College Financial Aid and Family Saving

by

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Submitted to the Department of Economics
in partial fulfillment of the requirements for the degree of

Ph.D.

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 1997

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Abstract

College financial aid in the U.S. is a means-tested subsidy. The more a family saves, the less the child gets in terms of financial aid in college. This penalty for pre-college saving is known as the education tax. The main purpose of the thesis is to gauge the saving reduction and the portfolio effects of the education tax.

To measure the reduction in family saving due to the penalty, I develop and solve a modified life cycle model with the education tax. The model shows that college financial aid reduces pre-college family saving through both price and wealth effects. The major empirical challenges for estimation are simultaneity bias and errors in variables. I identify the model by using as instruments the spacing between children, and the variation in college costs across states and over time. Estimates based on the data from the Survey of Income and Program Participation suggest that college financial aid is responsible for about a 20% reduction in family savings for a typical family. My estimates are smaller than previous estimates in the literature, but still represent a substantial effect.

Retirement saving vehicles, including IRAs and 401(k)s, protect families from the education tax, as parents are not required to report retirement savings when they file for their children's college financial aid. In contrast to the well-known favorable income tax treatment, this additional attraction of IRAs and 401(k)s has been virtually ignored in the literature. My estimates suggest that education tax exemption may be as important as income tax deferral for nearly half the middle-income families.

The thesis also measures the effects of the combined tax advantage on IRA and 401(k) saving, in terms of both participation and balances. The empirical specification is motivated by a stylized life cycle model featuring the choice between IRAs and 401(k)s *vs.* ordinary saving vehicles. The consistent IV estimates suggest that the education tax exemption may be responsible for about 7% increase in the participation probability, and more than 25% increase in balances in IRAs and 401(k)s for a typical middle income family.

Thesis Supervisor: James M. Poterba
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Acknowledgments

I have benefited from most wonderful teachers throughout my years at MIT, especially my thesis advisors. Prof. Jim Poterba, my main supervisor, represents to me what is best in the MIT tradition of research and teaching in economics. His insistence on rigorous theory and careful empirics is surpassed only by his passion for economic research meant for the real world. My thesis would have been unthinkable without his guidance and kind encouragement every step of the way. From my second thesis supervisor, Prof. Jon Gruber, I learned the basics of practical empirical analysis. Virtually all the empirical findings of my thesis partly bear his touch. I shall never forget lessons that I learned during hours and hours of his hands-on teaching. I owe special thanks to Prof. Jerry Hausman, my teacher of econometrics. Almost all my stock-in-trade as a budding empirical economist I obtained from him. With all due respect, I cannot say his lectures are the best organized in the world, but I adore and admire him for all his lessons on uses and abuses of econometrics.

I would like to thank Prof. Peter Diamond, Prof. Steve Pischke, and especially Prof. Josh Angrist, among members of the MIT Public Finance Seminar Group. They all read parts of my thesis and gave me invaluable suggestions. I am deeply indebted to their goodwill extended beyond the call of duty. It goes without saying that all the remaining errors are mine and mine alone.

Among my fellow students at MIT, I would like to express my gratitude to Sanghoon Ahn, David Gross, John Keeling, Kaivan Munshi, Dave Reily, Nick Souleles, and Shinkyu Yang. My thesis directly benefited from their spirited feedback, and their friendship has been an unfailing source of joy. I wish them all good luck with their professional career. It is only too appropriate for me to thank Korean friends of mine in Cambridge, unnamed here, who kept up my spirits in marvelous ways through thick and thin.

As I am looking to start my own teaching career, it is my bounden duty to thank my unforgettable teachers at Seoul National University. I would like to thank in particular Prof. Seung Hoon Lee, Prof. Ki-Jun Jeong, and Prof. Un-Chan Chung. Not only did I learn the essence of economics from them, but continue to find inspiration in their fine examples as economists as well as teachers. I owe special thanks to Prof. Seung-Soo Han and Prof. Joon Koo Lee for introducing me into the brave world of public economics. They taught me all-important basic concepts and principles of public economics; they also made me dream my future as a public finance economist.

The Korea Foundation for Advanced Studies financially supported my study and research for six years. Generous doesn't cut it to desc [illegible] agnanimity of the support. I cannot possibly hope to repay the debt in my life. The least I could do is to exert my best to live up the inspired ideals of the Foundation. I believe it is also a measure of gratitude that I feel that I chose college financial aid as my dissertation topic.

I cannot fail to thank Mr. and Mrs. Dunlavey, and their wonderful children. The partly-Irish, partly-Korean, American family has been my adopted home away from home. Mr. Michael Dunlavey even personally assisted my dissertation research. He took me to a paid-for session for parents with pre-college children held by professional consultants on family financial planning. He also gracefully shared with me his wisdom garnered through his own experience raising and educating four children. The discussions served in my mind as a useful device of reality check. I hope his personal help was not in vain.

I don't know how to begin to thank my family. I am afraid I am going to remember the past six years one of the happiest periods of my life, all the usual agonies accompanying a graduate student's life notwithstanding. If that turns out to be true, I will have to hold my wife, my best friend Hyosun, largely responsible for it.

Then, I have my parents. They must be proud of their son's achievement, but mine is a humble one compared to their own. I have yet to figure out the secret of their enormous personal integrity, truly warm-hearted concern for others, and their incredible sense of humour into the bargain, all maintained throughout their life marked by hardships and tribulations. I am still learning probably the most important lessons of life from them. To them, I dedicate my thesis, with love and respect.

