikely to have negative federal tax effects. If taxpayers rationally ignore negative tax effects, knowing that the combined gain is positive, then the difference in the elasticities of tax minimizing behavior with respect to state and federal tax effects may be driven by heterogeneity in the sign of state and federal tax effects. The smaller state elasticity in Column (4), where some taxpayers have negative state tax effects, is consistent with this

interpretation. However, this pattern does not hold for Column (2), where the elasticity of tax minimization with respect to federal tax effects is larger compared to the elasticity with respect to state tax effects.

To further address heterogeneity of state and federal tax effects, I limit the sample to taxpayers for whom the effects are of the same sign. Table 3.6 shows the results of the analysis on these samples in Columns (1) and (3). In both cases, the response to a $100 gain from federal taxes is significantly larger than a $100 gain from state taxes. While the point estimate of state tax effects is negative in Column (1), it is not significantly different than zero. The lower panel of Table 3.6 gives the implied elasticities from these estimates. In each case, taxpayers are responsive to federal tax effects and virtually non-responsive to state tax effects. Greater responsiveness to federal tax effects implies that taxpayers focus on the federal gain when making program selection decisions. In contrast, standard theory predicts equal responsiveness to state and federal tax effects. Intuitively, standard characterizations of behavior predict that the source of the gain should not matter.

In Table 3.6, salience of federal tax effects always leads to the optimal decision for taxpayers in Column (1). Accordingly, the average dependent variable in Column (1) of Table 3.6 is larger than the dependent variable of Table (5) where salience effects may not lead to the tax minimizing selection. Similarly, tax-minimizing selections among taxpayers for whom the Tuition Deduction is minimizing and for whom federal tax effects are negative is 0.300 (not shown in Table 3.6). Attributing the difference in tax-minimizing behavior between this group and taxpayers in Column (1) of Table 3.6 to tax salience effects implies that focusing on federal tax

effects reduces tax-minimizing selections by 58.6 percentage points (66 percent) relative to the case when salience effects push taxpayers towards the tax-minimizing selection. Similarly, if Column (1) defines a baseline rate of non-minimizing behavior *that is the result of factors other than tax evasion (or tax salience)*, then the difference in the rate of minimization across Column (1) and (3) of Table 3.6 may be attributed to tax evasion. Comparing the rate at which taxpayers make tax-minimizing selections in Table 3.6 suggests that tax evasion results in a 7.1 percentage point decrease in tax-minimization, or an 8 percent reduction relative to Column (1) where tax evasion effects should not impact selection.

To address concerns that tax evasion deterrence alters the composition of the sample by disproportionately removing non tax-minimizing Tuition Deduction claims, I perform the analysis after restricting the sample to 2002-2005. As Figure 3.7 shows, the pattern of Tuition Deduction use is relatively stable over this period, which is prior to policy changes that may have deterred use of the Tuition Deduction for tax evasion. These results appear in Columns (2) and (4) of Table 3.6. The implied elasticities from these samples are similar to those of the full sample reported in Columns (2) and (4) of Table 3.5. In particular, tax minimization is more elastic with respect to federal tax effects than to state tax effects in Columns (2) and (4) of Table 3.6, consistent with tax saliency effects. The implied elasticity in Column (2) is also larger compared to Column (4), consistent with use of non-minimizing Tuition Deductions as tax evasion. I find further evidence of tax evasion comparing the federal elasticity in Column (4) of Table 3.6 to the corresponding elasticity from the years 2006 and 2007 (not shown). The elasticity for these later years is larger compared the earlier period, although the

differences in the marginal effects are not significantly different. Intuitively, if there are relatively fewer evasion claims in the later years, then taxpayers should be more responsive to the gain from tax minimization.

V. Conclusion

The federal government offers an array of tax-based federal student aid programs to help students and families finance postsecondary education. Taxpayers are often eligible for more than one program, but are limited to one program per student per year. Given the choice among several tax-based aid programs, many taxpayers select a program that does not offer the largest reduction in combined state and federal taxes. I find that just over 1 out of 5 taxpayers who are eligible for both the Tuition Deduction and the Lifetime Learning Tax Credit, and who claim one of the programs, do not select the program that minimizes combined state and federal tax liability. Using sample weights to make the analysis sample nationally representative, this rate of non-minimization translates into an aggregate loss of roughly $312 million spread over 4.2 million tax returns between 2002 and 2007.

Analyzing a unique panel dataset of individual income tax returns from the United States, I provide three explanations for suboptimal tax-based aid program selection. First, I show that saliency of federal tax effects causes some taxpayers to myopically optimize with respect to federal tax effects, rather than with respect to combined state and federal tax effects. This result is consistent with Chetty Looney and Kroft (2009) and Finkelstein (2009) showing that consumer demand depends on price saliency, and by recent work by Jones (2010) who finds that adjustments to

personal income tax withholdings depend on the saliency of income changes. Second, I find evidence that many non tax-minimizing claims are made in order to evade taxes. The absence of third party reporting for the Tuition Deduction in some years allowed taxpayers to claim fraudulent deductions with a relatively lower probability of detection compared to the third-party verified Lifetime Learning Tax Credit. Previous work finds evidence of greater evasion in the absence of third party verification (Szilagyi 1991; Jeffrey Liebman 2000; Kleven, Knudsen, Kreiner, Pederson and Saez 2010). Third, I show that inertia in program selection causes some taxpayers to claim programs that are not tax minimizing. Default behavior not only exacerbates initial non-minimizing selections, it also causes some taxpayers to make non-minimizing selections in the current period when their prior choice is no longer tax minimizing. Such default behavior is consistent with findings by Madrian and Shea (2001) and Choi, Laibson, Madrian and Metrick (2003) in the context of employee savings plans and also with Jones (2010) in the context of personal income tax withholdings.

These findings have several important policy implications. First, the results suggest that offering a complex menu of overlapping programs diminishes the likelihood that beneficiaries realize the maximum statutory benefit. This implication is consistent with previous work on tax incentives for higher education (Davis 2002; Dynarski 2004; Dynarski and Scott-Clayton 2006; Bettinger, Long Oreopolus and Sanbanmatsu 2009) and also with work on complexity and uncertainty of other features of the tax code such as the Earned Income Tax Credit (Chetty 2009; Chetty and Saez 2009) or tax rates (de Bartolome 1995). Second, the strong evidence of default behavior suggests that inert taxpayers are likely to perpetuate other tax

decisions, such taking the standard deduction, or contributing to tax check off funds such as the Presidential campaign fund. This suggests that take-up rates of new programs that overlap with existing programs will be less than complete, even when the new programs offer relatively larger gains. Third, the greater responsiveness to more salient tax effects suggests policymakers can trade off program salience and program value in order to achieve the desired behavioral response. This implication is consistent with previous work on price saliency (Chetty, Loney and Kroft 2009; Finkelstein 2009) and tax saliency (Jones 2010).

Acknowledgements: I am grateful to Kevin Pierce of the Internal Revenue Service for his tireless efforts that aided in the data analysis portion of the paper, and for his constant willingness meet my analysis requests. I also thank Mike Webber of the Internal Revenue Service for his help in accessing the data. I thank Julie Cullen, Nora Gordon and Roger Gordon for their helpful suggestions.

This paper, in part, is being prepared for submission to the Journal of Public Economics.

