Tax benefits for graduate education: Incentives for whom?

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Abstract:

Numerous studies have examined the enrollment responses of traditional undergraduate students to the introduction of government-provided tuition subsidies, but far less attention has been devoted to the elasticity of demand for graduate education. This paper examines how the tax code and government education policies affect graduate enrollment and persistence rates along with the ways in which students fund their graduate education. Our empirical methodology is based on exogenous variations in the availability of an income tax exemption for employer-provided tuition assistance for graduate courses. We find that graduate attendance among full-time workers age 24–30 is higher when the tax exemption is available, mostly due to higher persistence in public universities and vocational course work. The use of employer aid for individuals enrolled in full-time and public part-time graduate programs also increases. We present some evidence that universities may adjust tuition to capture part of the incidence.

Keywords: educational finance | tax code | graduate education | employer-provided tuition subsidies | economics

Article:

1. Introduction

There are several reasons why it is important to understand the degree to which different groups of students respond to government-provided financial incentives for education, in particular ones available through the tax code. In the 2011–2012 academic year alone, over $18 billion of student aid was in the form of federal education tax credits and deductions; about 10% of this amount was used by graduate students (College Board, 2012). In addition, in 2010, the government lost an estimated $690 million in revenue due to tax exemptions for employer-provided educational assistance (Office of Management & Budget, 2010). Understanding how such benefits are likely to affect the recipients who are targeted, as well as those who may not be, can help in the cost-benefit analysis of government spending on education. Responses to changes

in the tax treatment of employer-provided tuition assistance can also provide a better understanding of firm-provided general training. Additionally, there is still a lot to be learned about the price elasticity of demand for graduate education.

This paper examines how the tax code and government education policies affect graduate enrollment and persistence rates as well as the ways in which students fund their graduate education. The tax code may provide an incentive for someone to enroll in graduate school who would not do so without tax incentives, and it could change how students pay for graduate school conditional on the fact that they would attend without any tax benefits. Over the past two decades, the United States government has enacted several federal policies with the goal of increasing graduate education enrollment. One important policy has been the allowance of an income tax exemption for employer-provided tuition assistance up to $5250. This tax exemption can affect enrollment decisions if the student ultimately receives the benefit, which amounts to a tuition subsidy. Firms can alter the availability of tuition assistance and universities can change tuition or grant amounts to capture the incidence. The tax exemption has been in place for undergraduate courses during the whole period we study (1989–2009), but employer assistance for graduate education was not exempt prior to 1991 and between 1996 and 2002. This allows us to test for responses to the tax policy in a difference-in-difference framework.

Descriptive evidence consistent with an impact of the tax exemption based on data from the College Board (2012) is presented in Fig. 1. The solid line shows the ratio of the number of full-time equivalent (FTE) graduate students to FTE undergraduate students in the United States between the 1990–1991 and 2011–2012 academic years. This ratio varies between 0.137 and 0.151 and tends to be higher during periods when the tuition assistance exemption is available for graduate course work. Further, the dashed line represents the ratio of employer and other private-source grants2 per FTE graduate student to employer and other private grants per FTE undergraduate student during the same time period. This ratio is increasing between the 1992–1993 and 1996–1997 academic years, then remains relatively flat or decreases slightly up to the 2003–2004 year, after which it exhibits a steady growth. It appears that employer aid responds to changes in Section 127 eligibility with a slight lag but in the expected direction.

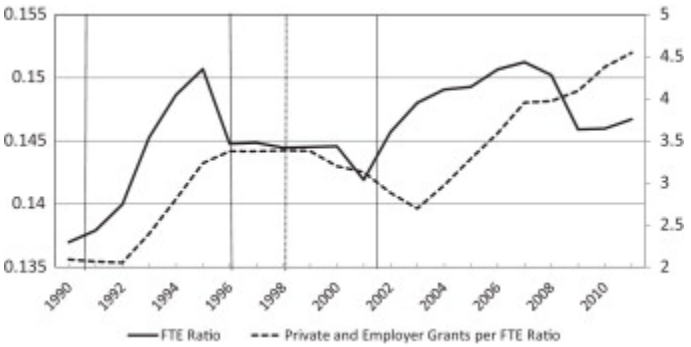

Fig. 1. Number of FTE students and employer/private grants per FTE student. The data are from the College Board (2012). The “FTE ratio” graph shows the ratio of full-time equivalent (FTE) graduate to FTE undergraduate students. The “private and employer grants per FTE ratio” represents grants from employers and other private sources per FTE graduate student divided by employer and other private grants per FTE undergraduate student. The years on the horizontal axis correspond to academic years, where 1990 stands for the 1990–1991 school year. The solid vertical lines show changes in Section 127 eligibility; the dotted vertical line shows the implementation of the Tax Relief Act.

While numerous studies have examined the enrollment responses of traditional undergraduate students to the introduction of government-provided tuition subsidies3 or to exogenous variations in the grant aid policy within specific institutions,4 far less attention has been devoted to graduate students and “nontraditional” undergraduate students.5 There is more room for increase in enrollment among older students because their attendance rates are considerably lower than the attendance rates of recent high school graduates. The incentives that older students face are likely to be very different from the driving forces behind the postsecondary enrollment of more typical college students. For example, two-thirds of undergraduate students between the ages of 18 and 23 are listed as dependents in our data while none of the individuals aged 24–30 are dependents. Older students are more likely to pay for the education themselves, rather than rely on parental transfers, so it is important to focus on personal, rather than parental income. In addition, individuals in the older age group have to balance work, family, and potentially school, both financially and in terms of time. For the reasons mentioned above, one's own employment status, among other factors, should have a strong impact on schooling decisions. In our study, employment status is given even more importance, as our identifying variation is linked to employer-provided education subsidies.

There are fewer studies that examine the role of financial aid for college persistence beyond the first year and completion, rather than first-year enrollment. Several of the papers that focus on the effects of education benefits for veterans find a positive effect of veteran benefits on the number of years of completed schooling or the fraction of college graduates in the affected population ([Angrist, 1993], [Bound and Turner, 2002] and [Stanley, 2003]). Similarly, Dynarski (2003) shows some evidence that Social Security education benefits may have a positive impact on college persistence in addition to college enrollment. Kane (2007) finds that the D.C. tuition assistance program affected both the probability of applying to and the probability of attending college, along with the type of college attended (public or private). Gicheva, Ionescu, and Simpson (2012) show that the availability of education financing can have different implications for the extensive and intensive margins of postsecondary education. Turner (2004) also points out that it is important to distinguish between college enrollment and completion when analyzing the impacts of aid policies. In the analysis here of graduate attendance rates, we consider both individuals who were enrolled in school a year before their interview date and those who were

not, so we measure overall attainment, including enrollment and persistence. We further use available data on the year of study to look at enrollment and persistence separately.

We use the exogenous changes in the tax exemption of employer-provided graduate tuition assistance to examine any accompanying changes in graduate education investments. The nature of the policy change allows us to use two different control groups: college graduates who are unemployed or out of the labor force and current and potential undergraduate students. Neither of these two groups should have been affected by the tax code changes we consider. Furthermore, we believe that the incentive was not large enough to induce individuals without an undergraduate degree to complete college in order to have access to the graduate tuition assistance exemption, or to lower workers' reservation wages. The unemployed control group allows us to remove any bias that arises from general trends in educational attainment for individuals with a college degree. Using individuals taking undergraduate courses as a control allows us to eliminate bias arising from changes in other employer policies that may be correlated with the timing of the tax exemption for graduate education. In addition, our control groups make it possible to control for other factors whose timing may be similar to the variations in Section 127 availability but which are associated with a different treated population. For example, changes in the return to education or to the opportunity cost of enrollment associated with business cycle variations are also differenced out in the estimation.

The quasi-experimental approach that we adopt avoids many of the problems of a cross-sectional study in which schooling outcomes are expressed as a function of individual characteristics, aid eligibility and the available tax incentives because the latter two are likely to be correlated with unobservables that affect schooling. We examine students' responses separately by type of program, as the relatively small monetary value of the benefit is expected to trigger more noticeable changes at less costly programs, for which a subsidy of around $1000 is more likely to matter.

Using the 1989–2009 October supplements of the Current Population Survey, we find that graduate attendance among full-time workers age 24–30 is higher when this tax exemption is available, mostly due to higher persistence in public universities. The probability of enrollment in part-time private programs and vocational non-degree courses also increases. We do not see these relationships in the case of undergraduate enrollment. We then examine the proportion of students in the National Postsecondary Student Aid Study who use educational assistance from their employer. We find that use of employer aid for individuals enrolled in full-time graduate programs, both public and private, increases relative to similarly aged students enrolled in undergraduate programs when the tax exemption is available. We also find an increase in

average tuition paid for all graduate students relative to similarly aged students in undergraduate classes when the subsidy is in place. It is unclear, however, if this is a supply effect (universities increasing tuition) or a demand response (students enrolling in more expensive universities).

