National Tax Journal, September 2011, 64 (3), 839–862

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

Nicholas Turner

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 causal effect on college enrollment. I find that tax-based aid increases full-time enrollment in the first two years of college for 18 to 19 years old by 7 percent. The price sensitivity of enrollment suggests that college enrollment increases 0.3 percentage points per $100 of tax-based aid. The programs do not appear to substantively affect part-time enrollment in the first two years of college.

Keywords: tax-based student aid, college enrollment

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 cost of tax-based aid was

[1] There are some tax benefits related to higher education in the federal tax code including the deduction of student loan interest, the exclusion of taxes on the interest of savings bonds redeemed for educational expenses, allowing parents to claim personal exemptions for students through age 23, tax-preferred savings accounts (Coverdell and Qualified Tuition Plans), penalty free IRA distributions used for education, and tax-free employer provided education support.

Nicholas Turner: Office of Tax Analysis, U.S. Department of the Treasury, Washington, DC, USA (Nicholas.Turner@treasury.gov)

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 who 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 determinants of college enrollment. In this paper, I exploit this source of variation to estimate the impact of tax-based aid on college enrollment. 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).

Only two papers consider the enrollment effects of tax-based aid, reaching different conclusions about the effectiveness of the programs. Long (2004) examines the HTC and LLTC between 1996 and 2000 for both traditional college age students (18–24) as well as older students (25–40) using data from the October Current Population Survey. Long's (2004) results imply no enrollment effects. Recent work by LaLumia (2010) examines the enrollment effect of the tax-based aid programs between 1998 and 2006 on older students (30 to 49 years old) using data from the National Longitudinal Survey of Youth 1979. LaLumia (2010) finds that the programs increase enrollment for a subset of older adult males who are eligible for tax-based aid. I complement this work by estimating the enrollment effect of tax-based aid on the college entry decision for 18 to 19 years olds between 1996 and 2003 using data from the Survey of Income and Program Participation (SIPP). Unlike Long (2004) and LaLumia (2010), I do not explicitly compare youths who are eligible for tax-based aid to ineligible youths. Instead, I exploit both time series and cross sectional variation in program generosity among youths who are potentially eligible based on family income to estimate the enrollment effects of tax-based aid. (As a robustness check, I use youths who are ineligible for tax-based aid based on family income as a control group.) 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.

The remainder of the paper proceeds as follows. In the next Section II, 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

[2] Pell Grants, which do require active appropriation, are expected to face a $6 billion shortfall in 2009 (Dillon and Lewin, 2008).

tax-based student aid in Section III. In the Section IV, I present the empirical results. In the final section, I offer a brief conclusion and discuss several avenues for future work.

II. TAX-BASED FEDERAL STUDENT AID

A. Program Details

In 1997, the Taxpayers' Relief Act introduced the HTC and the LLTC. In 2001, the Economic Growth and Taxpayers' Relief and Reconciliation Act added the 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 1998–2002, 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. The full value of the HTC and the LLTC is available for non-joint (joint) returns with adjusted gross income that is less than roughly $40,000 ($80,000). The credits are linearly phased out over the next $10,000 ($20,000) of adjusted gross income for non-joint (joint) returns (IRS, 1998–2003). The TD allows tax filers to deduct 100 percent of the first $3,000 of qualified education expenses as an above-the-line deduction.[3] 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 compared to the tax credits, and there is no phase-out region (IRS, 2002). Table 1 provides details on all three programs. Figure 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; Hoxby, 1998; Kane, 1997, 1998; Long, 2004) voice concern that tax-based aid benefits students from middle-class families who would have attended college without 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. As shown in Figure 1, students who are ineligible based on family income are composed of two distinct groups: those with income that is above the programs' limits, and those with income that is insufficient to