Appendix: *Program Selection by Online Tax Preparation Software and Paid Tax Preparers*

To investigate how popular tax preparation software handles the decision between the Lifetime Learning Tax Credit and the Tuition Deduction, I prepared 2009 tax returns using free online versions of three popular tax programs: Turbo Tax, H&R Block Tax at Home and Tax ACT. These are the three highest rated tax software options according to the "Top 10 Reviews" website (http://tax-software-review.toptenreviews.com/). I used two different scenarios to explore if the software makes the tax-minimizing decision with respect to federal tax liability, or the combined state and federal tax liability. For each program, I filled in all information on the return and checked for errors using review features of the programs.

In the first scenario, I prepared a married joint-filing return from a state with no personal income tax (New Hampshire). I selected taxpayer characteristics so that the tax-minimizing selection was the Tuition Deduction. I gave the return wage earnings of $90,000, claimed only 2 personal exemptions ($7,300) and took the standard deduction ($11,400). I added no additional earnings, so that federal taxable income was $71,300. This placed the return in the 25 percent tax bracket (lower bound is $67,900). I also assigned the return $2,000 of education spending. Under this scenario, the value of the Lifetime Learning Tax Credit is $400 (0.2*$2,000) and the value of the Tuition Deduction is $500 (0.25*$2,000). One out of three programs made the tax-minimizing selection of the Lifetime Learning Tax Credit.[13]

[13] The software making the suboptimal choice offered the following advice (name of program is replaced with PROGRAM): Which education deduction or credit should I claim? That's easy. PROGRAM handles it all for you. After you answer the Interview questions about your income and

In the second scenario, I prepared a married joint-filing return so that tax minimization with respect to federal tax liability would result in the Lifetime Learning Tax Credit, and tax minimization with respect to combined state and federal taxes would result in the Tuition Deduction. I gave the return wage earnings of $76,000, claimed only 2 personal exemptions ($7,300) and took the standard deduction ($11,400). I added no additional earnings, so that federal taxable income was $57,300. This placed the return in the 15 percent federal tax bracket (lower bound is $16,700). I also assigned the return $2,000 of education spending. I gave the return residency in Idaho. Idaho taxable income was $57,300. This placed the return in the 8 percent state tax bracket. Under this scenario, the value of the Lifetime Learning Tax Credit is $400 (0.2*$2,000). With respect to only federal tax effects, the value of the Tuition Deduction is $300 (0.15*$2,000). When state tax effects are included the value of the deduction is $460 ((0.15+0.08)*$2,000). Two programs made the non tax-minimizing decision to take the Lifetime Learning Tax Credit. One of these programs also made the suboptimal decision in the absence of state tax effects. For the second program, the help feature explicitly states that the program maximizes the *federal* tax benefit of tax-based aid and suggests that the taxpayer may achieve a better result by changing from the default selection.[14]

---

education expenses, the PROGRAM Education Optimizer calculates the education credits and deduction for you and selects the combination that saves you the most money.

[14] The program's help feature offered the following advice: "An effort is made to maximize the federal tax benefit for the qualifying expenses using the tuition deduction; the lifetime learning credit; and, if the student qualifies, the American opportunity credit or the Hope credit. Later, if you desire, you may try alternative tax benefit treatments for a student other than the automatically selected one. In some cases this will enable you to maximize the total tax benefit between the federal return and a state return."

I also spoke with several paid tax preparers, all of whom use professional level tax software from Drake and UltraTax to prepare returns. The cost of professional tax preparation software is substantially larger than the three consumer level tax programs mentioned above. (Cost of the professional tax packages ranged from $1,100-$4,000 compared to roughly $50 for the three consumer programs.) All of the paid preparers were confident that their programs properly incorporated state tax effects, leading to the tax-minimizing selection. None of the preparers were surprised to hear that popular online tax software resulted in non-minimizing selection. In particular, one preparer had encountered non-minimizing program selection by one of his clients. This preparer reviewed a tax return prepared by one of the three programs mentioned earlier and found that the taxpayer had failed to select the most valuable program. Correcting this mistake in both the current tax year and in previous tax years by filing amended returns resulted in a $6,500 reduction in taxes for the taxpayer.

References

Allingham, Michael G., and Agnar Sandmo. 1972. "Income Tax Evasion: A Theoretical Analysis," *Journal of Public Economics*, 323-338.

Baum, Sandy, Kathleen Payea, and Patricia Steel. 2009. "Trends in Student Aid," The College Board.

Chetty, Raj. 2009. "Do Tax Filers Bunch at Kink Points? Evidence, Elasticity Estimation and Salience Effects." elsa.berkeley.edu/~saez/bunch.pdf

Chetty, Raj, Adam Looney, and Kory Kroft. 2007. "Salience and Taxation: Theory and Evidence," *National Bureau of Economic Research,* Working Paper No. 13330.

Chetty, Raj, Adam Looney, and Kory Kroft. 2009. "Salience and Taxation: Theory and Evidence," *The American Economic Review,* 99(4): 1145-1178.

Chetty, Raj, and Emmanuel Saez. 2009. "Teaching the Tax Code: Earnings Responses to an Experiment with EITC Recipients," *National Bureau of Economic Research,* Working Paper No. 14836.

Choi, James, David Laibson, Bridgitte Madrian, and Andrew Metrick. 2003. "Optimal Defaults," *The American Economic Review,* 99, 1145-1177.

Davis, Albert J. 2002. "Choice Complexity in Tax Benefits for Higher Education," *National Tax Journal*, 55(3): 509-534.

Diamond, John W., Ralph A. Rector, and Michael Weber. 2007. "Using an Individual Income Tax Panel File to Measure Changes in Marginal Tax Rates: Opportunities and Limitations," *Internal Revenue Service Statistics of Income Paper Series.*

de Bartolome, Charles A. M. 1995. "Which Tax Rate Do People Use: Average or Marginal?" *Journal of Public Economics*, 56(1): 79-96.

Dynarski, Susan. 2004. "Tax Policy and Education Policy: Collision or Coordination? A Case Study of the 529 Coverdell Savings Incentives," in *Tax Policy and the Economy Volume 18,* James Poterba, ed. (Cambridge, MA: The MIT Press, Chap. 3).

Dynarski, Susan, and Judith Scott-Clayton. 2006. "The Cost of Complexity in Federal Student Aid: Lessons from Optimal Tax Theory and Behavioral Economics," *National Tax Journal*, 59(3): 319-356.

Finkelstein, Amy. 2009. "E-Z Tax: Tax Salience and Tax Rates," *Quarterly Journal of Economics,* 124(3): 969-1010.

Jones, Damon. 2010. "Inertia and Overwithholding: Explaining the Prevalence of Income Tax Refunds," *National Bureau of Economic Research,* Working Paper No. 15963.

Klepper, Steven, Mark Mazur, and Daniel Nagin. 1991. "Expert Intermediaries and Legal Compliance: The Case of Tax Preparers," *Journal of Law and Economics*, 5(1): 1-24.

Kleven, Henrik J., Martin B. Knudsen, Claus T. Kreiner, Soren Pederson, and Emmanuel Saez. 2010. "Unwilling or Unable to Cheat? Evidence from a Randomized Tax Audit Experiment in Denmark," *National Bureau of Economic Research,* Working Paper No. 15769.

Liebman, Jeffrey. 2000. "Who Are the Ineligible EITC Recipients?" *National Tax Journal*, 53(4): 1165-1186.