The rest of the paper is organized as follows. Section 2 provides more information about the tax treatment of employer-provided tuition assistance; Section 3 examines how the tax exemption affects enrollment decisions and utilizes the CPS data; Section 4 uses the NPSAS data set to address how enrolled individuals finance their education and whether employers or universities respond the to tax exemption, and Section 5 concludes.

2. Tax treatment of employer tuition assistance

According to a provision in the IRS tax code known as Section 127, employer contributions towards tuition are treated like other fringe benefits. They are reported on employees' W-2 forms but are tax exempt up to $5250,6 as long as the employer has a qualified educational assistance program. The course work does not need to be related to the job or lead to a degree for the tax benefit to apply, but education involving sports, games and hobbies is not eligible, unless directly related to the job. Expenditures that are included in the exemption are tuition, fees, books, supplies, and equipment, but not meals, room and board, and transportation. In March 2007, 49% of workers had access to work-related educational assistance through their firm, and non-work related assistance was available to 15% of employees. These numbers are higher for management and professional workers, full-time and unionized employees, as well as those who earn higher wages and work in larger establishments. There are also small geographic differences in the incidence of education assistance programs (U.S. Bureau of Labor Statistics, 2007). Employers can deduct the full cost of educational assistance from their annual income if the firm has a tuition reimbursement plan.

Section 127 has been extended several times, but the only amendments made since 1986 have been the inclusion or exclusion of graduate education; the coverage limit has remained unchanged.7 In 1990, Section 127 was amended and the $5250 exemption was applied to graduate education undertaken after January 1, 1991. A 1996 amendment excluded graduate education from Section 127 after June 30 of that year, but graduate courses were included again starting in January of 2002. We are not aware of any specific reason for which any of the changes were made that may be related to individual investment decisions. For more information on Section 127, see Levine and Lyke (2002) and Levine (2008).

The tuition assistance deduction was the main tax incentive for higher education until the Tax Relief Act (TRA) of 1997 was passed. A discussion of the provisions of the TRA and other tax benefits and education financing sources for graduate students is available in Appendix A. The timing and changes of the tax benefits for which graduate students are eligible are summarized in Fig. 2. Our estimation strategy allows for flexible functional forms that account for the effects these additional policies may have on education investment decisions while identifying the impact of the tax exemption for employer provided tuition assistance from the exogenous variation in its availability.

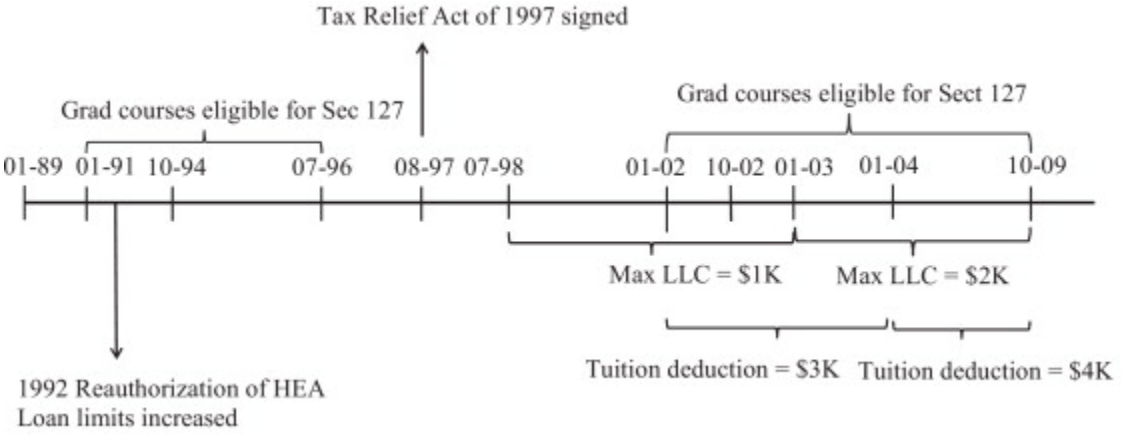

Fig. 2. Timeline of tax benefits for graduate education.

3. Attendance incentives

3.1. Attendance specifications

We use the 1989–2009 October supplements of the Current Population Survey to examine the changes in attendance rates associated with Section 127. The CPS allows us to use fairly large samples, which are representative of the U.S. population. We focus our attention on the October surveys because they contain school enrollment information for the current and previous years.

Given the availability of two separate control groups (unemployed college graduates and potential undergraduate students), we adopt a triple difference style approach in order to examine how changes in the tax treatment of employer-provided tuition assistance affect attendance rates in the CPS. A difference-in-difference approach has been used in Dynarski (2000) to evaluate the impact of Georgia's HOPE Scholarship on college attendance, and by Dynarski (2003) to examine the 1982 elimination of the Social Security Benefits Program for students with a deceased parent. Kane (2003) and Long (2004) use a similar approach to evaluate how the CalGrant program and the Hope and Lifetime Learning Credits, respectively, affected college enrollment.

Using the CPS employment status, we estimate a model of the form

$$\begin{aligned}\text{Attend}_{it} &= f\{X_{it}'\beta + (\text{Income}_{it}')\delta + \gamma_1(\text{Sec127}_t) + \gamma_2(\text{Grad}_{it}) + \gamma_3(\text{Empl FT}_{it}) \\ &+\gamma_4(\text{Empl PT}_{it}) + \eta_1(\text{Sec127}_t \times \text{Empl FT}_{it}) + \eta_2(\text{Sec127}_t \times \text{Empl PT}_{it}) \\ &+\eta_3(\text{Grad}_{it} \times \text{Empl FT}_{it}) + \eta_4(\text{Grad}_{it} \times \text{Empl PT}_{it}) + \eta_5(\text{Grad}_{it} \times \text{Sec127}_t) \\ &+\lambda_1(\text{Grad}_{it} \times \text{Sec127}_t \times \text{Empl FT}_{it}) + \lambda_2(\text{Grad}_{it} \times \text{Sec127}_t \times \text{Empl PT}_{it}) + \varepsilon_{it}\},\end{aligned}$$

where *Xi* contains demographic information, a quadratic in time, indicators for enrollment in the previous year and for $t \geq 1993$,[8] as well as the one-year lag of the state unemployment rate. The income vector consists of indicators for low and medium income (the high income category is excluded), and the interactions of each income category with an indicator for $t \geq 1998$, which should account for some of the changes in enrollment that are due to the TRA of 1997.[9] The binary variables *Empl PT* and *Empl FT*indicate part-time and full-time employment status, respectively, and *Grad* equals 1 for individuals with completed college education, who comprise the group of potential graduate students. The *Sec127* variable is an inflation-adjusted measure of tax benefits for the recipients of graduate tuition assistance. Our "treatment" group is comprised of employed college graduates, who would be affected by the changes in Section 127 benefits if they decide to use employer-provided grant aid. In this case the estimated coefficients of interest λ_1 and λ_2 measure the intention to treat.

We estimate Eq. (1) for high school graduates between the ages of 24 and 30. The triple difference model does not allow other coefficients to vary by education status. In addition, low undergraduate attendance rates at private institutions for the age groups of interest may make college students a less than ideal control group. For these reasons, we also estimate several sets of difference-in-difference models:

$$\begin{aligned}\text{Attend}_{it} &= f\{X_{it}'\beta + (\text{Income}_{it}')\delta + \gamma_1(\text{Sec127}_t) + \gamma_3(\text{Empl FT}_{it}) + \gamma_4(\text{Empl PT}_{it}) \\ &+\lambda_1(\text{Sec127}_t \times \text{Empl FT}_{it}) + \lambda_2(\text{Sec127}_t \times \text{Empl PT}_{it}) + \varepsilon_{it}\}.\end{aligned}$$

Eq. (2) is estimated for two separate groups: college graduates and high school graduates without a Bachelor's degree. The coefficients of interest are λ1 and λ2. We can look across specifications to compare the Section 127 attendance effects on potential graduate students, who would be affected by the changes, and potential undergraduate students, who should not be affected. We expect the models in (1) and (2) to yield similar results because they are based on the same estimation strategy.

We further consider in more detail what year of school a respondent is attending to investigate more closely the Section 127 effects on graduate enrollment and persistence. The tax exemption lowers the cost of each year of education. For programs in which individuals are less price

sensitive once enrolled, we would expect to see larger effects on first-year attendance rates than on upper-year attendance. These models also follow the structure in (2), but the dependent variables are based on reported year of attendance.