Contents

Chapter 1

College Financial Aid and Family Saving: A Critical Survey

1.1 Introduction

College financial aid in the U.S. is a means-tested subsidy. If a family saves more, the child is going to get less financial aid in college. The implied penalty for pre-college saving is known as the education tax. The tax does not apply to retirement saving vehicles, such as Individual Retirement Accounts and 401(k)s. There is a small but growing literature on the effects of the education tax on family saving. Feldstein(1995) presents evidence that suggests that the penalty may be responsible for as much as 50% reduction in pre-college family saving. Edlin(1993) reports simulation results that strongly support the Feldstein finding.

Kim(1995) suggests that the reduction in family saving may be smaller than Feldstein estimates, but still substantial at about 20% of family saving. The key contribution of Kim(1995) is to use a new identification strategy based on the variation of marginal education tax rates due to differential spacing between siblings. Kim(1997) considers the effects of college financial aid on IRA and 401(k) saving, in view of the exemption of such assets from the education tax. The main finding is that the education tax exemption, which has been ignored in the literature, may be as important as the income tax deferral for nearly half the middle income families. Kim(1997) also presents evidence suggesting that a typical middle income family is about 7% more likely to have retirement saving accounts, and have about 25% more in balances, due to the additional benefit of education tax exemption.

This paper critically reviews the literature that immediately bears on the effects of college financial aid on family saving.

The concern on family saving mainly stems from the low and declining U.S. household saving. The ratio of household saving as a percent of disposable income has remained below 5% for most of last two decades. International comparison shows that the U.S. saving ratio is the lowest among industrialized countries, not to mention some high-saving nations in Asia[1]. This is worrying on at least two accounts. First, low saving is likely to result in slow capital formation, international capital flow notwithstanding[2], which may hurt the long-term growth potential of the economy. Second, families may not accumulate an adequate amount of savings to maintain a reasonable standard of living in retirement[3].

A major concern in both the academia and policy circles has been the potentially detrimental effects of capital income taxation on household saving. The two major tax reforms during the Reagan administration, the Economic Recovery Tax Act of 1981 and the Tax Reform Act of 1986, were partly a response to empirical studies such as Boskin(1978), Summers(1981), and Feldstein(1983) that suggested a strong response in saving to changes in the rate of return. Intertemporal elasticity of substitution is the key preference parameter that determines the direction and the strength of the saving response to changes in the rate of return. Empirical estimates of the parameter vary quite substantially. Hall(1988) suggests that the value of the parameter is close to zero, clearly smaller than unity; Hansen and Singleton(1983) report estimates of the elasticity ranging from zero to two. Furthermore, Summers(1983) rr rts simulation results in the context of general-equilibrium life cycle saving that suggest that saving could increase dramatically even when low values of intertemporal

[1] See Skinner(1991).

[2] See Feldstein and Horioka(1980).

[3] See Poterba, Venti, and Wise(1996).

substitution elasticity are assumed.

1980s also witnessed a huge expansion of tax-based saving promotion policies, Individual Retirement Accounts(IRAs) and 401(k)s. Contributions to these accounts are tax deductible. Furthermore, returns accrue tax-free. IRA contributions represented almost 30% of total personal saving in 1986. New contributions to IRAs declined in the aftermath of Tax Reform Act, which limited tax-deductibility for relatively affluent families. The decline was, however, more than made up by steadily increasing contributions to 401(k)s. By mid-1990s, saving through these two vehicles exceeded contributions to traditional employer-provided pension plans[4]. A huge literature has been devoted to the question of whether contributions to IRAs and 401(k)s represent a new saving, or a mere reshuffling of assets.

The education tax implied by college financial aid adds an important twist to the family saving scene. First of all, it further reduces the after-tax rate of return, already diminished by capital income taxation. The theory is ambiguous on how much saving is lost, if any, due to the additional penalty. Empirical analysis is essential to determine the effects of the education tax on family saving. Empirical measurement of the reduction is made difficult by endogeneity bias and measurement errors. Kim(1995) pursues an identification strategy based on the observation that the current rules of college financial aid introduce a random variation in marginal education tax rates for families with differently spaced children. Kim(1995) suggests that the reduction in family saving due to the education tax may be smaller than the Feldstein finding, but still substantial at 20%.

In addition, college financial aid allows a haven from the education tax for a class of assets geared for retirement saving, including IRAs and 401(k)s. This implies that IRAs and 401(k)s enjoy two-fold tax benefits, income tax deferral as well as education tax exemption. The literature has been understating the merit of IRA and 401(k) saving by ignoring the preferential treatment in college financial aid. Kim(1997) bridges the gap by documenting the importance of education tax exemption and then estimating the effects on IRA and 401(k) saving. Tax-based saving promotion

[4]See Poterba, Venti, and Wise(1996).

policies such as IRAs and 401(k)s can be described in terms of two parameters: the annual contribution limit and the size of the tax benefit. The policy question that the traditional literature has been trying to answer revolves around the first: Will changing the annual contribution limits increase personal saving? The second parameter has been ignored in practice. As a result, the literature is less helpful in dealing with questions such as what will happen to IRA and 401(k) saving in case of a new income tax cut. Kim(1997) helps answer those potentially important policy questions by measuring the effects of the combined tax advantage on IRA and 401(k) saving.

The remainder of the paper proceeds as follows. Section 2 begins with a primer on college financial aid. Section 3 surveys the literature on the effects of the education tax on family saving in general. Section 4 discusses institutional arrangements regarding IRA and 401(k) saving. Section 5 reviews the literature on IRA and 401(k) saving. Section 6 concludes.