Long, Bridget Terry. 2004. "The Impact of Federal Tax Credits for Higher Education," in *College Choices: The Economics of Which College, When College, and How to Pay For It,* Caroline M. Hoxby, ed. (Chicago, IL: University of Chicago Press, Chap. 4).

Maag, Elaine and Jeffrey Rohlay. 2007. "Who Benefits from the Hope and Lifetime Learning Credit?" Tax Policy Center, Urban Institute and Brookings Institution.

Madrian, Brigitte C., and Dennis F. Shea. 2001. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *Quarterly Journal of Economics*, 116(4): 1149–87.

Reinhardt, Rob. 2009. "Individual Income Tax Provisions in the States," Wisconsin Legislative Fiscal Bureau, Informational Paper 4.

Szilagyi, John. 1991. "Where Some of the Dependent Went," *1990 Research Conference Report: How Do We Affect Taxpayer Behavior*, Internal Revenue Service, 162-163.

United States Government Accountability Office. 2005. "Students and Postsecondary Tax Preferences," *Report to the Committee on Finance, U.S. Senate,* GAO-05-684.

United States Government Accountability Office. 2006. "Paid Tax Return Preparers," *Testimony before the Committee on Finance, U.S. Senate,* GAO-06-563T.

Weber, Michael. 2005. "The Tax Year 1999-2003 Individual Income Tax Return Edited Panel: A First Look at the Data," *Proceedings of the American Statistical Association, Social Statistics Section.*

Yitzhaki, Shlomo. 1987. "On the Excess Burden of Tax Evasion," *Public Finance Quarterly*, 15(56): 44-48.

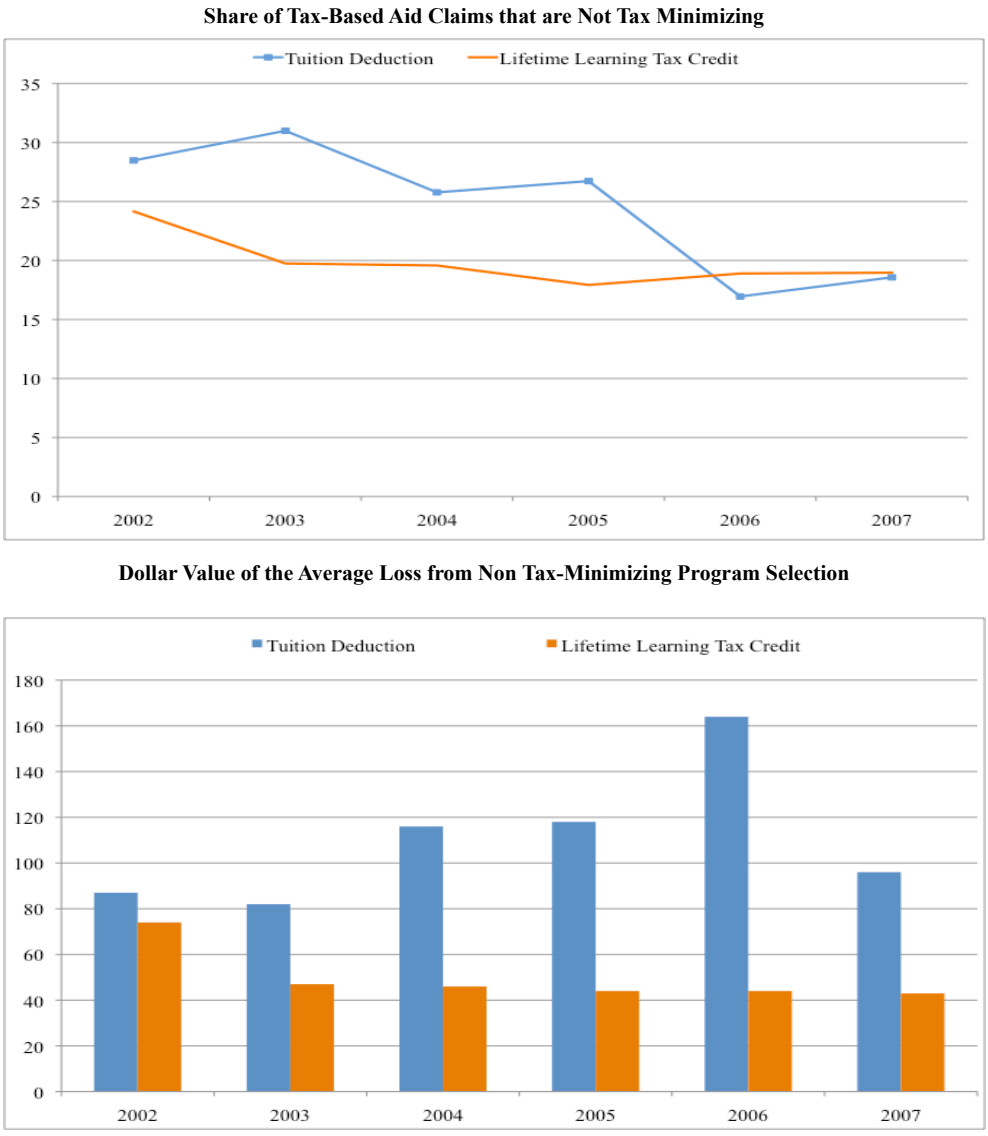
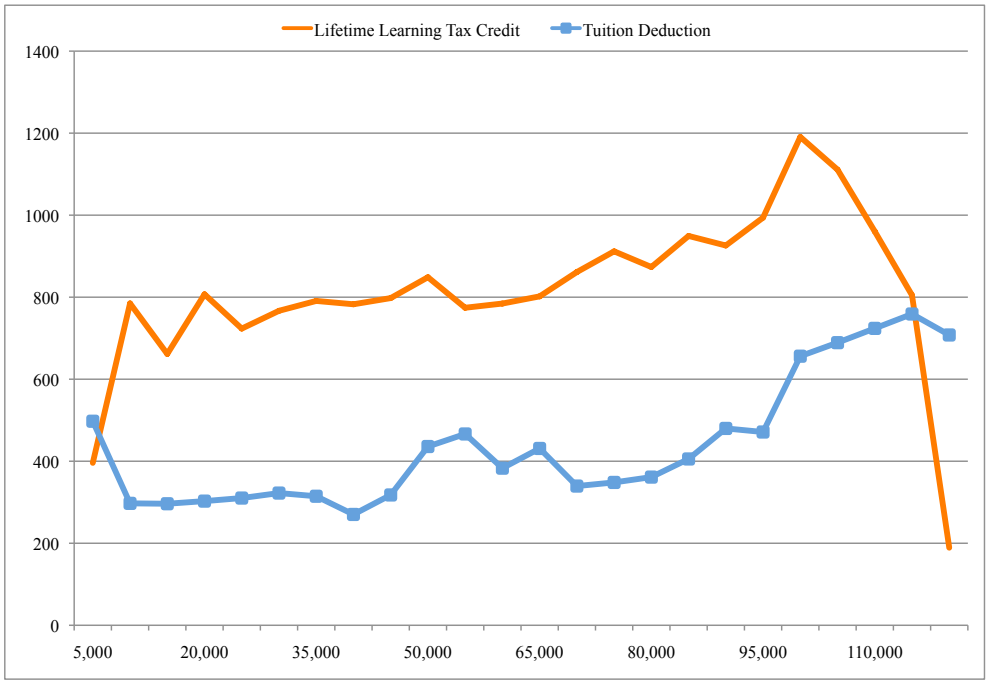
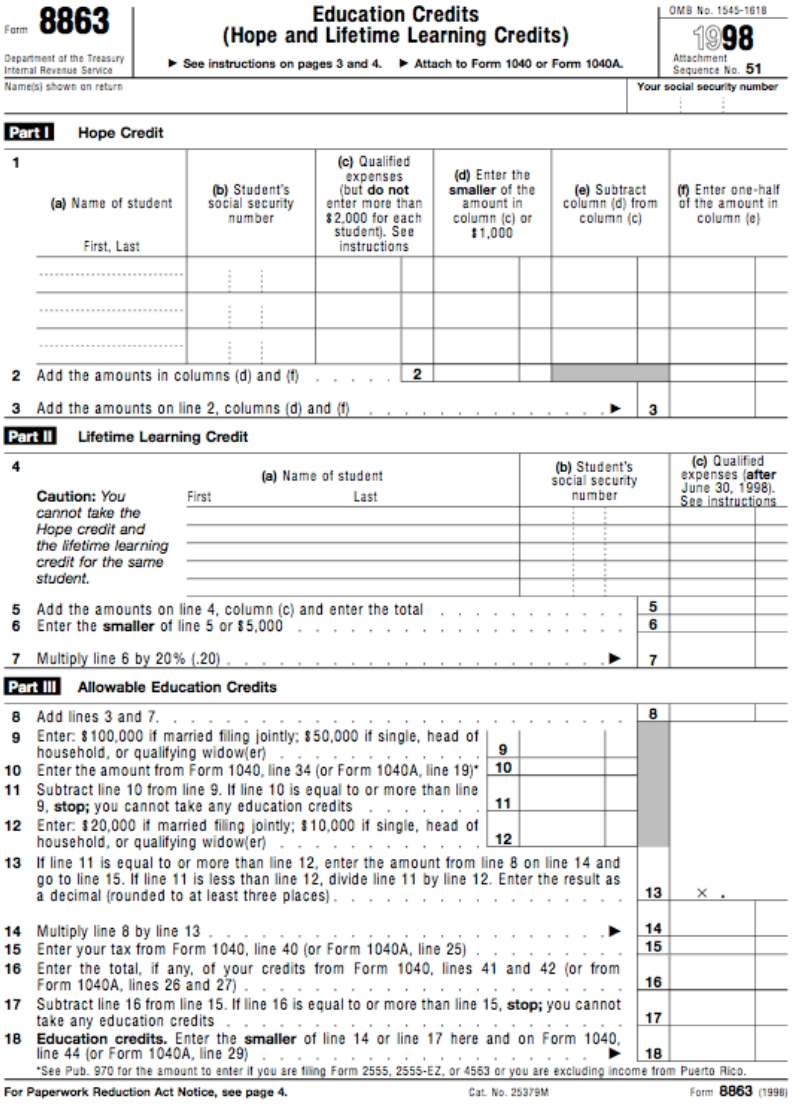