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

Table 1

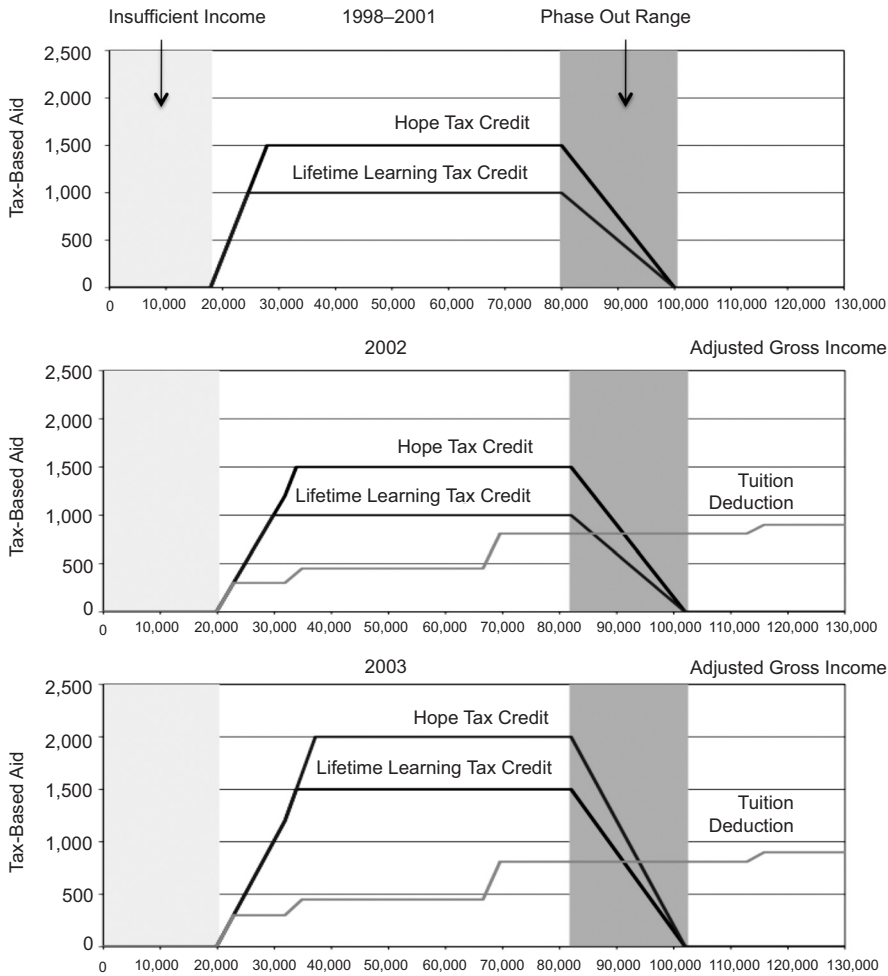
Tax-Based Aid Program Details

	Hope Tax Credit	Lifetime Learning Tax Credit	Tuition and Fees Deduction
Expenses covered	Tuition and required fees at an educational institution are 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	All Years: Married filers must file jointly. 1998–2001: Full credits for non-joint (joint) returns less than $40,000 ($80,000). Credits phased out linearly for non-joint (joint) returns until $50,000 ($100,000). 2002: Limits increased by $1,000 ($2,000) for non-joint (joint) returns. 2003: Limits increased by $1,000 for joint returns.		Married filers must file jointly. Non-joint filers with less than $65,000. Joint filers with less than $130,000.
Amount	100 percent of first $1,000 of spending plus 50 percent of the next $1,000 of spending. Maximum credit is $1,500 per student.	1998–2002: 20 percent of the first $5,000 of spending. Maximum credit is $1,000 per return. 2003: 20 percent of the first $10,000 of spending. Maximum credit is $2,000 per return.	100 percent of the first $3,000 of spending per return.
Recipient eligibility	Only available for two years for students in the first two years of post-secondary 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.	
Start date	January 1, 1998	July 1, 1998	January 1, 2002

Source: IRS (1998–2003)

Figure 1

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



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

generate tax liability. As a result of middle-class targeting, students who 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 students from families 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.

The use of the tax code to 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 (2006, 2008) 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 and Scott-Clayton (2006) suggest that this complexity disproportionately affects low-income youth. In contrast to the lengthy FAFSA, the application for tax-based aid is less burdensome. 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.[4] However, unlike the FAFSA, the tax-based aid forms do not include information on family wealth, so that tax-based aid is allocated based on income rather than asset wealth.

While applying for tax-based aid is easier than for traditional FAFSA-based aid, there is mixed evidence on program use. Long (2004) 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 return.[5] 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

Students presumably 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

[4] In 2003, IRS Form 8863 contained roughly seven lines/boxes, while the TD required a single line on Form 1040. In that same year, the FAFSA required as many as 100 lines/boxes and included three worksheets. Dynasrki and Scott-Clayton (2006) discuss the complexity of the FAFSA.

[5] Long (2004) 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).

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.

Studies using natural experiment settings to measure the enrollment effect of student aid provide insight into the expected effect of tax-based aid.[6] Several papers estimate the enrollment effects of the Georgia HOPE scholarship. (The HTC was named after the Georgia HOPE program.) This state-administered program generally benefits middle-class students and families, similar to federal tax-based aid. Unlike tax-based aid, eligibility for the Georgia HOPE scholarship 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 United States, including state-based grants (Kane, 2003), state merit-based aid (Dynarski, 2004), Pell Grants (Curs, Singell, and Waddell, 2007; Seftor and Turner, 2002), and institutional grant aid (van der Klaauw, 2002). Nielsen, Sorensen, and Taber (2008) report a smaller response to student aid among youths in Denmark, relative to enrollment effects found for the United States, 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. 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. Tax filers could smooth the impact of the credit by adjusting their withholdings in earlier periods. Such behavior may be especially helpful for credit constrained students and families. 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. Jones (2010) shows that there is inertia in individual income tax withholdings, suggesting that many taxpayers do not adjust their withholdings in response to changes in tax liability.