1.2 College Financial Aid and the Education Tax

College financial aid in the U.S. is a means-tested subsidy affecting a substantial portion of middle income families[5]. The stakes are high: the sum of financial aid in 1992-3 amounted to $33 billion[6]. About 50% of full-time students in public universities got some financial aid in 1989-9; about 70% of students did in private institutions[7]. The federal government accounted for about 75% of the amount given in student aid, the remainder coming from state governments and institutional funds. Individualized, need-based aid for college students is perhaps unique in the U.S. Most European and Asian countries provide need-blind tuition subsidy, as state government do in the U.S.

Federal Methodology, the current federal rule governing college financial aid, is

[5]This section heavily borrows from Kim(1997).

[6]This compares with $51 billion in tuition subsidy, which comes mainly from state governments. Tuition subsidy is need-blind, in that it reduces the general tuition charge regardless of individual students' financial needs.

[7]See Congressional Budget Office, ***Student Aid and the Cost of Postsecondary Education.***

essentially a progressive tax schedule on income and assets. The Methodology[8]. first calculates *Adjusted Available Income*, the equivalent of Adjusted Gross Income in personal income taxation, based on income and assets[9] reported in the financial aid application form. AAI is the sum of income after adjustments and *Income Supplement*, 12% of assets. *Expected Parental Contribution*, after-subsidy costs for college education, is then calculated by applying a series of increasing marginal rates on AAI[10]. Colleges provide financial aid packages covering the difference between actual costs and the EPC using funds from the federal and state governments as well as institutional funds.

One additional dollar in assets in the year when you send your child to college then adds to EPC by increasing AAI in two ways. First, the ensuing increase in capital income increases AAI dollar for dollar. Second, the additional dollar in assets directly increases AAI by 12% via *Income Supplement*.

Three special features of the Methodology are worth mentioning, since they separate the education tax from a typical tax. First, the education tax is an annual levy that parents have to pay every year as long as at least one child is attending college. We can treat the tax as if it is a one-shot levy by calculating its present discounted value.

Second, the Federal Methodology includes an interesting, rather quirky clause for the case when two or more children are attending college simultaneously. Under FM, EPC stays the same regardless the number of children in college. Combined with the duration of the education tax, discussed in the previous paragraph, this means that two otherwise similar families may end up paying vastly different total amounts for college education, just because of the difference in the spacing of their children. For example, a family with two children two years apart pays its EPC for six years;

[8]For details of Federal Methodology, see Feldstein(1995), Edlin(1993), or Kim(1995). A popular guide book, ***College Costs and Financial Aid Handbook***, is published every year by the College Scholarship Service, the federal agency responsible for the execution of Federal Methodology. The ultimate reference would be it United States Code Annotated, Title 20 Education, 1985, 1990, and 1995.

[9]The savings in retirement saving accounts need not be reported.

[10]The marginal rates range from zero to a high of 47%.

a similar family with two children four years apart for eight years. A family with twin children could in principle buy their college education at the price of one. It is the net duration of college education for all the children without double-counting the overlapping years that matters. This net duration is known as education window among experts on college financial aid[11] In our example, education window is 6 years for the first family, and 8 for the second. The family with twin sisters faces education window of just 4 years. This clause introduces a (partly) random variation in the education tax rates faced by individual families due to education window[12]. This observation is crucial for the identification strategy in Kim(1995, 1997).

Finally, if *EPC* is greater than actual annual college costs(C), parents pay the full "sticker" price. That is, they should expect to pay the full tuition and expenses. For them, the marginal education tax rate will be zero.

The following equation summarizes the determination of the marginal education tax rate, τ_E. *EW* stands for education window. A_S denotes the amount of taxable family assets in the beginning year of college education. $I(\cdot)$ is an indicator function assuming the value of unity when the statement inside the brackets is true, and zero otherwise. r is the before-tax rate of return on assets. *fm* is the marginal rate of the Federal Methodology converting *AAI* into *EPC*. τ_{FED}, τ_{FICA}, and τ_{STATE} represent marginal rates of federal income tax, Social Security tax, and state income tax, respectively.

$$\begin{aligned}\tau_E &= \sum_{n=1}^{EW} \frac{d}{dA_S} \frac{EPC_n(A_S)\, I(C_n > EPC_n)}{(1+r)^{n-1}} \\ &= \sum_{n=1}^{EW} \frac{fm * \{(1-\tau_{FED}-\tau_{FICA}-\tau_{STATE})r + 0.12\}\, I(C_n > EPC_n)}{(1+r)^{n-1}}\end{aligned}$$

[11]The terminology helps to graphically conjure up the image of a government poking hand remaining in the family coffer as long as the window stays open.

[12]Note that education window is only partly correlated with the number of children, which is, in all likelihood, an endogenous variable. Even with the number of children, one could acknowledge some randomness. The randomness, I argue, is even greater with education window, especially when we control for the number of children.

The formula above calculates the present value of the stream of additional education taxes when parents have one more dollar in their assets in year S when they send their first child to college. The duration is of course given by EW, education window. We are this way modeling the education tax as a one-shot asset levy for simplicity.

The expression inside the curly brackets on the second line gives the marginal increase in AAI due to one more dollar in assets. The increase comes in two ways, first through the increase in capital income, $(1 - \tau_{FED} - \tau_{FICA} - \tau_{STATE})r$ after income tax-related adjustments, and second through *Income Supplement*, 12% of the additional asset. The marginal increase in AAI multiplied by fm gives the marginal increase in EPC, which of course will be zero, if actual costs are smaller than EPC.