Figure 3.1
Share of Non Tax Maximizing Tax-Based Aid Claims and Dollar Value of the Average Loss from Minimization



Note: All dollar values are in 2007 dollars.

Figure 3.2
Average Value of Lifetime Learning Tax Credit and Tuition Deduction, by Adjusted Gross Income



Form **8863**

Department of the Treasury
Internal Revenue Service

Education Credits
(Hope and Lifetime Learning Credits)

► See instructions on pages 3 and 4. ► Attach to Form 1040 or Form 1040A.

OMB No. 1545-1618

1998

Attachment Sequence No. **51**

Name(s) shown on return

Your social security number

Part I **Hope Credit**

1	(a) Name of student First, Last	(b) Student's social security number	(c) Qualified expenses (but **do not** enter more than $2,000 for each student). See instructions	(d) Enter the **smaller** of the amount in column (c) or $1,000	(e) Subtract column (d) from column (c)	(f) Enter one-half of the amount in column (e)

2 Add the amounts in columns (d) and (f) 2

3 Add the amounts on line 2, columns (d) and (f) . . . . . ► 3

Part II **Lifetime Learning Credit**

4	(a) Name of student First Last	(b) Student's social security number	(c) Qualified expenses (**after** June 30, 1998). See instructions
Caution: *You cannot take the Hope credit and the lifetime learning credit for the same student.*			

5 Add the amounts on line 4, column (c) and enter the total 5

6 Enter the **smaller** of line 5 or $5,000 6

7 Multiply line 6 by 20% (.20) . . . . . ► 7

Part III **Allowable Education Credits**

8 Add lines 3 and 7. 8

9 Enter: $100,000 if married filing jointly; $50,000 if single, head of household, or qualifying widow(er) 9

10 Enter the amount from Form 1040, line 34 (or Form 1040A, line 19)* 10

11 Subtract line 10 from line 9. If line 10 is equal to or more than line 9, **stop;** you cannot take any education credits 11

12 Enter: $20,000 if married filing jointly; $10,000 if single, head of household, or qualifying widow(er) 12

13 If line 11 is equal to or more than line 12, enter the amount from line 8 on line 14 and go to line 15. If line 11 is less than line 12, divide line 11 by line 12. Enter the result as a decimal (rounded to at least three places) . . . . . 13 × .

14 Multiply line 8 by line 13 . . . . . ► 14

15 Enter your tax from Form 1040, line 40 (or Form 1040A, line 25) 15

16 Enter the total, if any, of your credits from Form 1040, lines 41 and 42 (or from Form 1040A, lines 26 and 27) 16

17 Subtract line 16 from line 15. If line 16 is equal to or more than line 15, **stop;** you cannot take any education credits 17

18 **Education credits.** Enter the **smaller** of line 14 or line 17 here and on Form 1040, line 44 (or Form 1040A, line 29) . . . . . ► 18

*See Pub. 970 for the amount to enter if you are filing Form 2555, 2555-EZ, or 4563 or you are excluding income from Puerto Rico.

For Paperwork Reduction Act Notice, see page 4. Cat. No. 25379M Form **8863** (1998)