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

[6] 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).

representative survey designed to provide accurate and comprehensive information on income and program use.[7] 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 (2004) relies on October Current Population Survey data, and her difference-in-differences findings that imply no enrollment effect may be the result of measurement error in program eligibility. However, measurement error of family income may be an issue in the SIPP data. To the extent that family income is measured with error, the value of the tax-based aid subsidy will be a noisy measure of actual program eligibility. Such error will bias the estimated effect of tax-based aid towards zero. The treatment of college-age youths in the SIPP is also different compared to the Current Population Survey. In the SIPP, youths remain on their family record until age 19, so that observations of youths may be linked to observations of their parents or guardians. Information on parents/guardians is crucial for determining program eligibility and award size, because in most cases dependent students are claimed on their family tax return.[8] In contrast to the SIPP, the likelihood of observing family income of a youth in other surveys, including the Current Population Survey, is related to their decision to live at home or to be enrolled at college.[9]

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 who 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.) I rely on annual family income data to determine program eligibility. I also limit the sample to 18 to 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.[10] 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 32 percent of youths in this sample are enrolled full-time in the first two years of college, with 25 percent enrolled in the first year and 7 percent in the second year. Another 3 percent are enrolled part-time in the first two years of college.

---

[7] 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.

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

[9] The Current Population Survey includes accurate family income only for youths that appear on the parent's record, which excludes youths over 18 who are not enrolled in college and who do not live with their parents. See Shin (2007) for full details

[10] 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.

Unfortunately, the SIPP does not include data on tax-based aid, and on 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 way. First, I use information from the IRS (1998–2003) to define the tax-based aid function for each of the three programs. (See Table 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.[11] 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.[12] For most of the analysis period, the programs' spending limits are relatively low. Data from the National Postsecondary Student Aid Study suggest that average spending by 18 to 19 year olds at four-year schools is at least as large as the programs' limits, although students at two-year schools have lower levels of spending.[13] (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 two-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, I assign each student to the program with the largest value.[14] This approach generates an estimate of the value of tax-based aid that a student would be eligible for, based on their family income, if that student enrolled in college and had education spending equal to or greater than the program's spending limits.

A further complication for estimating the value of tax-based aid is the overlap of two school years within a given calendar year. Tax-based aid applies to spending for a given calendar year, which includes parts of two school years. 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. Instead, I assign the entire incentive in each school year. This approach is conservative and works against finding a substantive effect of tax-based

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

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

[13] Qualified spending by 18 to 19 year olds in the 1999–2000 school year was $2,518 (four-year public), $8,307 (four-year private), and $470 (two-year public), and in the 2003–2004 school year spending was $3,286 (four-year public), $10,510 (four-year private), and $644 (two-year public).

[14] Turner (2010b) finds evidence that some tax filers do not maximize their tax-based aid award. However, the value of the forgone tax benefit for these taxpayers is relatively small so that the bias in the subsidy value should be minimal.

aid. It is expected that college enrollment will increase during the period on which the aid is based. By definition, tax-based aid depends on education spending, so that the increase in enrollment (and in qualifying spending) has to occur before tax-based aid can be claimed. However, it is possible that continued enrollment is a function of prior tax-based aid awards because students can use their aid from the prior year to pay for education in the next year. To consider this possibility, I separately consider enrollment in the first year from enrollment in the second year.[15] 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 2 shows tax-based aid eligibility by adjusted gross income for various years, highlighting the sources of policy-induced variation in the value of the eligible subsidy. 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 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 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 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.[16] The average value of tax-based aid for eligible students ($1,104) is relatively large compared to other forms of aid and tuition for 18 to 19 year olds during the 1999–2000 school year: Pell Grants ($506 four-year public schools, $500 four-year private schools, $352 two-year public schools); federal campus-based aid ($267 four-year public schools, $851 four-year private schools, $55 two-year public schools); and tuition (two-year schools $1,014, four-year schools $3,847, four-year private schools $14,787).[17] The increase in enrollment for eligible youths following the enactment of tax-based aid (4.9 percentage points) is larger than that of ineligible youths (1.7 percentage points), although 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.

[15] I estimate the enrollment effect in the second year of college as a function of the subsidy available that period. In the data, tax-based aid awards are comparable across years, so that the results are the same if the lagged subsidy is used in place of the contemporaneous subsidy when considering enrollment in the second year of college.