It is middle-income families that face the highest range of τ_E. Low income families benefit from low values of fm; rich families are likely to find $C < EPC$, getting τ_E effectively reduced to zero. Within the same income bracket, τ_E is chiefly a function of education window. Kim(1995) provides estimates of τ_E across different income brackets, based on the data from the Survey of Income and Program Participation. For families with annual income between \$40,000 and \$60,000, the median of τ_E is about 20%. 25% of the families face τ_E of 30% or above. For the unlucky 10% of the same group, τ_E goes beyond 40%.

1.3 Education Tax and the Reduction in Family Saving

The discussion in the previous section shows that the education tax significantly reduces the after-tax rate of return on pre-college saving, pointing to a potentially large reduction in family saving.

Case and McPherson(1986) are probably the first researchers to raise the issue. Their conjecture, however, was that the reduction in family saving would be negligible. Their conjecture was based on two premises. First, they cited empirical findings of low values of intertemporal elasticity of substitution, suggesting small responses of saving to changes in the rate of return. Second, they focused on the federal Pell grant and its lower implied tax rates on assets. Neither of the two premises is watertight.

First, the literature does not yet have a clear consensus on the value of intertemporal elasticity of substitution. Intertemporal elasticity of substitution refers to $\sigma = \frac{1}{1-\gamma}$, where γ is a preference parameter in a life cycle utility function, such as

$$U(c_1,\ c_2,\ \ldots,c_T) \quad = \quad \sum_{t=1}^{T} \frac{\frac{1}{1-\gamma} c_t^{1-\gamma}}{(1+\rho)^t}. \tag{1.1}$$

In a classical life cycle consumption context, values of γ greater than unity imply a positive saving response to an increase in the after-tax rate of return; $\gamma < 1$ means a negative response. While Hall(1986) provides estimates close to zero in value, Hanson and Singleton(1983) report estimates of γ ranging in values from zero to two. Furthermore, simulation results in Summers(1983) suggest that general-equilibrium life cycle saving response could be huge even when low values of intertemporal elasticity are assumed. The key insight of Summers(1983) is that a reduction in the after-tax rate of return will have the additional effect of reducing the value of "human wealth", the present discounted value of future earnings, causing the present consumption to fall and saving to rise.

Second, it also turns out that the implied tax rates in the federal Pell grant are not the appropriate tax measure. As Feldstein(1995) argues, if schools use institutional funds in addition to the Pell grant in aid packages, which most schools do, the relevant tax rates are those implied by the Federal Methodology, not by the Pell grant alone. And the marginal tax rates implied by the Federal Methodology are far from negligible.

The discussion makes it clear that the question can be properly addressed only by empirical studies, to which we turn now.

1.3.1 Huge Reduction?

Feldstein(1995) is the first empirical paper to tackle the issue. After examining the federal rules of means testing in college financial aid, he concludes that the rules reduce the value of an extra dollar of accumulated assets by 30% for a typical middle income family with one child. A similar family with two children who attend college in succession would see an initial dollar of assets reduced to 50 cents[13].

The representative estimation result in Feldstein(1995) is equation 11 in the paper, reproduced below. The estimates are obtained by least squares on a cross-section of households from the Survey of Consumer Finances 1986.

$$\begin{aligned} A_i &= -9934 + (-2.04 - 1.41\theta_i + 0.076AGE_i)Y_i \\ R^2 &= 0.30 \\ \textit{Adjusted } R^2 &= 0.28 \\ Obs. &= 161 \end{aligned} \tag{1.2}$$

A_i is the amount of financial assets, θ_i the marginal education tax rate[14], AGE_i the age of the head of the household, and finally Y_i annual household income. The model posits that household financial assets are a linear function of income, where the coefficient of income is itself a linear function of various factors, including the marginal education tax rate, θ_i. The standard errors for the coefficient estimates inside the parentheses in the equation above are 1.14, 0.60, and 0.026, respectively.

To evaluate the estimated effect, Feldstein considers a family with income of

[13] Note that these calculations broadly agree with the estimates in Kim(1995) discussed in the previous section.

[14] θ is closely related to τ_E of the previous section, though not identical. θ is defined as the remaining value of one additional dollar as follows. $\theta = 1 - (1 - \frac{\partial EPC}{\partial A})^{EW}$. On the other hand, $\tau_E = \sum_{n=1}^{EW} \frac{\frac{\partial EPC}{\partial A}}{(1+r)^n}$, ignoring the relatively rich families facing zero marginal tax rate. It is easily shown that θ is a positive monotonic transformation of τ_E. Yet, Kim(1995, 1997) can take advantage of a richer data set in estimating τ_E.

$40,000, a head aged 45, and two children who differ in age by two years. The estimated marginal education tax rate, θ, for such a family is 0.41. The equation above then predicts accumulated assets of $22,142 for the family. The implied effect of the educational capital levy is calculated to be very large, depressing asset accumulation by $\theta_i Y_i = 23,124$. The equation implies that the family would have accumulated $45,226 if there were no capital levy. Asset accumulation is about half what would have been without the education tax.

Edlin(1993) reports simulation results that strongly support the Feldstein finding of huge reduction in family saving. For a wide range of values for γ, he reports a dramatic reduction in asset holding. For instance, at an interest rate of 9%, and with a γ of 2, aggregate assets are from 2.5 to 10.45 times higher without the education tax, depending on the values of the discount factor, ρ, assumed. For a γ of 1, and at an interest rate of 9%, asset holdings are predicted to be 9.69 times higher without the education tax, or more. If a γ of 0.5 is assumed, the asset accumulation with the Federal Methodology drops below zero. While these simulation results are strongly supportive of the Feldstein result, one might conclude that the saving responses to the education tax are unrealistically high, pointing to a need for a more careful empirical examination of the issue.