We estimate Eqs. (1) and (2) by probit separately for each attendance variable (part-time public, part-time private, full-time public, full-time private and vocational courses).10 It has been pointed out (e.g. Greene, 2010) that the traditionally used marginal effects are not valid in the probit model when the explanatory variables of interest are interaction terms. Puhani (2012) notes that the treatment effect in a difference-in-difference probit model is given by

$$\begin{aligned} \hat{TE} &= E[Y^1|\text{Empl FT} = 1, \text{Sec127} = 1, X] - E[Y^0|\text{Empl FT} = 1, \text{Sec127} = 1, X] \\ &= \Phi(\gamma_1 + \gamma_3 + \lambda_1 + X\beta) - \Phi(\gamma_1 + \gamma_3 + X\beta), \end{aligned}$$

which equals zero if and only if λ1 is zero and has the same sign as λ1 (similar for part-time employment status). Thus, we report and conduct hypothesis testing on the linear index coefficients and in addition show the treatment effects estimated using (3) at the mean value of the covariates for employed individuals. The standard errors are clustered on the state level to account for the CPS sampling design and for state-level education policies.11

3.2. Attendance data

We restrict the estimation to the CPS reference person and his or her spouse. It is not clear how relevant the family income variable reported in the CPS is with regard to the schooling decisions of other household members. For example, an adult child of the reference person may be financially independent but living in the same household. Since the CPS definition of reference person is “the person (or one of the persons) in whose name the housing unit is owned or rented,” limiting the sample in this way should also guarantee that most of the individuals we study are independent from their parents. The age group we focus on is 24–30 year-olds. We exclude people younger than 24 because we are interested in the incentives created by tax benefits for financially independent individuals, and the IRS allows full-time students younger than 24 to be claimed as dependents. In addition, the age restriction is appropriate given that our study is directed at graduate education.12

Attendance measures are based on reported grade or year for respondents who identify themselves as students: “1st year of college” through “4th year of college;”13 “1st year of graduate school” and “2nd year or higher of graduate school.” The CPS October Supplement also asks whether students are attending a public or private institution. Full-time or part-time enrollment status is self-reported, so the definition may vary across respondents.

The descriptive statistics in Table 1 show that between 6 and 7% of college graduates are attending a part-time graduate program when interviewed, with public programs more than twice as popular as private ones. The rates are somewhat higher in years when Section 127 is not available to graduate students. The attendance rate is similar for public institution attendance among high school graduates with no Bachelor's degree (columns 3 and 4 of Table 1) but slightly higher when the tuition deduction applies to graduate studies. Private enrollment is consistently under 1% for this group. In addition to part-time and full-time programs, we also consider whether an individual reports taking "business, vocational, technical, secretarial, trade or correspondence courses." The vocational studies variable is relevant since Section 127 covers course work that may not lead to a degree. Non-degree vocational course work usually constitutes a smaller financial and time commitment than a degree program that may take several years to complete, so we expect such education to be more sensitive to the Section 127 benefit availability. Slightly more than 3% of respondents report taking such classes at the time when interviewed, with little variation by year or graduate/undergraduate status.

Table 1. CPS summary statistics.

Section 127 available to graduate students	College graduates		HS, no Bachelor's	
	Yes	No	Yes	No
Program attended:				
Part-time public	0.042	0.049	0.044	0.042
Part-time private	0.020	0.021	0.006	0.007
Full-time public	0.045	0.042	0.047	0.038
Full-time private	0.030	0.026	0.009	0.007
Vocational courses	0.033	0.033	0.032	0.031
Employed part-time	0.085	0.085	0.102	0.101
Employed full-time	0.796	0.803	0.687	0.715
Age	27.4	27.4	27.2	27.2
	(1.9)	(1.9)	(2.0)	(2.0)
White	0.836	0.850	0.813	0.826

Section 127 available to graduate students	College graduates		HS, no Bachelor's	
	Yes	No	Yes	No
Asian	0.078	0.074	0.022	0.023
Female	0.552	0.544	0.539	0.544
Married, spouse present	0.594	0.615	0.636	0.669
Was enrolled in school last year	0.191	0.192	0.111	0.102
Low income	0.058	0.072	0.178	0.193
Medium income	0.601	0.688	0.716	0.739
High income	0.341	0.240	0.106	0.068
N	30,761	18,380	62,945	40,517

Summary statistics using CPS individual weights. The samples consist of individuals age 24‑30, $1989 \leq t \leq 2009$.

Family income is reported as a categorical variable in the CPS data, which introduces much noise in our measure of income and makes it hard to determine respondents' eligibility for many of the tax benefits. Thus, we do not draw any conclusions about the enrollment effects of income-contingent benefits, such as the Lifetime Learning Credit (LLC), but nonetheless use income as a control. Since the income categories do not change over time (with the exception of an additional category at the top of the distribution starting with the 2003 survey), it is also not possible to systematically account for inflation. Then it is not surprising that average income is higher in years when Section 127 is available to all students, since this period includes the most recent time interval (2002–2009). The income measure that we use consists of three categories: low income (less than $10,000 for single respondents and less than $20,000 if married), medium income ($10,000–$49,999 if single; $20,000–$74,999 if married) and high income (all others). The low income category aims to include individuals whose income is too low to be taxable, which would make the tax benefits inapplicable. The high income category is constructed to include respondents whose income is above the eligibility cutoff for many of the benefits. Among high school graduates between the ages of 24 and 30 with no college degree, only 9% have high family income (11% when Section 127 is available to everyone and 7% during the rest of the sample period), and 18% have low income. Not surprisingly, family income is higher among college graduates. The main findings are robust to variations in the cutoffs for the income categories and to excluding income altogether from the regressions. The rest of the descriptive

statistics in Table 1 indicate that there is little difference in the CPS samples as a function of Section 127 status.

To indicate Section 127 availability and eligibility we first construct a variable that equals 1 in years 1991–1995 and 2002–2009. These are all years for which Section 127 benefits could be applied to graduate classes taken during the month of October. Because the nominal amount of the tax exemption did not change over time, we adjust the value of the benefit for inflation, indexing it to the 2009 Consumer Price Index for all items and all urban consumers.14 The models in (1) and (2) include interactions of the resulting variable with part-time and full-time employment status, since individuals who are unemployed or out of the labor force cannot take advantage of this benefit. We use the CPS labor force and part-time/full-time definitions.15 College graduates are more likely to be employed full-time than respondents in the less educated sample; the difference is 10 percentage points. Respondents without a Bachelor's degree are slightly more likely to be employed part-time, but also more likely to be unemployed or out of the labor force.

Finally, we control for the one year lag of the state-level annual unemployment rate for all workers from the Local Area Unemployment Statistics series provided by the BLS. There is evidence that unemployment may have an effect on postsecondary educational enrollment and the return to postsecondary degrees ([Betts and McFarland, 1995], [Bedard and Herman, 2008], [Kahn, 2010] and [Johnson, 2013]), although the CPS results do not indicate such a relationship among the age group of interest.

3.3. Attendance results

Graphical evidence of the impact of Section 127 availability on graduate enrollment rates is presented in Fig. 3. For every year between 1989 and 2009, we show the fraction of full-time employees in our CPS sample with a college degree who are enrolled in a part-time, full-time or vocational graduate program. We use the individual CPS weights to adjust the means since we do not condition on demographics, and detrend the series by regressing on a quadratic in time and reporting the residuals. We construct a similar time series for the fraction of full-time employees with a high school diploma but without a Bachelor's degree who are enrolled in an undergraduate program. In order to smooth the series, we graph the weighted running-means using six-year bandwidths.

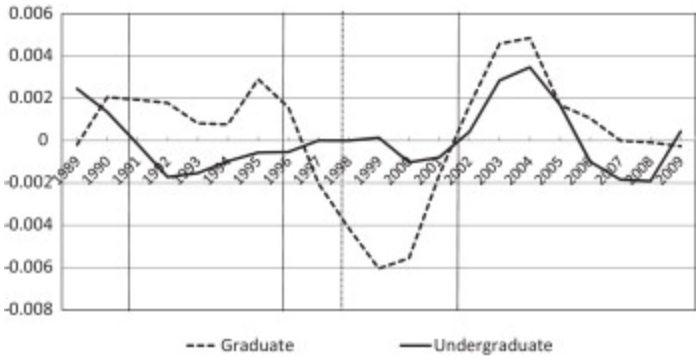

Fig. 3. Enrollment rates among full-time workers in the CPS. Fraction of students attending full-time, part-time and vocational programs among full-time workers with a Bachelor's degree (graduate graph) or a high school degree and no Bachelor's (undergraduate graph). Rates are calculated using CPS individual weights. The numbers shown are mean-smoothed residuals from regressions of enrollment rates on a quadratic in time. The solid vertical lines show changes in Section 127 eligibility; the dotted vertical line shows the implementation of the Tax Relief Act.

The trends in Fig. 3 parallel the pattern from Fig. 1 and are consistent with a positive response to Section 127. In particular, the detrended graduate enrollment rate for full-time employees is higher in the early 1990s compared to 1989 and 1997–2001, and we see another spike shortly after the 2002 inclusion of graduate course work in Section 127. The solid line in Fig. 3 reveals that undergraduate enrollment among full-time workers also increased briefly in the early 2000s but exhibits a dip between 1991 and 1996. The regression analysis that follows allows us to explore the enrollment response further by program type and year of study. In addition, we are able to make use of both control groups that are available and to condition on demographics and other available information.