[16] 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 who are never eligible for tax-based aid as ineligible.

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

Figure 2

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

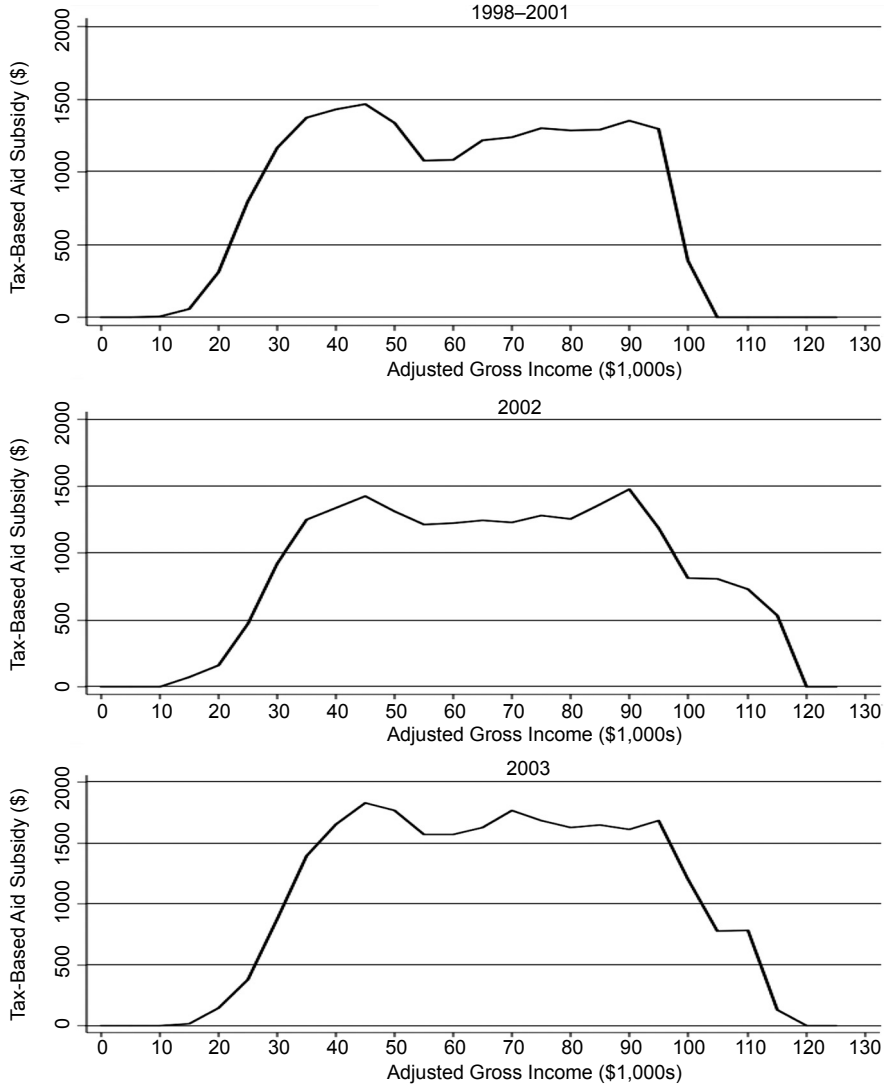


Table 2

Differences in Enrollment, Tax-based Aid, and Student Characteristics, by 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

Notes: All dollar values are in $1996. Tax-based aid became effective January 1, 1998. Eligibility is based on adjusted gross income using 2003 program rules.
Source: Data are from the 1996 and 2001 Core Wave files from the Survey of Income and Program Participation.

B. Econometric Specification for College Enrollment

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

$$(1) \quad \text{Enrollment}_{it} = \Phi(\beta_1 Subsidy_{it} + \beta_2 X_{it} + \varepsilon_{it}),$$

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 programs' limits. This can be interpreted as the effect of increasing the maximum value by $100, which may be of interest to policymakers who set the statutory limits of tax-based aid.

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 Mullainathan (2004).