1.3.2 Measurement Errors and Endogeneity Bias

It is very important to recognize that there are some serious specification issues with the Feldstein results. The estimates suffer from biases resulting from measurement errors and endogeneity of the tax variable, θ. Many of them seem to bias upward the coefficient estimate of θ in the direction of making the effect look stronger. The difficulties mainly arise because of the limits in the data set, the Survey of Consumer Finances. To begin with, we consider measurement errors.

First, since the SCF data does not provide the information on children's age, Feldstein assumes that all the siblings are two years apart from each other. Suppose that we have two families, A and B. Family A has two children one year apart; family B two children four years apart. The Feldstein procedure would assign education window of six years to both the families. This would overstate the marginal education tax rate for family A, and understate the marginal rate for family B. Suppose, further, that families do reduce saving when faced with a higher marginal education tax rate. Other things being equal, that would imply family B has accumulated less assets. The understating of family B's θ and the overstating of family A's θ would then have the effect of making the disincentive effect of the education tax rate look stronger than it actually is.

Second, since it is impossible to tell the exact college costs for children yet to attend college, Feldstein makes a practical assumption that all families face a common expected college costs equal to the average annual costs at private universities, $12,278 in the academic year 1986-7. He apparently does not include living and other expenses in annual costs. $12,278 is close to the sum of tuition and fees for a year, not including living and other expenses. Adding living and other expenses would make actual annual costs almost double the amount, even at public institutions. The Federal Methodology does use the sum of tuition and fees *and* living and other expenses in calculating annual costs. If the expected parental contribution is greater than this sum, the family is going to pay the full price, and thus faces the zero marginal education tax rate. Since Feldstein excludes a significant portion of actual costs, he is understating actual costs, and thus erroneously assigning zero marginal education tax rate to some relatively rich families. As these families are likely to have more assets than the families unaffected by the procedure, this might again make the negative disincentive effect of the education tax look stronger than is really the case.

Third, Feldstein uses current asset values to calculate his θ. The families in his sample are households with heads aged between 40 and 50: the prime saving period in life cycle. The amounts of assets in the year when the child goes to college may be quite larger than the current values. Younger families are likely to have less assets than older ones, and thus get assigned lower values of θ. This would make the effect weaker, a bias in the opposite direction from the previous two.

Then there is the issue of the endogeneity of the tax variable, θ. The relationship between θ and the amount of assets is simultaneous: while theory predicts that θ

affects asset accumulation, the Federal Methodology stipulates that θ is a function of assets among other things. The greater the amount of family assets, the higher the family EPC will be.

It is important to note that this second relationship between the amount of assets and θ is nonlinear. For low to middle income families, the higher EPC would mean higher marginal education tax rates. Beyond a certain point, however, higher values of EPC could mean zero marginal tax rate, since the family might have to pay the full price and face the zero marginal education tax rate. Because of the nonlinearity, we cannot tell the direction of the bias introduced by the endogeneity of θ. One major concern is with the relative affluent families with enough assets to face zero marginal education tax rate. Given the well-known skewedness in wealth distribution, one might reasonably worry that the Feldstein finding is partly driven by these wealthy families facing zero marginal tax rate.

1.3.3 Identification of the Education Tax Effect

Kim(1995) takes advantage of richer information from the Survey of Income and Program Participation to ameliorate some of the measurement error issues. He can calculate the exact values of education window based on the data on children's age. He also utilizes the state of residence information from the data set to form a more refined measure of annual college costs. Instead of assuming a nationally uniform college costs, he hypothesizes that students go to a hypothetical in-state institution whose annual costs are the weighted average of private 4 year, public 4 year, and public 2 year institutions in the given state[15].

Kim(1995) also provides a procedure to take care of arbitrariness in using current asset values to calculate marginal education tax rates. As a solution for the life time utility maximization problem with the education tax, Kim(1995) derives an "asset evolution equation". He uses the equation to predict asset values in the year when college starts. The predicted asset values are then used to estimate τ_E.

[15]One justification of the procedure lies in the fact that a surprisingly high portion of students choose to remain in-state. See *Residence and Migration of College Freshmen(1979)*.

While these innovations help reduce the severity of measurement errors, it is clear that Kim(1995)'s estimation of τ_E also suffers from measurement errors. He also has to deal with the endogeneity bias, which may be a more serious problem. The situation clearly calls for an identification strategy based on instruments. Kim(1995)'s key insight is to identify the education tax effect off the variation in τ_E due to education window.

Recall the equation defining τ_E.

$$\tau_E = \sum_{n=1}^{EW} \frac{fm * \{(1 - \tau_{FED} - \tau_{FICA} - \tau_{STATE})r + 0.12\}\, I(C_n > EPC_n)}{(1+r)^{n-1}}.$$

First of all, Kim argues that education window makes a suitable instrument. It is very important to distinguish between education window and the number of children. Two families with the same number of children, differently spaced, can wind up with vastly different values of τ_E. While the number of children might appropriately be regarded as a result of rational choice, the spacing between siblings, after controlling for the number of children, is to a large extent randomly determined. Couples who have got their first child after a long waiting period, or those with a child born unplanned might more strongly agree on that.