Figure 3.3
Internal Revenue Service Form 8863, Education Credits, 1998

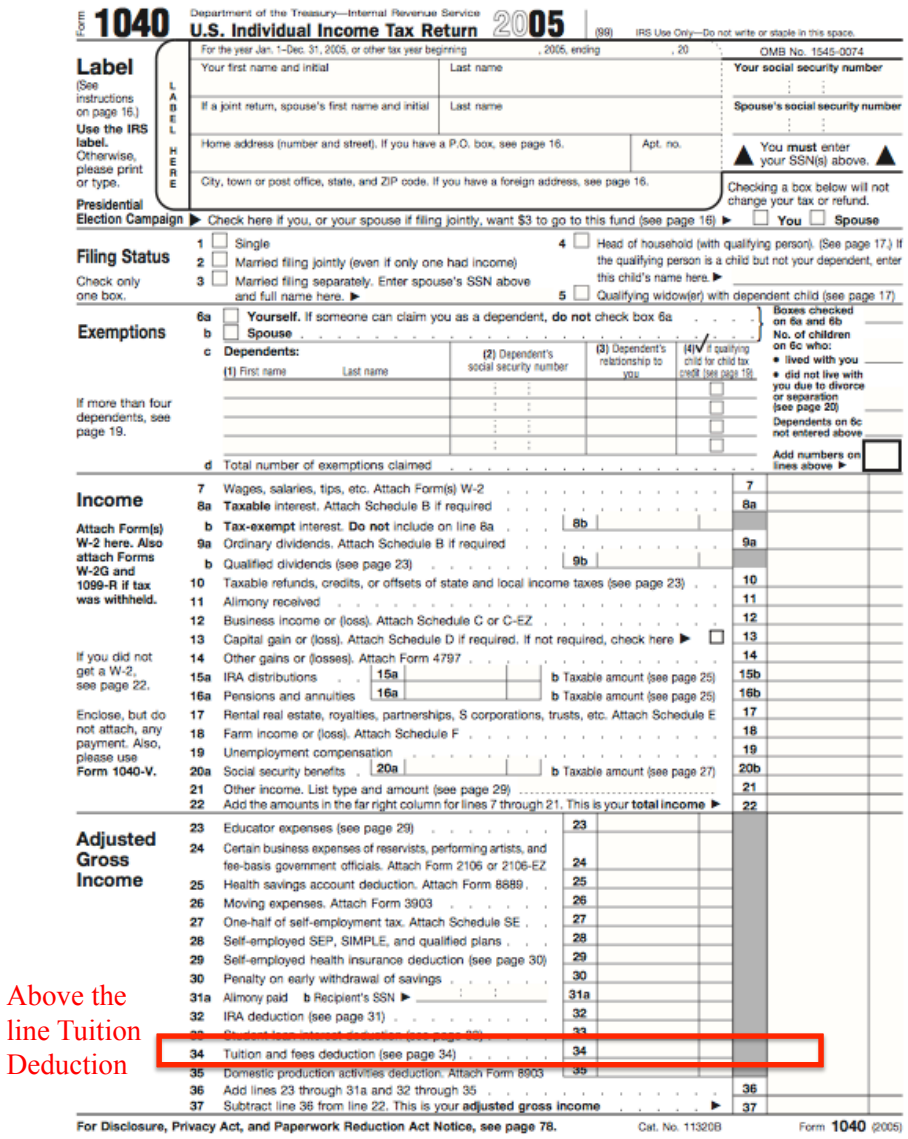
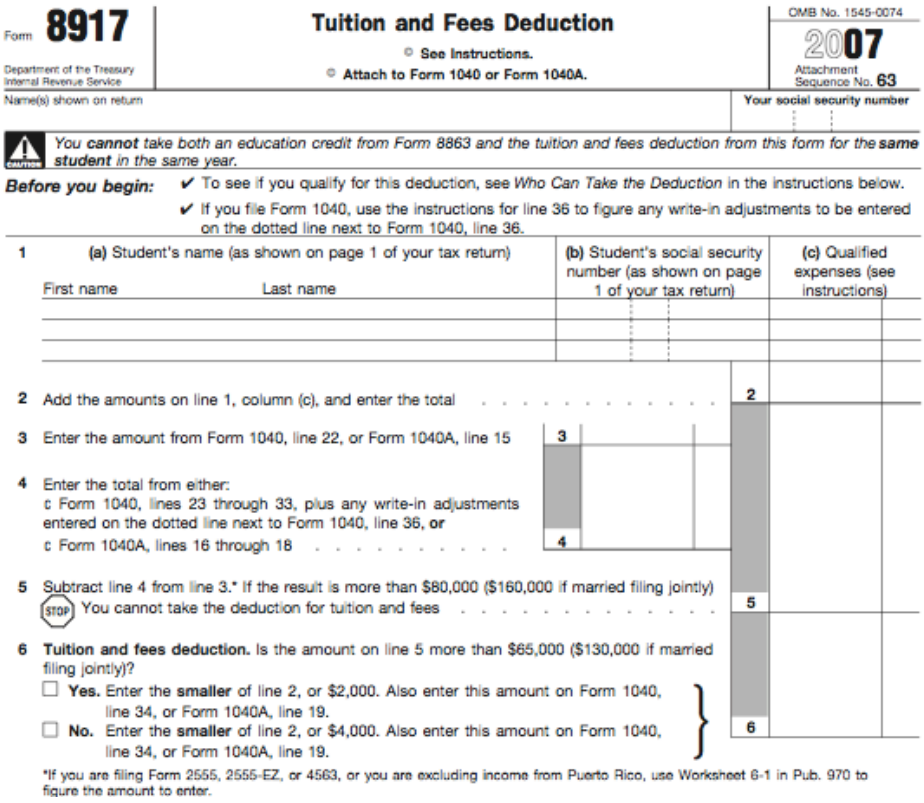


Figure 3.4
Internal Revenue Service Form 1040, Individual Income Tax Return, 2005



Form **8917**

Department of the Treasury
Internal Revenue Service

Tuition and Fees Deduction

© See Instructions.
© Attach to Form 1040 or Form 1040A.

OMB No. 1545-0074

2007

Attachment Sequence No. 63

Name(s) shown on return

Your social security number

*You **cannot** take both an education credit from Form 8863 and the tuition and fees deduction from this form for the **same student** in the same year.*

Before you begin: ✔ To see if you qualify for this deduction, see *Who Can Take the Deduction* in the instructions below.

✔ If you file Form 1040, use the instructions for line 36 to figure any write-in adjustments to be entered on the dotted line next to Form 1040, line 36.

1	**(a)** Student's name (as shown on page 1 of your tax return) First name Last name	**(b)** Student's social security number (as shown on page 1 of your tax return)	**(c)** Qualified expenses (see instructions)

2 Add the amounts on line 1, column (c), and enter the total 2

3 Enter the amount from Form 1040, line 22, or Form 1040A, line 15 . . . 3

4 Enter the total from either:
c Form 1040, lines 23 through 33, plus any write-in adjustments entered on the dotted line next to Form 1040, line 36, **or**
c Form 1040A, lines 16 through 18 4

5 Subtract line 4 from line 3.* If the result is more than $80,000 ($160,000 if married filing jointly)
STOP You cannot take the deduction for tuition and fees 5

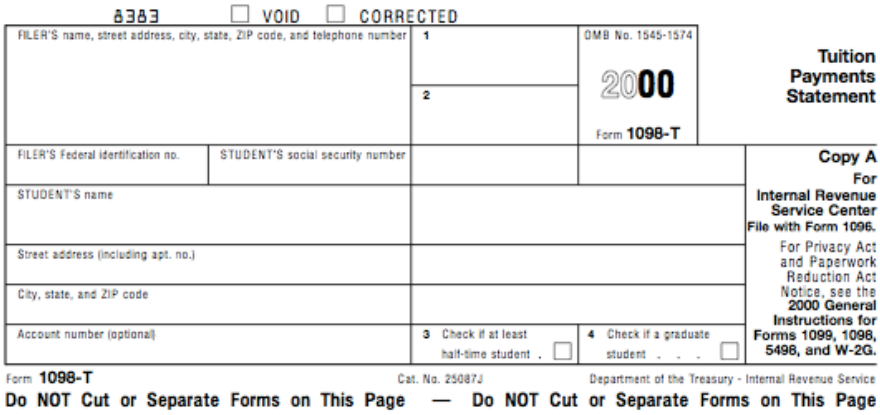
6 **Tuition and fees deduction.** Is the amount on line 5 more than $65,000 ($130,000 if married filing jointly)?