In the primary analysis sample, I remove youths who are never eligible for tax-based aid based on family income. (I drop youths with no tax liability and also remove youths who do not meet the 2003–2004 adjusted gross income requirements.) Instead of explicitly comparing eligible youths to youths who are never eligible, I rely on cross sectional variation in award size due to program rules and from time series variation in program implementation *among eligible youths* for identification. A key identifying assumption of this approach is that other forms of aid for eligible students are not changing over time in a way that is correlated with tax-based aid. Unfortunately the SIPP does not contain information on student aid awards. However, the targeting of tax-based aid is different from 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, 2004). The discrete change in tax-based aid that results from the introduction of the program is substantively larger than changes in other federal programs during the analysis period. 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 $187 dollar increase in Pell Grants, and a $7 increase in campus-based aid nationally over the same period.[18] As a sensitivity check, I include ineligible youths as a control group, an approach that relies on the identifying assumption that there are no *differential changes in other forms of aid across eligible and ineligible youths*. Difference-in-differences estimation, which is commonly used to estimate the enrollment effects of student aid (Cornwell, Mustard, and Sridhar, 2006; Dynarski, 2000, 2003; LaLumia, 2010; Long, 2004), requires this assumption. In the case of tax-based aid, this approach involves the comparison of youths from different ethnic and minority groups who may have different time trends in college enrollment. As shown in Table 2, students who are eligible for tax-based aid based on family income are less likely to be Hispanic or black, compared to youths who are ineligible for tax-based aid based on family income.

[18] The differences in Pell Grants and campus-based aid (Supplemental Education Opportunity Grants and Federal Work Study) between the 1997–1998 and 1998–1999 school years are from Baum and Steele (2007), who also report that the average increase in tax-based aid nationally is $914 during the same period. Turner (2010a) finds a similar pattern for changes in student aid using a sample of four-year schools.

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. 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).[19] Column (2) shows the results for part-time enrollment. Column (1) in Table 3 shows the baseline full-time enrollment results. The enrollment increase does not appear to extend to 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.[20]

Table 3

Effects of Tax-Based Student Aid on First and Second Year College Enrollment

Enrollment	(1) Full-time	(2) Part-time	(3) Full-time	(4) Full-time
Subsidy	0.320	–0.023	0.266	0.357
	(0.141)	(0.036)	(0.112)	(0.153)
Wald Chi^2	1,128	371	1,411	1,132
Pseudo R^2	0.145	0.075	0.159	0.146
Sample Size	18,990	18,990	23,175	18,990
Mean Dependent Variable	32.31	2.90	30.72	32.31
Mean Subsidy	6.76	6.76	5.52	5.77

Notes: 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. Columns (1) and (2) use the baseline specification, including only eligible youths and using tax-based aid based on maximum spending. Column (3) includes all youths, both eligible and ineligible, and uses tax-based aid based on maximum spending. Column (4) includes only eligible youths and tax-based aid based on simulated spending. Control variables include indicators for race, Hispanic, gender, married, age, state of residence, parent/guardian education, household type, month, and a spline function of income (3 knots).
Source: Data are from the 1996 and 2001 Core Wave files of the Survey of Income and Program Participation.

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

[20] 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.

Tax-based aid appears to increase both postsecondary entry and persistence into the second year of college. In column (1) of Table 4, I report the effect of the subsidy on the first year of college. The estimate suggests that enrollment in the first year increases by 1.6 percentage points (6.3 percent). To measure the impact of tax-based aid on the second year of college, I limit the sample to youths who I observe in consecutive school years, and who are enrolled in the first year of college during the initial school year. I limit the sample in this way so that I am able to observe the second year decision for all observations. Among this group, tax-based aid increases enrollment by 1.4 percentage points (2.2 percent). This implies that tax-based aid has a positive effect on the likelihood of continuing into the second year of college, conditional on having enrolled in the first year.[21] 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 (Bradburn, 2002; Horn, 1998).

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

Table 4

Additional Effects of Tax-Based Student Aid on Full-time College Enrollment

Enrollment	(1) 1st Year	(2) 2nd Year	(3) 1st & 2nd Year
Subsidy	0.235	0.210	0.372
	(0.129)	(0.101)	(0.169)
Wald Chi^2	627	844	1,225
Pseudo R^2	0.090	0.112	0.132
Sample Size	18,990	8,663	10,971
Mean Dependent Variable	25.20	66.81	29.77
Mean Subsidy	6.76	6.89	7.31

Notes: 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. Column (1) includes all eligible youths and uses enrollment in the first year as the dependent variable. Column (2) includes all eligible youths who are observed in consecutive school years who are enrolled in the first year of college in the initial school year and uses enrollment in the second year as the dependent variable. Column (3) includes 18 year old eligible youths and uses enrollment in the first two years as the dependent variable. Control variables include indicators for race, Hispanic, gender, married, age, state of residence, parent/guardian education, household type, month, and a spline function of income (3 knots).

Source: Data are from the 1996 and 2001 Core Wave files of the Survey of Income and Program Participation.

[21] The effect on second year enrollment is in part attributable to the changing composition of students who enroll in the first year of college as a result of tax-based aid.