Kim also uses as instruments the variation in college costs across states and over time. Higher education policies differ vastly among states. Some have affordable, high-quality public programs; some don't. Two otherwise identical families, one living in a high-cost state and the other in a low-cost state, might face different values of τ_E. The latter, sending the child to a relatively cheap school, might have to pay the full price–$C < EPC$– and thus face $\tau_E = 0$, while the former might be faced with a high positive marginal education tax rate. In estimating τ_E, Kim calculates C as the weighted average of state- and year-specific college costs of 4-year public, 2-year public, and 4-year private institutions. That means he has three college cost variables that are correlated with τ_E, to be used as instruments.

This variation in college costs may not be random. States with more affluent residents are likely to have higher education policies different from others. Fortunately, there are more instruments than endogenous variables. This allows a test of overidentifying restrictions. Test results in Kim(1995) fail to reject joint orthogonality of the instruments. Kim(1997) runs an informal specification check based on the same idea, obtaining similar estimates using just one instrument, education window.

Based on the proposed identification strategy, Kim(1995) suggests that the reduction in pre-college saving due to the education tax may be somewhat smaller than the Feldstein finding, but still substantial at 20%. In a sense, Kim(1995) could be interpreted as an independent corroboration of the original Feldstein result.

1.4 Interaction of College Financial Aid and Income Tax in Retirement Saving

1.4.1 A Primer on IRAs and 401(k)s

Individual Retirement Accounts(IRAs) and 401(k)s are tax-based saving promotion programs. If capital income taxation reduces personal saving, these are attempts designed partly to reverse the detrimental effect.

The two programs share essential features. Contributions are tax-deductible. Furthermore, returns accrue tax-free. Both of them have annual contribution limits. Any working couple can contribute up to $4,000 in IRAs, $2,000 each. A non-working spouse can contribute up to $250. Contribution limits to 401(k)s are typically determined in terms of percents of wages and salaries; concrete amounts of limit vary across individual plans. Withdrawals after retirement are taxed as a part of ordinary income. In addition, early withdrawals before the age of $59\frac{1}{2}$ are penalized by a 10% surcharge.

Before 1982, IRAs were available only for employees without company-provided pension plans. Contributions to IRAs skyrocketed after the program was made available in 1982 to all employees regardless of their pension status. By 1986, IRA contributions grew to about $38 billion, roughly 30% of all personal saving[16]. Tax Reform Act of 1986 limited eligibility for tax-deductible contributions for families with annual income over $40,000 and also with an employer-provided pension plan. IRA contributions dropped dramatically after that.

The fall in IRA contributions, however, were more than made up by steadily increasing contributions to 401(k)s. 401(k)s were available for a long time, but it was only after 1980 when the Internal Revenue Service provided clarifications that 401(k) contributions really soared. There are a few differences between IRAs and 401(k)s. 401(k)s are provided by employers in the form of deferred compensation. Even though the proportion of families with 401(k) accounts is roughly similar to that of families with IRA accounts, the take-up ratio of 401(k)s conditional on its availability is almost 70%. 401(k)s offer two additional benefits not applicable to IRAs. Many employers voluntarily match employee contributions to 401(k)s, say 50%. This matching could make 401(k)s a highly profitable proposition from the viewpoint of employees. In addition, even though early withdrawal is penalized, many 401(k) plans allow participants to borrow against their balances when special occasions arise such as a health emergency or college entrance of children. This makes 401(k) a more liquid form of saving than IRAs.

By 1992, saving through IRAs and 401(k)s was the single most important form of personal saving. In 1992, contributions to these retirement saving vehicles totaled $81 billion, compared to $64 billion in contributions to traditional employer-provided pension plans[17].

One can cite several factors that might account for the huge popularity of these retirement saving programs. Heavy promotion of IRAs by financial institutions and the value of these programs as a commitment device are often mentioned[18]. No doubt, the tax advantage resulting from tax deferral and tax-free accrual of return plays a critical role.

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[16]See Poterba, Venti, and Wise(1996).
[17]See Poterba, Venti, and Wise(1996).
[18]See Skinner, for instance.

There is an additional important factor, however, that has been ignored in the literature so far. These retirement saving vehicles provide a tax haven from the education tax. Parents are not required to report the value of their IRA and 401(k) savings when whey file for their children's college financial aid. As a result, savings in IRAs and 401(k) are shielded from the education tax. We now turn to this important aspect of the IRA and 401(k) advantage.

1.4.2 IRA and 401(k) *vs.*. Ordinary Saving Vehicles

Compared to ordinary saving, IRAs and 401(k)s provide partial protection against the income tax and total protection from the education tax[19]. IRAs and 401(k)s allow families to save their before-tax dollar, deferring income tax payment until after retirement. The marginal income tax rate applicable after retirement is likely to be lower than that during the prime saving age. In addition, returns accumulate tax-free. When parents send their child to college, assets in IRAs and 401(k)s are exempt from the education tax, since they are not considered taxable assets in the Federal Methodology.

For a family with n years to go before retirement, the at-retirement value of one more dollar in IRA or 401(k) saving today, V_{RET}, is given by the following equation. For simplicity, call IRA and 401(k) accounts retirement saving vehicles. Hence the subscripts on V_{RET}. Assume that τ_{FED} remains constant throughout the life cycle. The family can contribute its before-tax dollar, which grow at the untaxed rate of r. At retirement, the withdrawal will be taxed at the regular income tax rate.

$$V_{RET} = (1 - \tau_{FED}) * (1 + r)^n. \tag{1.3}$$

On the other hand, the equivalent value of one more dollar in ordinary saving, V_{ORD} will be:

$$V_{ORD} = (1 - \tau_E) * (1 - \tau_{FED}) * \{1 + (1 - \tau_{FED})r\}^n. \tag{1.4}$$

[19]This subsection is based on Kim(1997).