☐ **Yes.** Enter the **smaller** of line 2, or $2,000. Also enter this amount on Form 1040, line 34, or Form 1040A, line 19.

☐ **No.** Enter the **smaller** of line 2, or $4,000. Also enter this amount on Form 1040, line 34, or Form 1040A, line 19. 6

*If you are filing Form 2555, 2555-EZ, or 4563, or you are excluding income from Puerto Rico, use Worksheet 6-1 in Pub. 970 to figure the amount to enter.

Figure 3.5
Internal Revenue Service Form 8917, Tuition and Fees Deduction, 2007



8383 ☐ VOID ☐ CORRECTED

FILER'S name, street address, city, state, ZIP code, and telephone number	1	OMB No. 1545-1574	Tuition Payments Statement
	2	2000 Form 1098-T	
FILER'S Federal identification no. / STUDENT'S social security number			Copy A For Internal Revenue Service Center File with Form 1096.
STUDENT'S name			For Privacy Act and Paperwork Reduction Act Notice, see the 2000 General Instructions for Forms 1099, 1098, 5498, and W-2G.
Street address (including apt. no.)			
City, state, and ZIP code			
Account number (optional)	3 Check if at least half-time student . ☐	4 Check if a graduate student . . . ☐	

Form 1098-T Cat. No. 25087J Department of the Treasury - Internal Revenue Service

Do NOT Cut or Separate Forms on This Page — Do NOT Cut or Separate Forms on This Page

☐ CORRECTED (if checked)

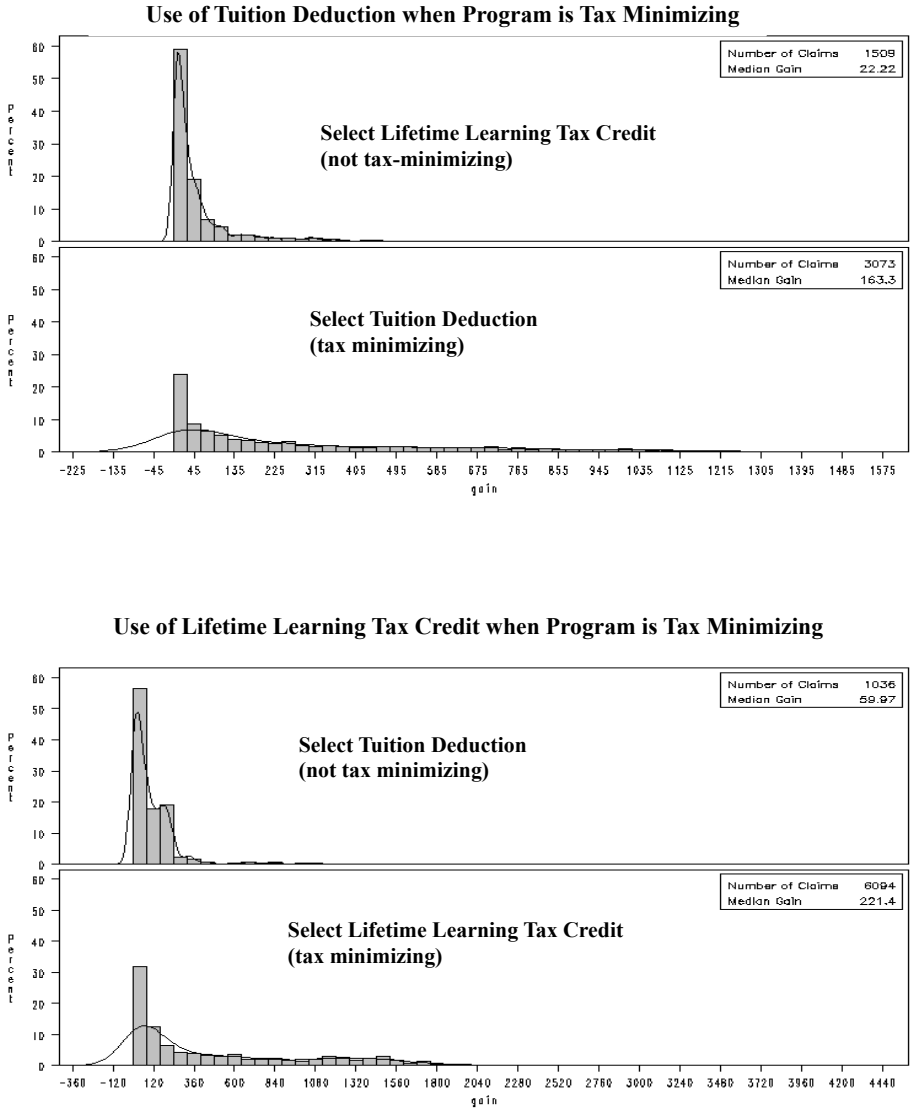
FILER'S name, street address, city, state, ZIP code, and telephone number	1	OMB No. 1545-1574	Tuition Payments Statement
	2	2000 Form 1098-T	
FILER'S Federal identification no. / STUDENT'S social security number			Copy B For Student
STUDENT'S name Street address (including apt. no.) City, state, and ZIP code			This is important tax information and is being furnished to the Internal Revenue Service.
Account number (optional)	3 At least half-time student (if checked) ☐	4 Graduate student (if checked) . . ☐	

Form 1098-T (Keep for your records.) Department of the Treasury - Internal Revenue Service

Figure 3.6
Internal Revenue Service Form 1098-T, Tuition Payments, 2000

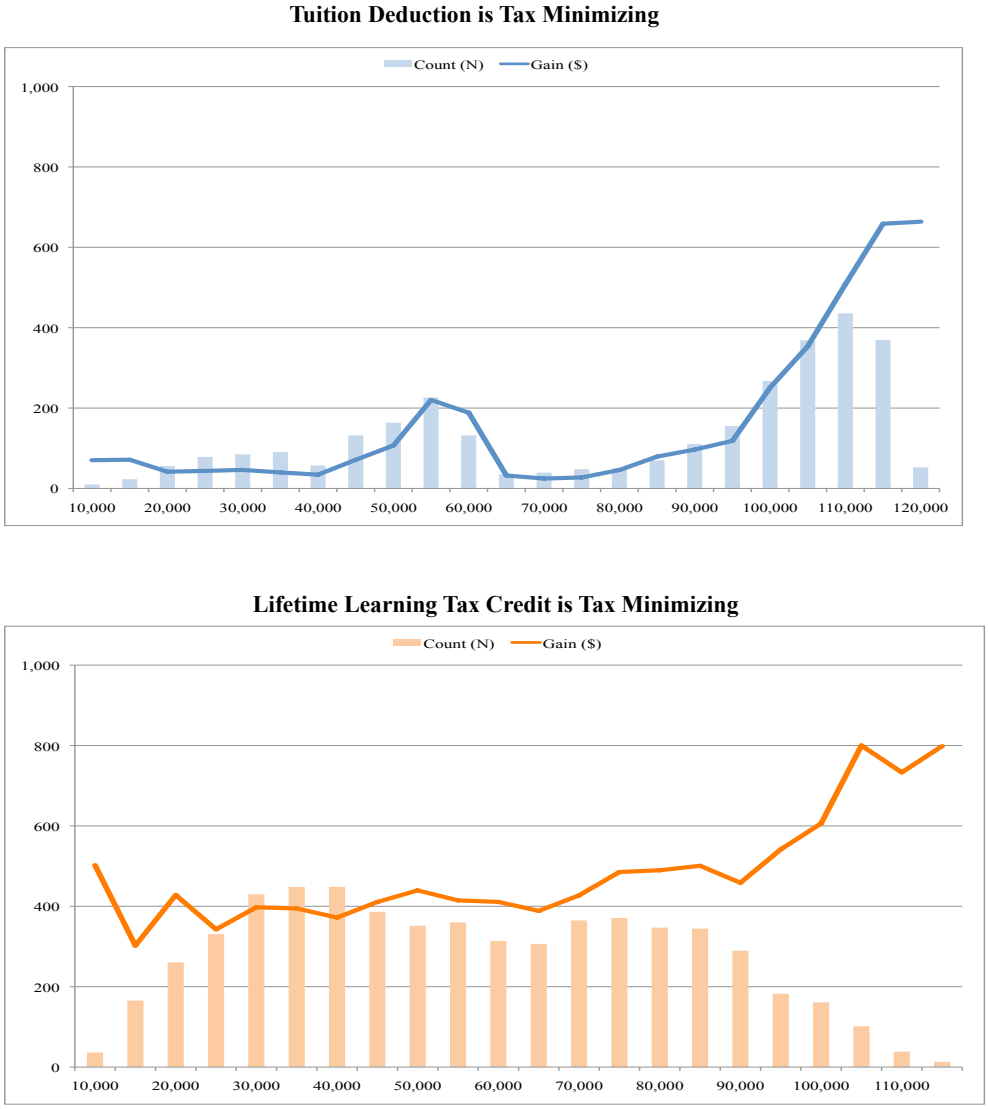
By definition, a non tax-minimizing selection offers a smaller reduction in combined state and federal tax liability compared to the alternate program. See Section IV.B for details.