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 affirms speculation by Dynarski and Scott-Clayton (2006), Long (2004), and Kane (1997, 1998) that youths who would have enrolled in the absence of tax-based aid will also benefit from the programs. 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 total take-up is equal to the lower limit reported by Maag and Rohlay (2007). In this case, roughly seven inframarginal youths are subsidized per marginal enrollment. This level of subsidization is within the range found in analyses of other student aid programs, although estimates in previous work vary widely. In response to the Georgia HOPE Scholarship, estimates of the number of inframarginal students who are subsidized per marginal enrollment ranges from four (Dynarski, 2000) to 16 (Cornwell, Mustard, and Sridhar, 2006).[22] In the context of Pell Grants, results from Seftor and Turner (2002) suggest that the number of inframarginal students who are subsidized is between 6 and 10 students per marginal enrollment, while the findings from Cameron and Heckman (2001) suggest that virtually all Pell Grants flow to inframarginal students.[23]

The inability of policymakers to perfectly target inframarginal students represents an important friction for any student aid program. If bolstering postsecondary enrollment is the sole goal of student aid, then subsidizing between 7 and 13 inframarginal students implies that tax-based aid may not be cost effective. However, Burgdorf and Kostka (2006) suggest that another goal of student aid is to alleviate student debt burdens. By subsidizing inframarginal students, tax-based aid may lower student debt levels, which may be socially desirable. Lower levels of debt may allow students to pursue lower paying but socially beneficial public interest careers (Rothstein and Rouse, 2007). I am unable to explore this possibility in the current paper, although this may be an interesting area for future research.

The estimated price sensitivity of postsecondary enrollment to tax-based aid assumes 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 (2010a) finds that colleges and universities lower school grant aid by as much as dollar-for-dollar for students who are likely to benefit from tax-based aid. As a result, eligible youths may not experience any of the intended cost reduction from tax-based aid. Yet, the findings of this paper are not necessarily incongruent with the institutional aid crowd-out results from Turner (2010a) for several reasons.

---

[22] In response to the Georgia HOPE scholarship, Dynarski (2000) finds that enrollment in Georgia increases 23 percent (7–8 percentage point increase relative to a pre-HOPE enrollment level of 30 percent), while Cornwell, Mustard, and Sridhar (2006) find that first year enrollment increases by 6 percent.

[23] Seftor and Turner estimate that enrollment decreases between 9 and 14 percent for a subpopulation of older students after the loss of Pell Grant eligibility. Cameron and Heckman (2001) report that a $1,000 increase in Pell Grants increases enrollment by less than 1 percent.

First, the enrollment effect found here may be driven by enrollment increases at two-year schools as well as four-year schools, whereas Turner (2010a) analyzes four-year institutions. (Note that the SIPP data does not include sufficient information on school type to differentiate enrollment at two-year schools from four-year schools.) A simulation by Cameron and Heckman (1999) is consistent with the possibility that the enrollment effects of tax-based aid are concentrated at two-year schools.[24] Some of the enrollment increase may also be the result of increases at smaller and less selective four-year schools. The schools in the sample analyzed by Turner (2010a) are larger and more selective than four-year schools.

Second, the results from Turner (2010a) allow for less than complete crowd out of institutional aid.[25] This implies that eligible youths may experience some of the intended cost reduction from tax-based aid. To the extent that this occurs, the results here underestimate the true price sensitivity of enrollment by assuming that students realize their full statutory tax-based aid subsidy as a cost savings.

Third, even if tax-based aid is substantively offset by reductions in school grant aid, enrollment may still increase if tax-based aid reduces the uncertainty over the value of student aid. Unlike traditional student aid, tax-based aid gives students and their families information on likely aid receipt prior to making application decisions. Results from Cellini (2009) suggest that uncertainty in the cost of college is a deterrent to enrollment. Additionally, the application process for tax-based aid is likely to be less burdensome than for traditional forms of federal student aid. Recent work (Bettinger et al., 2009) suggests that reduced uncertainty about the cost of college and lower transaction costs increases postsecondary enrollment.

B. 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 using ineligible youths as a control group, and to the use of an alternate subsidy that includes student-level heterogeneity in education spending. 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.

Although not shown, I also find that the results are robust to the following specifications: using alternate enrollment months (September and February, or November and

[24] This analysis is based on national enrollment data from the Digest of Education Statistics 2007, Table 189 "Total first-time freshman fall enrollmnet in degree-granting institutions, by attendance status, sex of student, and type of control of institution: 1955 through 2005" (http://nces.ed.gov/programs/digest/d07/tables/dt07_189.asp); enrollment would have to increase by roughly 17 percent at two-year schools to account for the total enrollment effect. Tax-based aid is likely to represent a relatively larger share of total attendance at these schools, compared to four-year schools.

[25] Using the preferred instrumental variable results from Turner (2010a), the 95 percent confidence interval of the effect of a $1.00 increase in tax-based aid on institutional grant aid is –$1.06 to –$0.73 for public schools and –$1.38 to –$0.44 for private schools.