In ordinary saving accounts, you start with an after-tax dollar. The annual rate of return will be $(1-\tau_{FED})*r$, not r. During children's college years, the value will be slashed by the factor of $(1-\tau_E)$, capturing the impact of the education asset levy. The past literature on incentives for IRA and 401(k) saving has ignored this factor. As a result, incentives for IRA and 401(k) saving over ordinary saving vehicles have been understated.

Table 1 illustrates how important the education tax exemption is in raising the return on retirement saving vehicles *vis-à-vis* ordinary saving[20]. Panels 1 to 3 describe saving incentives for people at different stages of their lives: Panel 1 a person who is 40 years of age with 20 more years to go, Panel 2 45, and Panel 3 50 years of age[21]. Each panel compares two alternative means of saving, ordinary *vs.* retirement, in terms of both at-retirement values of one before-tax dollar saved today(V_{ORD} and V_{RET}) and implied annualized rates of return. The calculation assumes that $\tau_{FED}=0.28$ and that $r=0.06$.

V_{ORD} in the first column and V_{RET} in the fifth column are calculated according to the two equations above. V'_{ORD} in the third column represents the traditional estimates in the literature ignoring the impact of the education tax. Alternatively, V'_{ORD} can be construed as at-retirement values of one dollar saved today for families without a pre-college child. That is,

$$V'_{ORD}=(1-\tau_{FED})*\{1+(1-\tau_{FED})r\}^n. \tag{1.5}$$

For a family with a college-bound child, V_{ORD} gives the true return to be expected from an ordinary saving account, not $V_{ORD'}$.

Once the at-retirement value gets determined, the implied annualized rate of return, r^*, is calculated as a solution to the equation: $V=(1+r^*)^n$. V and r^* represent the same information, as one is a positive monotonic transformation of the other, given n.

Row-wise, each panel compares families facing different marginal education tax

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[20]This table is reproduced from Kim(1997).

[21]IRAs and401(k)s allow withdrawal without penalty once the contributor gets $59\frac{1}{2}$ in age.

rates. Kim(1995) provides estimates of τ_E based on the data from the Survey of Income and Program Participation. For middle income families earning between \$30,000 and \$60,000 a year, the median of τ_E is about 0.2. About a quarter of the same group face τ_E of 0.3 or above. Some unlucky families with large education window–about 10 % of the group–may face τ_E of 0.4 or up.

Panel 1 considers the case of a person from the middle income group, 40 years old with \$1 fund before tax. Suppose she faces $\tau_E = 0.2$ (row 1). She could contribute the dollar in her retirement saving account, either an IRA or a 401(k), enjoy deduction from income tax, and see the money grow tax-free. The only tax she should be concerned about is the income tax to be paid on withdrawal when she gets 60. After the tax, \$1 today will have grown into \$2.31 in 20 years of time(column 5). The implied compound annual interest rate is 4.3%(column 6). On the other hand, if she decides to save it through an ordinary saving vehicle, there will be no income tax deduction, interest income will get taxed in the future, and there will be an asset levy of 20% down the road. In 20 years of time, the saving will be worth only \$1.34 after all the taxes(column 1). Accordingly, the implied annual rate of return will be only 1.5%, about a third of what's available via retirement saving vehicles(column 2). There will be about 50% of people with a comparable amount of income who find the disparity even larger. For instance, the person at the upper quartile of the distribution of τ_E in the same group, with τ_E=0.3, may find ordinary saving provides less than one sixth of the annual return available from IRA or 401(k) saving(row 2). About 10% of middle income families with τ_E 0.4 or up(row 3) would be lucky to barely get back their principal from an ordinary account in 20 years.

The first row in Panel 2 describes a "typical" person who might be anxious about the choice between different means of saving. Aged 45, he has a daughter going to college in three years. From the tax point of view, the choice should be obvious. He can expect 3.7% annualized return from an IRA, but only 0.6% from an ordinary account. It is interesting to note that ignoring education tax results in 2.1% for annual return, halfway between 0.6% and 3.7%.

As a person gets older, the disadvantage of ordinary vehicles of saving gets aggravated, as saving there is allowed less and less time to recover from the shock of the education asset levy. A person 50 years old with a child to go to college later, from tax considerations alone, should not choose ordinary saving before he has exhausted contribution limits for retirement saving. After-tax rates of return on ordinary saving for such a person can be negative for a wide range of values for τ_E(Panel 3, columns 1 and 2). This analysis suggests the possibility of an unconventional explanation for why IRA contributors are predominantly older people.

Lessons from Table 1 seem loud and clear. A substantial portion of the attraction of retirement saving vehicles is accounted for by the education tax exemption. The older the family, and also the larger the education window(implying higher τ_E), the more significant the role of education tax exemption becomes. The traditional approach in the IRA and 401(k) literature ignoring the effect clearly understates the relative advantage of retirement saving vehicles. It would be surprising if this much difference in net rates of return due to the differing education tax rates does not affect portfolio choices regarding IRA and 401(k) *vs.* ordinary saving.

1.5 College Financial Aid, Income Tax, and Retirement Saving

1.5.1 New *vs.* Old Saving Controversy

Given the increasing dominance of saving through retirement saving vehicles among total personal saving, it is critically important to understand the nature of contributions to these instruments. Do they represent a new saving funded by reduced consumption, or merely an asset reshuffling funneled through either relabeling existing assets or redirecting the saving that would have been made anyway? If IRA and 401(k) contributions are not a new saving, the programs would be merely a tax windfall for the relatively rich families financed by a massive revenue cost. The huge existing literature on the subject has sensibly focused on this question. The relevant public policy question in the background is, should we raise the annual contribution limits in the programs?