Figure 3.7
Total and Non Tax Minimizing Tax-Based Aid Use, 2002-2007



Note: All dollar values are in 2007 dollars.

Figure 3.8
Distributions of Gains from Tax Minimization



Note: All dollar values are in 2007 dollars.

Figure 3.9

Gain from Selecting Tax-Minimizing Program, and Number of Tax Returns Claiming the Tax-Minimizing Program, by Adjusted Gross Income

Table 3.1
Tax-Based Aid Program Details, 1998-2007

	Hope Tax Credit	Lifetime Learning Tax Credit	Tuition and Fees Deduction
Expenses Covered	Tuition and required fees at an educational instituion eligible for Department of Education student aid programs. Expenses covered do not include medical expenses, room and board, transportation, insurance, scholarships, Pell Grants or any other tax free funds used to pay education expenses.		
Adjusted Gross Income Eligibility	1998-2001: Full credits for single (joint) returns less than $40,000 ($80,000). Credits linearly phased out for single (joint) returns until $50,000 ($100,000). 2002: Upper limits changed to and $51,000 ($102,000) for single (joint) returns. 2003: Upper limit changed $103,000 for joint returns. 2004: Upper limits changed to and $52,000 ($105,000) for single (joint) returns. 2005: Upper limits changed to and $53,000 ($107,000) for single (joint) returns. 2006: Upper limits changed to and $55,000 ($110,000) for single (joint) returns. 2007: Upper limits changed to and $57,000 ($114,000) for single (joint) returns. Credits 2002-2007 linearly phased out beginning $10,000 ($20,000) below the upper limit for single (joint) returns.		2002-2003: Single filiers with less than $65,000. Married couples must file a joint return and have income less than $130,000. 2004-2007: Eligibility extended to single returns with income above $65,000 and below $80,000, joint returns with income greater than $130,000 and less than $160,000 at half the rate (see below).
Amount	100 percent of first $1,000 plus 50 percent of the next $1,000 of qualified education spending. Max credit $1,500 per student.	1998-2002: 20 percent of first $5,000. Max credit $1,000 per return. 2003: 20 percent of first $10,000. Max credit $2,000 per return.	2002-2003: 100 percent offirst $3,000 of education spending per return. 2004-2007: 100 percent offirst $4,000 of education spending per return for returns meeting. 2002-2003 AGI limits. 100 percent of first $2,000 for higher income returns (see above).
Recipient Eligibility	Only available for two tax years for the first two years of postsecondary education. Must be enrolled at least half-time, pursuing a degree or credential and student can't have a felony drug conviction.	Undergraduate, graduate, vocational education and job skills programs. Available for an indefinite number of years. Lack of a felony drug conviction rule does not apply.	
Start Date	January 1, 1998	July 1, 1998	Janury 1, 2002
Source: IRS Publication 970 "Tax Benefits for Education" Various Years.			

Table 3.2
Characteristics of Tax Returns by Tax-Minimizing Program and Program Use

Tax Minimizing Program	(1) Tuition Deduction	(2) Tuition Deduction	(3) Lifetime Learning Tax Credit	(4) Lifetime Learning Tax Credit
Program Selected	Tuition Deduction	Lifetime Learning Tax Credit	Tuition Deduction	Lifetime Learning Tax Credit
Tax-Based Aid Use				
Value of Program Claimed	567	354	300	974
Value of Alternate Progam	259	405	405	479
Tax Return Characteristics				
Adjusted Gross Income	78,659	62,180	51,285	52,877
Federal Taxes Owed	6,736	4,188	3,052	2,429
Total Exemptions	2.97	2.67	2.56	2.70
Exemptions for Children	1.21	1.01	0.92	1.02
Male Primary Taxpayer	0.77	0.76	0.72	0.72
Joint Return	0.72	0.68	0.60	0.63
Piad Tax Preparation	0.48	0.60	0.40	0.58
Form 1040	0.85	0.80	0.72	0.75
Standard Deduction	0.33	0.45	0.53	0.50
Tax-Based Aid Use in Previous Year				
Hope Tax Credit	0.09	0.11	0.07	0.15
Minimizing Tuition Deduction	0.23	0.07	0.06	0.04
Minimizing Lifetime Learning Tax Credit	0.10	0.12	0.10	0.35
Non-Minimizing Tuition Deduction	0.04	0.22	0.01	0.03
Non-Minimizing Lifetime Learning Tax Credit	0.02	0.01	0.19	0.02
No Tax-Based Aid Progam Claimed	0.53	0.47	0.58	0.41
Number of Returns	3,073	1,509	1,036	6,094

Minimizing programs are defined relative to combined state and federal taxes.
Data from the Internal Revenue Service, Individual Income Tax Return Edited Panel Data.

Table 3.3
Non-Minimizing Program Selection (Combine Tax Liability) by Year and Tax Preparation Status

	2002	2003	2004	2005	2006	2007
Panel A: Lifetime Learning Tax Credit						
Percent Self Prepared	32	37	39	40	45	40
Value of Loss ($)						
Self Prepared	67	46	44	39	49	30
Paid Prepared	77	47	48	47	39	47
Panel B: Tuition Deduction						
Percent Self Prepared	59	72	65	56	39	41
Value of Loss ($)						
Self Prepared	88	87	115	130	154	104
Paid Prepared	87	70	116	103	170	90

By definition, a selection is non-minimizing if it offers a smaller reduction in combined state and federal tax liability compared to the alternate program. All dollars amounts in 2007 dollars.
Data from the Internal Revenue Service, Individual Income Tax Return Edited Panel Data.