March); using alternate time controls (separate time trends by income tercile); using alternate income controls (cubic and linear spline functions with up to 7 knots); using Ordinary Least Squares; and including a subset of covariates in the main specification. As a falsification test, I estimate the impact of tax-based aid on the probability that a student is a high school dropout. Although tax-based aid may impact this decision, it is unlikely that students on the margin of dropping out of high school will be affected by tax-based aid. In this case, the estimated effect of $100 of tax-based aid is –0.08 (standard error of 0.05), relative to an average dropout rate of 10.6, implying a small effect. Lastly, I do not find evidence that there is a heterogeneous effect of the subsidy for students who may be credit constrained, by family income or by race/ethnicity (not shown).[26]

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 column (3) of Table 3. I find similar effects when only one group of ineligible students is included (not shown). However, interpreting results that include 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 two-year schools, as it allows for education spending that is less than the programs' limits. 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 1995–1996 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.[27] 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

[26] These results rely on interactions with the subsidy variable. To estimate the marginal effects of these key interaction terms, I follow the approach discussed in Ai and Norton (2003) and Norton, Wang, and Ai (2004).

[27] I estimate education spending as a function of student characteristics (gender, marital status, race/ethnicity) and parent/family characteristics (family income, parental education attainment). Results are available from the author.

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 the subsidy based on maximum spending, 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 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 column (4) of Table 3. 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.)

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 column (3) of Table 4, 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. This translates into an enrollment increase of 2.7 percentage points (9.1 percent).

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 to 19 year olds in the first two years of college by 2.2 percentage points (6.7 percent).

The finding that full-time college enrollment increases in response to tax-based federal student aid suggests several avenues for future work. For example, do students use the programs to upgrade their education? The result from one possibility considered here, that students use tax-based aid to shift away from part-time enrollment towards greater full-time enrollment, is unclear. Additional topics for future work include examining how tax-based aid impacts the transition from two-year schools into four-year schools, the decision to enroll in public versus private institutions, and the impact of tax-based aid on degree attainment, possibilities not considered here due to data limitations.

ACKNOWLEDGEMENTS

This paper represents my own research efforts and does not reflect the views or opinions of the U.S. Department of the Treasury. I thank Julie Cullen, Nora Gordon, Roger Gordon, and Robert Tannenwald for their support and helpful advice. I am grateful for comments from the editors of the National Tax Journal, William Gentry and George Zodrow, and the numerous helpful suggestions from two anonymous referees. Earlier drafts of this paper also benefited from comments received at the U.C.S.D. Applied Seminar and at the 101st annual meeting of the National Tax Association.

REFERENCES

Ai, Chunrong, and Edward Norton, 2003. "Interaction Terms in Logit and Probit Models." *Economics Letters* 80 (1), 123–129.

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

Baum, Sandy, and Patricia Steele, 2007. *Trends in Student Aid*. The College Board, New York, NY.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, 2004. "How Much Should We Trust Difference in Differences Estimates?" *The Quarterly Journal of Economics* 119 (1), 249–275.

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

Bradburn, Ellen M., 2002. "Short-term Enrollment in Postsecondary Education: Student Background and Institutional Differences in Reasons for Early Departure, 1996–1998." U.S. Department of Education, National Center for Education Statistics, Washington, DC.

Burgdorf, Barry, and Kent Kostka, 2006. "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*. U.S. Department of Education, Washington, DC.

Cameron, Stephen, and James Heckman, 1999. "Can Tuition Policy Combat Rising Wage Inequality?" In Kosters, Marvin H. (ed.), *Financing College Tuition: Government Policies and Educational Priorities*, 76–124. American Enterprise Institute Press, Washington, DC.

Cameron, Stephen, and James Heckman, 2001. "The Dynamics of Educational Attainment for Black, Hispanic and White Males." *Journal of Political Economy* 109 (3), 455–499.

Cellini, Stephanie R., 2009. "Crowded Colleges and College Crowd-Out: The Impact of Public Subsidies on the Two-Year College Market." *American Economic Journal: Economic Policy* 1 (2), 1–30.

Cornwell, Christopher, David Mustard, and Deepa Sridhar, 2006. "The Enrollment Effect of Merit Based Financial Aid: Evidence from Georgia's HOPE Program." *Journal of Labor Economics* 24 (4), 761–786.

Currie, Janet, 2006. "The Take-up of Social Benefits." In Auerbach, Alan J., David Card, and John M. Quigley (eds.), *Public Policy and the Income Distribution*, 80–148. Russell Sage Foundation, New York, NY.