3.3.1. Attendance rates at public and private institutions

Table 2 shows Eq. (1) estimation results for the CPS sample of high school graduates between the ages of 24 and 30. The dependent variables are part-time attendance in public (column 1) and private (column 2) universities, full-time public (column 3) and private (column 4) attendance and vocational course work (column 5).

Table 2. CPS triple difference results – public/private attendance.

	PT public	PT private	FT public	FT private	Vocational
Grad × Sec 127 × Empl FT	0.0981	0.1451	0.1604**	0.0444	0.2327***
	(0.0711)	(0.1235)	(0.0649)	(0.0652)	(0.0631)

	PT public	PT private	FT public	FT private	Vocational
Grad × Sec 127 × Empl PT	−0.0348	0.2899*	0.1489**	0.0833	0.1810*
	(0.0892)	(0.1497)	(0.0718)	(0.0903)	(0.0981)
Section 127 available	0.0236	0.0070	0.0475**	0.0363	0.0796***
	(0.0354)	(0.0660)	(0.0234)	(0.0381)	(0.0281)
Grad	−0.1880***	0.1506	0.0533	0.8501***	0.0391
	(0.0582)	(0.1094)	(0.0618)	(0.0916)	(0.0502)
Employed FT	0.2925***	0.2615***	−0.9380***	−0.5391***	−0.0359
	(0.0363)	(0.0799)	(0.0402)	(0.0589)	(0.0298)
Employed PT	0.2056***	0.2229***	0.1258***	0.0514	−0.0123
	(0.0594)	(0.0847)	(0.0400)	(0.0663)	(0.0435)
Section 127 × employed FT	−0.0244	0.0030	−0.0225	0.0177	−0.0791***
	(0.0365)	(0.0781)	(0.0283)	(0.0457)	(0.0283)
Section 127 × employed PT	0.0368	−0.1119	−0.0790**	−0.1075	−0.0624
	(0.0502)	(0.0971)	(0.0378)	(0.0704)	(0.0489)
Employed FT × Grad	0.1566**	0.1331	−0.2595***	−0.6962***	−0.0629
	(0.0649)	(0.1209)	(0.0759)	(0.0922)	(0.0615)
Employed PT × Grad	0.0779	−0.0764	−0.0063	−0.3917***	−0.1357
	(0.0945)	(0.1377)	(0.0712)	(0.0974)	(0.0935)
Section 127 × Grad	−0.1112*	−0.1623	−0.0859*	−0.0690	−0.1813***
	(0.0615)	(0.1169)	(0.0508)	(0.0597)	(0.0616)
Low income	−0.2107***	−0.4571***	0.3227***	0.2481**	−0.0474
	(0.0393)	(0.0577)	(0.0653)	(0.1135)	(0.0483)
Medium income	0.0113	−0.2534***	0.1636***	0.0891	−0.0202
	(0.0344)	(0.0415)	(0.0593)	(0.0964)	(0.0480)

	PT public	PT private	FT public	FT private	Vocational
Low income and $t \geq 1998$	0.0645	0.0315	−0.1063**	−0.1090	0.1119**
	(0.0470)	(0.1041)	(0.0522)	(0.0904)	(0.0467)
Medium income and $t \geq 1998$	0.0199	0.0831	−0.0163	−0.0001	0.0637*
	(0.0305)	(0.0506)	(0.0365)	(0.0784)	(0.0363)
High income and $t \geq 1998$	0.0313	−0.0333	0.0005	−0.0368	0.0680
	(0.0407)	(0.0631)	(0.0766)	(0.0954)	(0.0572)
Treatment effect at $\overline{X}$					
Grad × Sec 127 × Empl FT	0.0065	0.0040	0.0024	0.0006	0.0131
Grad × Sec 127 × Empl PT	−0.0026	0.0069	0.0023	0.0011	0.0107
$\overline{Y}$ for employed (FT or PT) college graduates when Sec 127 unavailable					
	0.0496	0.0227	0.0295	0.0146	0.0315

Estimation results for Eq. (1). The dependent variable is an attendance indicator for the given program. The reported coefficients are from probit models, with treatment effects defined in Eq. (3). The sample consists of high school graduates age 24–30, $1989 \leq t \leq 2009$. The controls include quadratics in age and t, race, gender, marital status, state dummies, the state's unemployment rate from the previous year and indicators for previous year enrollment and for $t \geq 1993$ (post-HEA reauthorization). The standard errors are clustered on the state level. N = 152, 603.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

We find that the impact of Section 127 is strongest for vocational graduate education and is also positive and statistically significant for full-time public programs (marginally significant in the part-time private model). The availability of Section 127 benefits, adjusted for inflation, increases full-time graduate attendance at public institutions by slightly more than two tenths of a percentage point relative to the control groups, which corresponds to an 8% increase relative to the baseline rate for employed college graduates. The estimated effects are larger for vocational courses. The corresponding coefficients on the interaction between Section 127 and graduate

education are negative and significant at the 10% level, indicating that fewer respondents who are unemployed or out of the labor force attend such programs when tax-free employer assistance is available. Given that employment status is not truly exogenous, the negative estimate for $\eta 5$ and positive estimates for $\lambda 1$ and $\lambda 2$ may also indicate that more graduate students choose to remain employed while attending school and possibly use employer-provided tuition assistance, as opposed to leaving work for the duration of their studies, although this seems unlikely given the limited value of the benefit. The effect on part-time public graduate programs is also relatively large (0.7 percentage points for full-time workers but not significant at the 10% level). Full-time public attendance rates being more responsive than full-time attendance rates at private institutions supports the idea that a relatively small benefit such as Section 127 should not have strong incentive effects on the margin for individuals considering high-cost education.

The estimates for $\eta 1$ and $\eta 2$ suggest that fewer part-time employees attend full-time undergraduate programs and fewer full-time workers take undergraduate vocational courses when Section 127 is available for graduate studies compared to other years covered by the sample period. At the same time, we see a switch toward undergraduate attendance by respondents who are not working (measured by the uninteracted coefficient on Section 127). The magnitudes of all these estimates are again smaller in absolute value than the estimated coefficients for graduate students. It is possible that we see some degree of crowding out of employer-provided resources when they become more valuable to college graduates who desire to continue their education.

The post-1997 income interactions in Table 2 are significant for the low-income group, where the sign of this coefficient is negative in column 3 (full-time public education) and positive in column 5 (vocational education). The medium income interaction is also positive and significant in column 5, but all others coefficients are noisy or close to zero. One interpretation of these estimates is that the introduction of the Lifetime Learning Credit had little effect on students age 24–30, but it could also be the case that the Section 127 and employment status interactions are picking up part of the effects, since our income variable is measured with a lot of error, and employment status tends to be highly correlated with income. The rest of the results in Table 2 are not sensitive to the exclusion of the income variables.

We next split the sample based on whether respondents completed a Bachelor's degree and show estimates for Eq. (2) in Table 3. The estimates in Panel A (college graduates age 24–30) and B (high school graduates age 24–30) mirror the triple difference results from Table 2, which is not surprising given that the estimation approaches are similar. The interaction between Section 127

and full-time employment is positive and significant for the graduate part-time private, full-time public and vocational attendance specifications and positive but not significant in the other two models. The interaction with part-time employment is largest and only significant for part-time private graduate programs. The estimated treatment effects have similar magnitudes. In the undergraduate sample in Panel B the interactions between Section 127 and employment status are either close to zero or negative and significant.

Table 3. CPS difference-in-difference results – public/private attendance.