Table 3.4
Federal Tax Minimization and Combined State and Federal Tax Minimization

Panel A: Tuition Deduction Combined Tax Minimizing			
Program Claimed	*Minimizing Federal*	*Non-Minimizing Federal*	*Total*
Tuition Deduction	56.19	10.88	67.07
Lifetime Learning Tax Credit	25.76	7.17	32.93
Total	81.95	18.05	100.00
Panel B: Lifetime Learning Tax Credit Combined Tax Minimizing			
Program Claimed	*Minimizing Federal*	*Non-Minimizing Federal*	*Total*
Lifetime Learning Tax Credit	85.30	0.17	85.47
Tuition Deduction	0.63	13.90	14.53
Total	85.93	14.07	100.0
By definition, a selection is minimizing if it offers a larger reduction in taxes compared to the alternate program.			
Data from the Internal Revenue Service, Individual Income Tax Return Edited Panel Data.			

Figure 3.5
Determinants of Tax-Based Aid Selection (Linear Probability Model)

Tax Minimizing Program	(1) Tuition Deduction	(2) Tuition Deduction	(3) Lifetime Learning Tax Credit	(4) Lifetime Learning Tax Credit
Combined Gain	0.049		0.014	
	[0.002]		[0.001]	
Federal Tax Effect		0.069		0.014
		[0.003]		[0.001]
State Tax Effect		0.023		0.011
		[0.010]		[0.001]
Paid Preparer	-0.080	-0.080	0.072	0.072
	[0.013]	[0.013]	[0.010]	[0.008]
Tax-Based Aid Use in Previous Year				
Hope Tax Credit	-0.071	-0.073	0.080	0.080
	[0.022]	[0.022]	[0.012]	[0.012]
Minimizing Tuition Deduction	0.075	0.074	-0.030	-0.030
	[0.016]	[0.016]	[0.023]	[0.022]
Minimizing Lifetime Learning Tax Credit	-0.096	-0.097	0.116	0.115
	[0.022]	[0.022]	[0.010]	[0.010]
Non-Minimizing Tuition Deduction	0.076	0.076	-0.344	-0.344
	[0.046]	[0.046]	[0.028]	[0.027]
Non-Minimizing Lifetime Learning Tax Credit	-0.294	-0.294	0.069	0.069
	[0.024]	[0.024]	[0.019]	[0.019]
Mean Dependent Variable	0.660	0.660	0.841	0.841
Mean Combined Gain	2.220		4.360	
Mean Federal Tax Effect		1.350		4.700
Mean State Tax Effect		0.870		-0.340
Implied Elasticities of Tax-Minimization				
Combined Gain	0.165		0.073	
Federal Tax Effect		0.141		0.078
State Tax Effect		0.030		-0.004
Number of Returns	4,582	4,582	7,130	7,130
Number of Tax Units	3,059	3,059	4,187	4,187
R^2	0.346	0.346	0.192	0.192

The dependent variable in Columns (1) and (2) is an indicator for claiming the Tuition Deduction. The dependent variable in Columns (3) and (4) is an indicator for claiming the Lifetime Learning Tax Credit.
Combined gain, federal tax effect and state tax effect are measured in hundreds of 2007 dollars. Control variables include adjusted gross income, number of dependents, number of child exemptions, state of residency, tax form, itemized deductions, gender of primary taxpayer, and a squared time trend. See Section IV.B for details.
Standard errors are reported in brackets and are clustered at the tax unit level.

Table 3.6
Robustness Checks of Tax-Based Aid Selection (Linear Probability Model)

	(1)	(2)	(3)	(4)
Tax Minimizing Program	Tuition Deduction		Lifetime Learning Tax Credit	
Federal Tax Effect	0.033	0.059	0.017	0.015
	[0.002]	[0.003]	[0.001]	[0.001]
State Tax Effect	-0.017	0.040	0.001	0.011
	[0.011]	[0.001]	[0.000]	[0.003]
Paid Preparer	-0.086	-0.108	0.075	0.109
	[0.012]	[0.016]	[0.018]	[0.011]
Tax-Based Aid Use in Previous Year				
Hope Tax Credit	-0.034	-0.053	0.090	0.102
	[0.021]	[0.028]	[0.017]	[0.015]
Minimizing Tuition Deduction	0.021	0.086	-0.029	-0.017
	[0.013]	[0.021]	[0.033]	[0.029]
Minimizing Lifetime Learning Tax Credit	-0.090	-0.09	0.141	0.138
	[0.023]	[0.028]	[0.013]	[0.128]
Non-Minimizing Tuition Deduction	0.024	0.113	-0.312	-0.379
	[0.042]	[0.050]	[0.032]	[0.031]
Non-Minimizing Lifetime Learning Tax Credit	-0.204	-0.299	0.083	0.089
	[0.041]	[0.030]	[0.056]	[0.023]
Mean Dependent Variable	0.886	0.670	0.815	0.823
Mean Federal Gain	2.670	1.258	3.910	4.342
Mean State Gain	0.690	0.863	0.420	-0.302
Implied Elasticities of Tax-Minimization				
Federal Tax Effect	0.099	0.111	0.081	0.079
State Tax Effect	-0.013	0.052	0.001	-0.004
Number of Returns	2,884	3,194	4,391	4,955
Number of Tax Units	2,080	2,311	2,549	3,288
R^2	0.183	0.192	0.169	0.219

The dependent variable in Columns (1) and (2) is an indicator for claiming the Tuition Deduction.
The dependent variable in Columns (3) and (4) is an indicator for claiming the Lifetime Learning
The samples in Columns (1) and (3) include only tax returns with positive federal and state tax effects.
The samples in Columns (2) and (4) include only years 2002-2005.
Combined gain, federal tax effect and state tax effect are measured in hundreds of 2007 dollars.
Control variables include adjusted gross income, number of dependents, number of child exemptions, state of residency, tax form, itemized deductions, gender of primary taxpayer, and a squared time trend. See Section IV.B for details.
Standard errors are reported in brackets and are clustered at the tax unit level.

Table 3.A1
State Personal Income Tax Features, 2002-2007

	Deduct Federal Taxes	Federal Tuition Deduction Applies	Federal Lifetime Learning Tax Credit
Alabama	X		
Alaska			
Arizona		X	
Arkansas			
California			
Colorado		X	
Connecticut		X	
District of Columbia		X	
Deleware		X	
Florida			
Georgia		X	
Hawaii			
Idaho		X	
Illinois		X	
Indiana		X	
Iowa	X		
Kansas		X	
Kentucky		X	
Louisana	X	X	
Maine		X	
Maryland			
Massachusetts			
Michigan		X	
Minnesota		X	
Mississippi			
Missouri	X	X	
Montana	X	X	
Nebraska		X	
Nevada			
New Hampshire			
New Jersey			
New Mexico		X	
New York		X	
North Carolina		X	X
North Dakota		X	
Ohio		X	
Oklahoma	X	X	
Oregon	X		X
Pennsylvania			
Rhode Island*	X	X	
South Carolina		X	
South Dakota			
Tennessee			
Texas			
Utah	X	X	
Vermont*	X	X	
Virginia		X	
Washington			
West Virginia		X	
Wisconsin		X	
Wyoming			

Sources: The Book of States 2002-2007, The Tax Foundation "State Tax Rates 2000-2010," searches of state individual income tax forms by author.
*Rhode Island used federal liability as the tax base and applied a 25 percent rate until 2006.
*Vermont used federal liability as the tax-baseand applied a 24 percent rate until 2004.