Curs, Bradley, Larry Singell, and Glen Waddell, 2007. "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* 2 (3), 228–261.

Davis, Albert J., 2002. "Choice Complexity in Tax Benefits for Higher Education." *National Tax Journal* 50 (3), 509–538.

Dillon, Sam, and Tamar Lewin, 2008. "Pell Grants Said to Face a Shortfall of $6 Billion." *The New York Times*, September 17, A21.

Dynarski, Susan M., 2000. "Hope for Whom? Financial Aid for the Middle-Class and Its Impact On College Attendance." *National Tax Journal* 53 (3), 629–662.

Dynarski, Susan M., 2003. "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion." *American Economic Review* 93 (1), 279–288.

Dynarski, Susan M., 2004. "The New Merit Aid." In Hoxby, Caroline M. (ed.), *College Choices: The Economics of Where to Go, When to Go, and How to Pay For It,* 63–100. University of Chicago Press, Chicago, IL.

Dynarski, Susan M., and Judith E. Scott-Clayton, 2006. "The Cost of Complexity in Higher Education: Lessons from Optimal Tax Theory and Behavioral Economics." *National Tax Journal* 59 (2), 319–356.

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

Ellwood, David T., and Thomas J. Kane, 2000. "Who is Getting a College Education? Family Background and the Growing Gaps in Enrollment." In Danziger, Sheldon, and Jane Waldfogel (eds.), *Securing the Future: Investing in Children from Birth to College*, 283–324. Russell Sage Foundation, New York, NY.

Heller, Donald E., 1997. "Student Price Response in Higher Education: An Update to Leslie and Brinkman." *The Journal of Higher Education* 68 (6), 624–659.

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

Hoxby, Caroline M., 1998. "Tax Incentives for Higher Education." In Poterba, James M. (ed.), *Tax Policy and the Economy, Volume 12,* 49–82. MIT Press, Cambridge, MA.

Internal Revenue Service, 1998–2003. *Tax Benefits for Education: Publication 970.* Internal Revenue Service, Washington, DC.

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

Kane, Thomas J., 1994. "College Entry by Blacks Since 1970: The Role of College Costs, Family Background, and the Returns to Education." *Journal of Political Economy* 102 (5), 878–911.

Kane, Thomas J., 1997. "Beyond Tax Relief: Long Term Challenges to Financing Higher Education." *National Tax Journal* 50 (2), 335–349.

Kane, Thomas J., 1998. "Savings Incentives for Higher Education." *National Tax Journal* 51 (3), 609–620.

Kane, Thomas J., 2003. "A Quasi-Experimental Estimate of the Impact of Financial Aid on College-Going." NBER Working Paper No. 9703. National Bureau of Economic Research, Cambridge, MA.

LaLumia, Sara, 2010. "Tax Preferences for Higher Education and Adult College Enrollment." Working Paper. Williams College, Williamstown, MA.

Leslie, Larry, and Paul Brinkman, 1987. "Student Price Response in Higher Education." *Journal of Higher Education* 58 (2), 181–204.

Long, Bridget Terry, 2004. "The Impact of Federal Tax Credits for Higher Education." In Hoxby, Caroline M. (ed.), *College Choices: The Economics of Which College, When College, and How to Pay For It,* 101–168. University of Chicago Press, Chicago, IL.

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

Mercer, Charmaine, 2005. "Federal Pell Grants, Implications for Increasing Maximum Awards." CRS Report for Congress RL32923. Congressional Research Service, Washington, DC.

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

Norton, Edward C., Hua Wang, and Chunrong Ai, 2004. "Computing Interaction Effects and Standard Errors in Logit and Probit Models." *The Stata Journal* 4 (2), 154–167.

Rothstein, Jesse, and Cecilia E. Rouse, 2007. "Constrained After College: Student Loans and Early Career Occupational Choices." NBER Working Paper No. 13117. National Bureau of Economic Research, Cambridge, MA.

Seftor, Neil S., and Sarah E. Turner, 2002. "Back to School: Federal Student Aid Policy and Adult College Enrollment." *Journal of Human Resources* 37 (2), 339–352.

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

Turner, Nicholas, 2010a. "Who Benefits from Federal Student Aid? The Economic Incidence of Tax-Based Aid." Working Paper. University of California San Diego, San Diego, CA.

Turner, Nicholas, 2010b. "Why Don't Taxpayers Maximize their Tax-Based Aid Awards? Salience, Inertia and Tax Evasion in Tax-Based Aid Selection." Working Paper. University of California San Diego, San Diego, CA.

Van der Klaauw, Wilbert, 2002. "Estimating the Effect of Financial Aid Offers on College Enrollment: A Regression-Discontinuity Approach." *International Economic Review* 43 (4), 1249–1287.