	PT public	PT private	FT public	FT private	Vocational
A. Graduate (N = 49, 141)					
Section 127 and employed FT	0.0671	0.1967**	0.1582***	0.0721	0.1469**
	(0.0663)	(0.0918)	(0.0548)	(0.0590)	(0.0583)
Section 127 and employed PT	−0.0130	0.2372*	0.0528	−0.0189	0.1155
	(0.0888)	(0.1212)	(0.0558)	(0.0764)	(0.0823)
Section 127 available	−0.0822	−0.1969**	−0.0580	−0.0739	−0.0983*
	(0.0572)	(0.0977)	(0.0494)	(0.0597)	(0.0542)
Treatment effect at $\overline{X}$					
Sec 127 and employed FT	0.0044	0.0049	0.0027	0.0007	0.0088
Sec 127 and employed PT	−0.0009	0.0056	0.0010	−0.0002	0.0071
B. Undergraduate (N = 103, 462)					
Section 127 and employed FT	−0.0230	−0.0057	−0.0156	0.0241	−0.0791***
	(0.0378)	(0.0783)	(0.0290)	(0.0486)	(0.0286)
Section 127 and employed PT	0.0287	−0.1126	−0.0885**	−0.1155	−0.0631
	(0.0517)	(0.0988)	(0.0386)	(0.0730)	(0.0500)
Section 127 available	0.0212	0.0068	0.0471**	0.0568	0.0779***
	(0.0363)	(0.0700)	(0.0238)	(0.0383)	(0.0287)
Treatment effect at $\overline{X}$					

	PT public	PT private	FT public	FT private	Vocational
Sec 127 and employed FT	−0.0015	−0.0001	−0.0003	0.0002	−0.0054
Sec 127 and employed PT	−0.0018	0.0013	−0.0020	−0.0010	−0.0043

Estimation results for Eq. (2). The dependent variable is an attendance indicator for the given program. The reported coefficients are from probit models, with treatment effects defined in Eq. (3). The sample consists of college graduates (Panel A) or high school graduates without a college degree (Panel B) age 24‑30, $1989 \leq t \leq 2009$. The controls include income categories and their interactions with $t \geq 1998$, the state's unemployment rate from the previous year, quadratics in age and *t*, race, gender, marital status, state dummies and indicators for previous year enrollment and for $t \geq 1993$ (post-HEA reauthorization). The standard errors are clustered on the state level.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

3.3.2. Effects of Section 127 on enrollment and persistence

The results in Table 4 address the difference between initial enrollment and subsequent persistence in the program of study. We construct separate dependent variables when the reported year of study is “1st year of graduate school” (“1st year of college”) and “2nd year or higher of graduate school” (“2nd year of college” through “4th year of college”). The first variable is designed to measure changes in enrollment, while the second variable should focus on persistence.16

Table 4. CPS difference-in-difference results ‑ enrollment and persistence.

	Public		Private	
	1st year	2nd+ year	1st year	2nd+ year
A. Graduate part-time programs (N = 49, 141)				
Section 127 and employed FT	−0.0063	0.1670**	0.3145***	0.0206
	(0.0839)	(0.0666)	(0.1092)	(0.1237)
Section 127 and employed PT	−0.0241	0.0530	0.3986**	0.0113

	Public		Private	
	1st year	2nd+ year	1st year	2nd+ year
	(0.1271)	(0.0930)	(0.1667)	(0.1510)
Section 127 available	0.0303	−0.2197***	−0.2939***	−0.0452
	(0.0813)	(0.0671)	(0.0983)	(0.1305)
Number obs. with $Y = 1$	965	1189	453	567
B. Graduate full-time programs (N = 49, 141)				
Section 127 and employed FT	0.1360**	0.1471**	0.1447*	0.0061
	(0.0591)	(0.0710)	(0.0781)	(0.0612)
Section 127 and employed PT	−0.0504	0.1012	0.0937	−0.0988
	(0.0762)	(0.0724)	(0.1009)	(0.0721)
Section 127 available	−0.0327	−0.0624	−0.1044	−0.0218
	(0.0533)	(0.0608)	(0.0648)	(0.0627)
Number obs. with $Y = 1$	692	1478	445	945
C. Undergraduate part-time programs (N = 103, 462)				
Section 127 and employed FT	−0.0295	−0.0067	0.0092	0.0054
	(0.0452)	(0.0592)	(0.1002)	(0.1188)
Section 127 and employed PT	0.0413	0.0248	0.1187	−0.1387
	(0.0577)	(0.0742)	(0.1691)	(0.1303)
Section 127 available	0.0467	−0.0071	0.0507	−0.0178
	(0.0401)	(0.0536)	(0.0851)	(0.1158)
Number obs. with $Y = 1$	1255	3048	164	553
D. Undergraduate full-time programs (N = 103, 462)				

	Public		Private	
	1st year	2nd+ year	1st year	2nd+ year
Section 127 and employed FT	−0.0762	0.0231	−0.0476	0.0729
	(0.0533)	(0.0405)	(0.0843)	(0.0585)
Section 127 and employed PT	−0.0438	−0.0919**	−0.2669**	−0.0396
	(0.0486)	(0.0453)	(0.1241)	(0.0812)
Section 127 available	0.0680*	0.0222	0.1729***	−0.0096
	(0.0367)	(0.0310)	(0.0662)	(0.0454)
Number obs. with $Y = 1$	835	3632	170	690

Estimation results for Eq. (2). The reported coefficients are from probit models. The sample consists of college graduates (Panel A and B) or high school graduates without a college degree (panels C and D) age 24‑30, $1989 \leq t \leq 2009$. The controls include income categories and their interactions with $t \geq 1998$, the state's unemployment rate from the previous year, quadratics in age and *t*, race, gender, marital status, state dummies and indicators for previous year enrollment and for$t \geq 1993$ (post-HEA reauthorization). The standard errors are clustered on the state level.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

Panel A of Table 4 shows results for part-time graduate attendance, and Panel B focuses on full-time graduate attendance. We see that inflation-adjusted Section 127 availability increases the relative persistence of full-time employees in part-time and full-time public programs (the treatment effect at the mean level of the covariates for full-time workers is 0.0041 for part-time programs and 0.0011 for full-time programs), possibly at the expense of decreasing the probability of second or higher year attendance of individuals who are unemployed or out of the labor force. As discussed previously, this may reflect a trend of more students staying with their employers until completion of the graduate program. Both full-time and part-time employment are positively related to enrollment in private part-time programs when the tuition deduction can be applied to graduate studies; the estimated treatment effects equal 0.0042 and 0.0049, respectively. Parallel to the findings from columns 3 and 4 of Table 2 and Table 3, the change in full-time attendance for workers is more pronounced in the case of public institutions. We also

see that the effect is most consistent in columns 2 and 3 of Table 4, the public program persistence and private program enrollment specifications. Full-time employment is associated with an increase both in second or higher year attendance rates and in first-year enrollment when the tax deduction can be used for graduate studies.

Panels C and D repeat the estimation for undergraduate education. All of the full-time program coefficients are close to zero and statistically insignificant. Two of the part-time public program coefficients on Section 127 interacted with employment status are negative and significant at the 5% level. This indicates once again that making Section 127 available to graduate students did not increase undergraduate attendance.

Overall, the CPS results presented in this section show that the graduate attendance response to the tax deduction for employer-provided tuition assistance is small but positive for working college graduates. It is not surprising that the effect we find is small given the limited incentive value of the benefit. The attendance rates of workers with a high school diploma but no college degree are unaffected or fall slightly, which may suggest that employers may redistribute part of the resources they devote to tuition assistance as a result of increased demand for graduate subsidies.

4. Effects on financing

4.1. Financing empirical specification

We use the National Postsecondary Student Aid Study (NPSAS) data to uncover whether the way students finance their education changes when employer tuition assistance is tax-favored. More graduate students should report receiving any employer tuition assistance if there is an enrollment response to the exemption. The policy could also change the mix of students even if overall enrollment remains the same or decreases. When estimating the effect of the tax exemption on the probability of using employer-provided tuition assistance and the amount of assistance we can no longer use the unemployed as a control group because by definition they cannot receive any tuition assistance whether there is an exemption or not. We do not drop non-workers because the employment decision is not exogenous and some non-workers may take a leave of absence from work to attend school full-time, then return to work. The baseline model that we estimate using the NPSAS data is a difference-in-difference specification given by

$$\begin{aligned} Y_{it} = \quad & f\{X_{it}'\beta + \gamma_1(\text{Sec127}_t) + \gamma_2(\text{Grad}_{it}) \\ & + \lambda(\text{Grad}_{it} \times \text{Sec127}_t) + \varepsilon_{it}\}, \end{aligned}$$

where the vector X includes race, gender, a quadratic in age, marital status, income, the one-year lag of the state unemployment rate and a quadratic in time. The coefficient of interest, λ, in this case is a measure of the treatment effect on the treated. Following Puhani (2012) as explained in Section 3.1, we report treatment effects at the mean from

$$\begin{aligned}\hat{TE} &= E[Y^1|\text{Grad} = 1, \text{Sec127} = 1, X] \\ &\quad - E[Y^0|\text{Grad} = 1, \text{Sec127} = 1, X] \\ &= \Phi(\gamma_1 + \gamma_2 + \lambda + X\beta) - \Phi(\gamma_1 + \gamma_2 + X\beta).\end{aligned}$$

We explore how graduate students finance their degrees by estimating the model in Eq. (4) using different versions of the dependent variable. First, we estimate a probit model in which Yit is an indicator for any employer-provided tuition assistance received during the academic year when the interview took place. An increase in the proportion of graduate students who use employer-provided tuition reimbursement during periods when Section 127 applies to this type of aid could indicate one of two things. It is possible that graduate enrollment increases and marginal individuals who would not have undertaken the education without the deduction enroll when the cost drops by the tax deduction amount. We cannot distinguish this scenario from the case in which enrollment remains the same but students shift towards using more employer-provided aid because either its value increases or because more firms start offering this benefit. Thus, it is important to consider both the CPS and NPSAS results.

We then examine in more detail how the students who use employer tuition assistance finance their degrees and how universities respond to the tax incentive in order to shed light on who captures the incidence of the tuition subsidy. The incidence will fall on firms if they change the amount of tuition assistance offered in response to the change in the tax code. For example, suppose a firm provides $5000 in tuition assistance of which the student must pay $1000 in taxes (assuming a 20% average tax rate) if the tuition assistance is not exempt. When the assistance becomes exempt, the employer could decrease the assistance offered to $4000 and the student could pay $1000 to cover the difference. The student is thus no better or worse off, but the firm has reduced its labor costs. We estimate a model in which the dependent variable is the amount of employer tuition assistance, conditional on receiving any aid. In an unconditional regression we may find that the average graduate student uses more assistance simply because more students use it. However, conditioning on any aid will uncover how much aid the students are able to use. Researchers have also pointed out that educational institutions may increase tuition costs or lower the amount of aid they offer in response to the introduction or expansion of education tax benefits (e.g. [Hoxby, 1998], [Long, 2004] and [Turner, 2012]). We therefore estimate Eq. (4) by OLS with a dependent variable that measures the amount (in 2009 dollars) of listed tuition and by Tobit for the amount of institutional grants received, as there is a large proportion of students who receive no institutional aid. An increase in tuition for graduate students relative to undergraduates when the tax exemption is in place can reflect institutions

increasing tuition or it could be that students enroll in more expensive programs when the tax exemption is in place. We are unable to distinguish between these two cases. Combining these two ideas, we estimate how the employer's share of tuition changes in response to the change in the tax code. Finally, we estimate a model with the total cost of attendance for the survey year, which includes tuition, fees, books and living expenses, as the dependent variable using OLS. This is the total expenditure from the student as well as all sources of aid including grants, loans and waivers. Conditioning on receiving any tuition assistance is important again as we want to know how the students factor this aid into their total budget. Do students think of this aid as fungible or as a supplement to what they would have spent? As in the CPS specifications, the standard errors are clustered at the state level.

4.2. Financing data

We use the 1989–1990, 1992–1993, 1995–1996, 1999–2000, 2003–2004 and 2007–2008 waves of the NPSAS to analyze how graduate students finance their education.17 NPSAS surveys individuals who are enrolled in the current school year about their finances and supplements these data with individual-level institutional records. Both undergraduate and graduate students are interviewed. The survey includes detailed and accurate accounts of the dollar amounts of different types of grants received, including employer tuition assistance and institutional grants, loans, the amount of tuition charged by the institution and the amount of other fees and living expenses. Information on whether a student is enrolled part-time or full-time, the type of degree and whether the school is public or private allows us to examine the impact of the tax exemption on different types of students.

Income is taken from the Free Application for Federal Student Aid (FAFSA) if the student filled one out. If not, then the student selects an interval that her income falls into and this information is used to impute an income value. Thus, the income variable is more reliable than in the CPS data but is still subject to some measurement error. All of our results are robust to dropping the income variable as a control. We restrict our sample to students aged 24–30 as none of them are dependents.

Trends in student financing follow those reported by the College Board (2012).18 Employer tuition assistance has stayed close to 20% of total funding for graduate students as a whole, but grants have made up a smaller fraction of funding over time, being replaced by loans, especially from the Stafford program. In 2008, loans made up roughly 54% of total funding. Work-study and grants from the State and Federal government make up a negligible amount of aid for graduate students. Graduate students receive some grants from their institutions, making up

anywhere from 6 to 17% of total funding in a given year. Since the amount of grants being awarded has fallen over time relative to tuition, the tuition assistance tax exemption could have a significant effect on maintaining or increasing graduate enrollment.

Comparing demographic characteristics of the NPSAS data in Table 5 to those in the CPS in Table 1, we find that students are slightly younger and less likely to be married than the population as a whole and less likely to be white but more predominantly Asian. In both data sets, about half of the graduate students are in part-time programs. Graduate students are more likely to receive aid from their employers than undergraduate students and receive about twice as much aid from employers on average compared to undergraduate students, while very few receive more than $5250, the maximum amount that can be utilized tax-free. More students are enrolled in public programs than private programs, and the share in each is close to those reported from the CPS. The amount of income that these students report may seem surprisingly high. Income is reported at the household level and some students will have working spouses while others will continue to work while enrolled in a program.

Table 5. NPSAS summary statistics.

Section 127 available to graduate students	Graduate students		Undergraduate students	
	Yes	No	Yes	No
Receives employer aid	0.149	0.120	0.076	0.070
Amount of employer aid	594	514	146	108
Employer aid (*if* > 0)	3990	4282	1909	1535
Amount of institution aid	1813	1613	199	134
Tuition	9405	7554	3121	2573
Total expenses	22,514	22,474	9821	12,969
Program attended				
Part-time public	0.296	0.339	0.512	0.590
Part-time private	0.220	0.205	0.101	0.081
Full-time public	0.250	0.237	0.206	0.222

Section 127 available to graduate students	Graduate students		Undergraduate students	
	Yes	No	Yes	No
Full-time private	0.234	0.206	0.135	0.097
Age	26.50	26.64	26.45	26.50
	(1.92)	(1.92)	(1.98)	(2.01)
White	0.741	0.786	0.637	0.691
Asian	0.077	0.076	0.050	0.047
Female	0.558	0.535	0.556	0.532
Married	0.296	0.345	0.306	0.349
Income	35,293	39,054	28,539	31,867
	(34,223)	(36,686)	(26,396)	(29,302)
Observations	13,600	9100	44,190	13,690

Summary statistics using NPSAS weights. The samples consist of individuals age 24‐30 attending a graduate or undergraduate program. Standard deviations are in parentheses. Sample sizes are rounded to nearest 10 as per NPSAS restricted use agreement.

4.3. Financing results

4.3.1. Probability of using employer tuition assistance

We examine the probability that an individual uses employer tuition assistance as a source of finance for their graduate education in Table 6. The tax rules did not change for undergraduates, so we compare students enrolled in graduate programs to similarly aged students enrolled in any undergraduate program. The samples compare respondents enrolled in part-time public graduate programs (column 1), part-time private graduate programs (column 2), full-time public graduate programs (column 3) or full-time private graduate programs (column 4) to respondents in any undergraduate program. That is, the control group is the same for each regression. We find that the tax incentive increases the probability of using any employer tuition assistance by about one and a half percentage points for students enrolled in full-time public programs. This is consistent with the CPS findings that the tax exemption increases enrollment for this group. Given that only about three percent of individuals enrolled in full-time public programs utilize employer tuition assistance in the years when it is not tax favored, this is a substantial increase in percentage

terms. We also find a similar increase in the probability of using employer tuition assistance for students enrolled in full-time private programs and a three and half percentage point increase for part-time public students. Around 16% of part-time public students use this aid in the years when it is not tax favored so this translates into roughly a 20% increase. Given that we did not find an enrollment response in the CPS data, this indicates that the subsidy is not enough to incentivize someone to enroll in these programs, but it could persuade someone who intends to enroll to seek out employer assistance. The positive coefficient on income illustrates that firms that pay higher salaries are more likely to offer tuition assistance.19 The lagged state unemployment rate does not appear to play a role in whether a student utilizes employer tuition assistance. A negative coefficient would have indicated that firms offer fewer fringe benefits when the economy is slack.

Table 6. NPSAS results – probability of using employer tuition assistance.

	PT public	PT private	FT public	FT private
Grad × Section 127	0.1423**	−0.0017	0.2211***	0.2079***
	(0.0587)	(0.0782)	(0.0435)	(0.0588)
Grad	0.3009***	0.5355***	−0.3819***	−0.4131***
	(0.0611)	(0.0613)	(0.0510)	(0.0849)
Section 127 available	−0.0829***	−0.0674**	−0.0911***	−0.0905***
	(0.0311)	(0.0324)	(0.0324)	(0.0326)
Married	0.0347	0.0208	0.0497**	0.0373
	(0.0239)	(0.0267)	(0.0250)	(0.0290)
Female	−0.1044***	−0.1057***	−0.0793***	−0.0895***
	(0.0213)	(0.0176)	(0.0215)	(0.0230)
Black	−0.0309	−0.0233	−0.0285	−0.0220
	(0.0355)	(0.0352)	(0.0365)	(0.0364)
Asian	−0.1293***	−0.1318***	−0.0955***	−0.1294***
	(0.0343)	(0.0352)	(0.0325)	(0.0304)
Family income (10,000s)	0.0893***	0.0957***	0.0885***	0.0918***
	(0.0055)	(0.0062)	(0.0058)	(0.0066)

	PT public	PT private	FT public	FT private
State UR last year	−0.0021	−0.0116	−0.0003	−0.0006
	(0.0183)	(0.0184)	(0.0193)	(0.0188)
N	58,890	57,660	60,200	59,810
Treatment effect at $\overline{X}$				
Grad × Sec 127	0.0344	−0.0005	0.0155	0.0157
$\overline{Y}$ for graduate students when Sec127 unavailable				
	0.1583	0.2507	0.0318	0.0294

Estimation results for Eq. (4). The dependent variable is an indicator for any employer-provided tuition assistance. The reported coefficients are from probit models, with treatment effects defined in Eq. (5). The samples consist of individuals age 24‑30 attending a graduate program of the type specified in the column heading or any undergraduate program. The controls include quadratics in age and *t* and state dummies. The standard errors are clustered on the state level. Sample sizes are rounded to the nearest 10 as per NPSAS restricted use agreement.

** $p < 0.05$.

*** $p < 0.01$.

4.3.2. Financing graduate education

The tax incentive could potentially change the behavior of students, firms and universities. We investigate several responses to the tax exemption in Table 7. Each row represents a different dependent variable and the columns correspond to the four types of graduate students we study. Each cell houses the coefficient on the interaction between the graduate dummy and the tax exemption dummy for the given dependent variable and type of graduate student and each regression conditions on receiving a positive amount of employer tuition assistance. We thus look at the treatment effect on the treated.

Table 7. NPSAS results ‑ how graduate students finance their education.

	PT public	PT private	FT public	FT private
Amount of employer assistance ($1000s)	0.4103**	−0.5036	−2.2709**	−2.8191**
	(0.1884)	(0.4536)	(1.0142)	(1.3073)
Employer assistance share of tuition	−0.0048	−0.0612**	−0.1372***	−0.0920**

	PT public	PT private	FT public	FT private
	(0.0197)	(0.0255)	(0.0408)	(0.0373)
Listed tuition ($1000s)	0.5689**	1.1921*	1.8362***	3.5263***
	(0.2141)	(0.6105)	(0.6422)	(1.0395)
Amount of institutional grants ($1000s)	2.2405	1.5507	1.5571	2.0397
	(1.4598)	(1.6481)	(1.7712)	(2.5316)
Total cost of attendance ($1000s)	1.1186	0.8017	5.8599***	7.3179***
	(0.8095)	(0.9470)	(2.0581)	(1.5319)
Observations	4540	4540	3930	3940

The coefficients in this table are for the interaction of Grad and Section 127 where each row represents a different dependent variable. All regressions condition on receiving a positive amount of employer tuition assistance. Coefficients on institutional grants are estimated from Tobit models. All other coefficients are from OLS. All dependent variables except for the employer share are in terms of thousands of 2009 dollars. The samples consist of individuals age 24‑30 attending a graduate program of the type specified in the column heading or any undergraduate program. The controls include quadratics in age and *t*, race, gender, marital status, income, the state's unemployment rate from the previous year and state dummies. The standard errors are clustered on the state level. Sample sizes are rounded to the nearest 10 as per NPSAS restricted use agreement. Full tables for each regression are available upon request.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

Consistent with the finding that individuals enrolled in full-time programs are more likely to receive any tuition assistance, the unconditional average assistance increases for these students (results not shown). Looking only at the students who receive any aid, we find that the average amount decreases for those enrolled in full-time private programs by somewhere between $2000 and $3000. This provides some evidence that firms that sponsor these more expensive types of programs may try to capture part of the incidence of the tax exemption. Alternatively, individuals who work at firms that offer lower amounts of tuition assistance may decide to enroll in these more expensive programs when the assistance is tax-free, bringing down the average amount of aid in full-time private programs. Students in part-time public programs also use a greater amount of employer aid, taking about $400 more, even though there is no enrollment response in the CPS data. Part-time public programs tend to have lower costs than full-time and private

programs, so small changes in costs may not play a prominent role in the enrollment decision. When borrowing becomes free, however, individuals should be willing to take more.

The fraction of tuition covered by employers conditional on receiving any aid decreases for all of the students, even if the amount of employer aid increased or stayed the same. In addition to the incentive for individuals to acquire more education when the tax exemption is in place, universities may increase tuition to capture the incidence of the subsidy. Turner (2013) shows that universities capture 15% of Pell Grant aid, for example. Alternatively, students can afford more expensive education so they may enroll in a university that charges higher tuition. While we cannot distinguish between the two scenarios, we find that all graduate students pay more for tuition when the tax exemption is in place and the difference increases as the type of degree becomes more expensive. Instead of altering tuition, universities can change the amount of institutional grants they provide in response to the tax benefit. However, we have no evidence that universities adjust on this margin. It is unclear whether universities first know about other forms of tuition assistance before making their aid decisions.

Finally, we include the total cost for the academic year including tuition, books, fees and other living expenses as a dependent variable. This is equivalent to the amount that is spent by the student and on the student's behalf through grants, loans and waivers. For full-time students this amount increases by about twice as much as the increase in tuition. The average full-time student who receives employer aid utilizes just over $5000 in the years when it is tax favored, which is close to the point estimates in these regressions. While the favorable tax treatment provides the incentive to use employer assistance, this is evidence that the students may think of this as free money that increases their budget instead of replacing money they needed to spend.

5. Conclusion

In this paper we examine how changes in the tax code affect enrollment in and financing of graduate education. We focus on the six-year lapse in exemptions for employer-provided graduate tuition assistance. Using the October supplements of the CPS, we find that full-time graduate enrollment in public institutions among 24–30 year-old employed college graduates increases by about 8% in years when the tuition reimbursement tax exemption is available. Even though the treatment samples are different, this result is comparable to the findings of previous studies that use exogenous changes in education financing policies to study the effects of aid on college attendance (e.g. [Dynarski, 2000], [Cornwell et al., 2006], [Kane, 2003] and [Seftor and Turner, 2002]). Our results are also in line with other studies that find an effect of financial aid policies on the outcomes of recent college graduates (e.g. [Rothstein and Rouse, 2011] and

[Field, 2009]). The estimated effects are small enough to lead us to believe that partial equilibrium analysis is sufficient in this case and we do not need to conduct general equilibrium analysis that takes into account changes in skill prices ([Heckman et al., 1998] and [Hendel et al., 2005]).

In terms of graduate education financing, we find that the students who report an increase in attendance (full-time public) also report a greater propensity to use employer tuition assistance. Students in part-time public and full-time private programs are also more likely to utilize employer tuition assistance, which suggests that the effect is not limited to the enrollment decision. It appears that some students are prone to increase their education-related expenditures when more aid is available. We also find some evidence that firms and universities may adjust their policies to try to capture part of the incidence of the tax benefit.

Although the literature up to date has mostly focused on the elasticity of demand for college education, particularly among recent high school graduates, it is important when doing program evaluation to keep in mind that financial aid policies may have a different effect on graduate students. This paper provides a look at one such policy that is targeted at employed college graduates whose firms offer educational assistance. Our treatment group is not fully representative of all potential graduate students, but the fact that we find a response to changes in the cost of graduate education suggests that other educational assistance programs are also likely to have a nontrivial impact on graduate enrollment. It is also necessary to examine in more detail how firms respond to changes in Section 127 in terms of the tuition assistance offered for both graduate and undergraduate courses, and whether educational institutions increase the effective cost to students when federal aid policies for graduate students are more generous. We find that students are more likely to report receiving tuition assistance but also pay more in tuition during tax exempt years. However, we are unable to tell whether this comes from more employers offering education benefits or more employees making use of existing programs. The data are also not sufficient to answer whether universities are increasing tuition or if individuals choose to attend more expensive programs. We offer an initial insight but leave untangling these effects for future work.

Appendix A. Tax benefits and other sources of education financing

The two most significant provisions of the TRA of 1997 are the Hope Credit and the Lifetime Learning Credit (LLC) (both introduced in 26 U.S.C. §25A(b)). The Hope Credit benefits only undergraduate students in the first two years of their postsecondary schooling. It covers the first $1000 of tuition and fee expenditures, as well as half of the next $1000. The maximum credit is

thus $1500, and can be claimed for own schooling expenditures or for a taxpayer's spouse or children's education. The LLC is aimed at a different group of students. It covers tuition and fees for any postsecondary education, including graduate degrees and course work that is not part of a degree program. The maximum credit was $1000 when first introduced, but increased up to $2000 in 2003. Unlike the Hope Credit, the LLC covers 20% of the qualifying expenses. Both the LLC and the Hope Credit are subject to the same income eligibility requirements and neither is refundable meaning that the amount of the credit received is also capped at the amount of taxes owed. This makes very low income households ineligible for these credits if their income is below the taxable minimum.

Another important provision was introduced starting with the 2002 tax year, when students could deduct up to $3000 from their taxable income for postsecondary tuition and fees. In 2004 the limit was increased to $4000. The benefit is available to both graduate and undergraduate students, their spouses and dependents, but it may not be used concurrently with the Hope Credit or LLC. This deduction is again aimed at the middle class because households who do not owe income tax are not eligible (or are eligible for less than the full amount if the sum they owe is less than the maximum deduction), and there exist upper income limits that exclude households with income over $80,000 (if single) or $160,000 (if filing jointly).20 Other tax incentives for education introduced with the TRA of 1997 include a student loan interest deduction, the Coverdell Education Savings Account and a tax exception for early IRA distributions used to cover schooling expenses. We do not include additional controls for these provisions in our empirical models because the timing of the incentives they create is unclear and the latter two are more likely to be used by parents for their children's college education. Furthermore, the controls we do include for the provisions of the TRA of 1997 should account at least partly for the aforementioned benefits.

Tax benefits constitute a small portion of the total aid received by graduate students, with the majority (69% in the 2009–2010 academic year) coming from federal loans. Most loans are taken out under the Stafford Loan Program. Graduate students can accrue up to $138,500 in debt from subsidized and unsubsidized Stafford loans. Perkins Loans are not available at all institutions and account for less than 1% of total federal loans for graduate students. Limits and eligibility for the federal loan program increased most substantially after the 1992 reauthorization of the Higher Education Act (HEA) of 1965, so to account for any effects of this change on enrollment in our empirical models we include an indicator for the post-1992 period.21 Students have been able to take out private loans since 1995 and starting in July 2006, graduate students are able to borrow through the PLUS program to cover additional tuition costs that are not covered by other forms of aid (College Board, 2012). Graduate students are not eligible for Federal Pell Grants, Federal Supplemental Educational Opportunity Grants

(FSEOG), Academic Competitiveness Grants (ACG), and SMART Grants, but can receive institutional and private awards, in addition to employer grants. An overview of the benefits described in this section is available in Table A.1.

Table A.1. Education benefits overview.

Benefit	Eligibility	Amount
Lifetime learning credit	Available for course work; can be claimed for net tuition and fees (less grant aid) for taxpayer, spouse, dependent; 20% credit against total tax liability for first $A per household of qualified tuition and expenses	*A* = $5K (1998–2002) or $10K (2003–2009) Phase-out income: $40K/$80K to $50K/$100K (1998–2001) $50K/$100K to $60K/$120K (2009)
Interest deduction	Deduction up to $A of adjusted gross income for interest payments on student loans; 1998–2001: limited to first 60 months of interest payments	*A* = $1000 (1998), $1500 (1999), $2000 (2000), $2500 (2001–2007) Phase-out income: $40K/$60K to $55K/$75K (1998–2001) $55K/$110K to $70K/$140K (2007)
Tuition and fees deduction	Deduction up to $A for postsecondary tuition and fees	*A* = $3K (2002–2003) or $4K (2004–2009) Income limits: $65K/$130K (2002–2003) $80K/$160K (2004–2009)
Section 127	Tax-free status of employer-provided subsidy up to $A for graduate courses	*A* = $5250 (1991–1995, 2002–2009) or 0 (1989–1990, 1996–2001)

Benefit	Eligibility	Amount
Perkins Loan	Fixed-rate (5%) loan; annual limit of $A and aggregate limit of $B for graduate students	*A* = $5K (1995–1998) or $6K (1999–2007) $30K (1995–1998) or $40K (1999–2007)
Subsidized Stafford loan	Variable interest rate; annual limit of $A and aggregate limit of $B for graduate students	*A* = $7.5K (1987–1993), $8.5K (1994–2007) *B* = $54.75K (1987–1992), $65.5K (1993–2007)
Unsubsidized Stafford loan	Annual limit of $A and aggregate limit of $B for graduate students	*A* = $4K (1986–1994) or $10K (1995–2007) *B* = $73K (1994–2007)

Graduate students are not eligible for the HOPE credit, Federal Pell Grants, Federal Supplemental Educational Opportunity Grants (FSEOG), Academic Competitiveness Grants (ACG), and SMART Grants.

Appendix B. Using an alternative measure of graduate school persistence in the CPS

Table B.1.

Table B.1. CPS persistence results for graduate students, alternative measure.

	Public		Private	
	PT	FT	PT	FT
Section 127 and employed FT	0.0927	0.1420**	−0.0945	−0.0171
	(0.0687)	(0.0679)	(0.1267)	(0.0463)
Section 127 and employed PT	0.0220	0.1484***	0.0214	−0.0888
	(0.0970)	(0.0570)	(0.1580)	(0.0556)
Section 127 available	−0.1535**	−0.0860	0.0628	−0.0092

	Public		Private	
	PT	FT	PT	FT
	(0.0631)	(0.0552)	(0.1424)	(0.0501)
Number obs. with $Y = 1$	892	1331	473	859

Estimation results for Eq. (2). The reported coefficients are from probit models. The sample consists of college graduates age 24-30, $1989 \leq t \leq 2009$. The controls include income categories and their interactions with $t \geq 1998$, the state's unemployment rate from the previous year, quadratics in age and t, race, gender, marital status, state dummies and indicators for previous year enrollment and for $t \geq 1993$ (post-HEA reauthorization). The standard errors are clustered on the state level. $N = 49, 141$.

** $p < 0.05$.

*** $p < 0.01$.

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1 Tel.: +1 336 278 5935; fax: +1 336 278 5952.

2 The College Board (2012) reports these grants jointly so we are unable to show data on employer aid only.

3 Programs whose effects on enrollment have been studied recently include the Georgia Hope Scholarship ([Dynarski, 2000] and [Cornwell et al., 2006]), the CalGrant program in California (Kane, 2003), the Washington, D.C. Tuition Assistance Grant Program ([Abraham and Clark, 2006] and [Kane, 2007]) and, most notably, the Tax Relief Act of 1997 ([Long, 2004], [Chenevert, 2010] and [Turner, 2011]). Nielsen, Sørensen, and Taber (2010) study the college enrollment effects of an increase of the generosity of student aid in Denmark. Dynarski (2003) is among the few studies who focus on the enrollment effects of the elimination of a program (the Social Security Student Benefit Program in 1982). See the overview in Dynarski (2002) for a list of other papers that use the quasi-experimental approach to estimate the elasticity of demand for college education.

4 See van der Klaauw (2002) and Linsenmeier, Rosen, and Rouse (2006) for example.

5 Two exceptions are Seftor and Turner (2002), who examine how changes in the Pell Grant Program impact the college enrollment rates of individuals in their twenties and thirties, and LaLumia (2012), who studies the impact of the Tax Relief Act of 1997 on older college students. Long (2004) shows estimates of her college enrollment specifications for a sample of older CPS respondents (age 25–40) but similarly to her results for traditional college students, finds no enrollment effect of the Tax Relief Act.

6 Amounts greater than $5250 can be exempt only if they qualify as a working condition fringe benefit, meaning that the amount could have been deducted as an employee business expense (i.e. Section 132 benefit).

7 Levine (2008) lists in detail all Section 127 extensions and their provisions.

8 In 1992, Congress reauthorized the Higher Education Act of 1965, expanding substantially the limits and eligibility for federal student loans beginning in 1993. Our estimation strategy allows for enrollment trends to change upon the HEA reauthorization, but the estimated coefficients are small and not statistically significant.

9 While we do not show the results here, we also estimated the models with a set of two interactions for each income variable, one for $1998 \leq t < 2003$ and another for $t \geq 2003$ in order to account for changes in the Lifetime Learning Credit maximum and the introduction of tuition deductions as another tax benefit. This introduced more noise in the estimates but did not change the main findings.

10 We also estimated a multinomial logit model of the joint decision of full-time or part-time public and private attendance with a base outcome of no schooling; the results were virtually identical. The last outcome, vocational training, is not mutually exclusive with the rest because respondents can be enrolled in a degree program and take vocational courses at the same time.

11 Clustering by year or by the interaction of year, college degree attainment and employment status results in similar standard errors.

12 Some preliminary robustness checks (available on request) suggest that varying the age cutoff does not change the results substantially.

13 There is no option to report higher years of college.

14 We also estimated the models with a Section 127 variable that was not adjusted for inflation. The results did not change in terms of significance.

15 Workers who are employed but currently absent from work are treated as employed, and full-time status corresponds to 35 h per week or more.

16 Appendix B shows estimation results from a similar model when persistence is defined as the interaction between the “2nd year or higher of graduate school” variable and the indicator for enrollment during the previous year, while this indicator is excluded from the set of explanatory variables. This specification accounts for interruptions in the course of study, where higher-year enrollment may not necessarily mean that a person is continuing in a program that they attended during the previous year. The difference in the reported number of observations with $Y = 1$ suggests that this may be an issue for part-time students. The patterns we observe are similar between the models in Table 4 and Table B.1.

17 The tax exemption was not available for respondents in the 1989–1990 and 1999–2000 samples.

18 Full tables for NPSAS funding trends are available upon request.

19 Firms that offer tuition assistance may use income as a compensating differential. All of our results are robust to dropping income as a control, mitigating this concern.

20 These amounts were lower prior to 2004.

21 We do not include this indicator in the financing models because we only have six years of data, one of which is pre-1992 and is one of two years when the Section 127 exemption is not in place.