Two schools with opposing views have been making contributions to this remarkably lively debate. See Venti and Wise(1992) and Poterba, Venti, and Wise(1996) for evidence supporting the new saving view; and Gale and Scholz(1994) for an opposing view.

If IRA and 401(k) contributions are a reshuffled saving, non-IRA, non-401(k) financial assets of contributors should decrease, or not increase as fast as those of non-contributors. However, other assets of contributors do exhibit faster growth that those of non-contributors. The response of the old saving school is, of course, that unobserved individual effects are behind the figures. IRA and 401(k) contributors are "savers", as different from non-contributors, and thus save actively through both IRAs and 401(k)s *and* ordinary channels. The question is, would IRA and 401(k) contributors have saved as much without the programs?

Empirical efforts of the new saving school have focused on controlling for these unobserved individual effects. They include, following the same households over time at the outset of the IRA program[22], within group comparisons[23], and an experimental approach[24]. The evidence seems to be overwhelming that IRA and 401(k) contributions cannot be merely a reshuffled saving.

[22]See Venti and Wise(1995). When families who didn't contribute in 1984 began to contribute in 1985, the non-IRA financial assets declined by only $193 between 1984 and 1985.

[23]See Poterba, Venti, and Wise(1995). They first set up groups similar in saving habits based on their participation or non-participation in the retirement saving programs using data from different years of Survey of Income and Program Participation. The only within group difference between different years is the number of years of exposure to the saving promotion programs. There was no noticeable reduction in other assets as IRA and 401(k) assets grew.

[24]See Poterba, Venti, and Wise(1994). This approach is based on the observation that only those persons whose employers decide to establish a 401(k) plan are eligible to contribute. In 1984, before the program could have had much effect on accumulated assets, the ratio of the median of non-IRA, non-401(k) assets of eligibles to that of noneligibles, controlling for income and weighted by the number of observations within income brackets, was exactly 1. By 1987, the ratio of total financial assets of eligibles to noneligibles was 1.62, and by 1991, the ratio was 2.22. The large difference in total financial assets is largely due to the difference in 401(k) assets.

1.5.2 Education Tax into the Scene

The new *vs.* old saving controversy has spawned superb, interesting empirical papers in a fine example of empirical research on an important public policy issue. Yet, in view of the important role played by the education tax exemption in enhancing the total tax advantage of IRA and 401(k) saving over ordinary saving, one might see some neglected spots in the literature.

First of all, tax-based saving promotion programs such as IRAs and 401(k)s are described by two parameters, the annual contribution limit and the size of the tax advantage. The received literature has focused on the first aspect with the second getting virtually ignored.

The interaction of college financial aid and income tax in retirement saving incentives implies that even if there is no change in the income tax treatment of retirement saving accounts, for instance no change in the annual contribution limits, changes on the college financial aid side may have significant effects. Interesting in this regard is the possible linkage between the tuition inflation in the recent past and the increasing popularity of retirement saving accounts. Remember that families with assets or income beyond a certain point should expect to pay full costs and thus face zero marginal education tax rate. The rapid pace of tuition inflation means that the number of such "rich" families is quickly diminishing, which in turn means that more and more families get to appreciate the additional merit of IRA and 401(k) saving in the form of education tax exemption.

Possible reforms of college financial aid, such as repealing means testing or abolishing the tax haven in IRA and 401(k) assets, could have substantial repercussions on retirement saving.

Focusing on the contribution limit aspect of the programs also make it difficult to answer other potentially important policy questions. What will happen to IRA and 401(k) contributions if there is another round of income tax cut? Can the different patterns of retirement saving contributions between different countries, for instance the U.S. 401(k) *vs.* the Canadian RRSP contributions, be accounted for by different marginal income tax rates?

It is also interesting to note that it may be lifetime contribution limits rather than annual contribution limits that is more important in the context of lifetime saving plans. Skinner(1991) notes that the lifetime limit of IRA accumulation is close of $95,000 including interest accumulated at 3 percent, over a thirty-year span of saving. Few families save close to the amount in liquid assets in the whole lifetime. In this light, one might conclude that in the longer term the tax advantage, or the size of incentives, of IRA and 401(k) saving may be more important than the amount of annual contribution limits.

Kim(1997) represents the first empirical paper to deal with the role of college financial aid in retirement saving. The estimates based on the data from the Survey of Income and Program Participation suggest that education tax exemption may be as important as preferential income tax treatment for nearly half the middle income American families. The paper does not make any direct contribution to the new *vs.* old saving controversy. Rather, it complements the existing literature, in that it highlights the role of the size of tax advantage. The more immediate contribution of the paper is to measure the influence of college financial aid and its means testing on IRA and 401(k) saving. The additional merit of education tax exemption is estimated to increase the participation probability in retirement saving programs by about 7%, and increase the balances by about 25%, for a typical middle income family.

1.6 Conclusion

Means testing in college financial aid implies a substantial penalty on pre-college family saving. The implicit tax is known as the education tax. This paper first discusses the salient institutional features of the Federal Methodology, the current federal rules governing the subsidy, and then critically examines the existing literature on the disincentive effect of the education tax on family saving. The emphasis is on the difficulties in terms of specification issues in measuring the education tax effect. The identification strategy based on the variation of marginal education tax rates due to differential spacing of siblings is discussed, following Kim(1995).

Retirement saving vehicles, such as IRAs and 401(k) plans, enjoy two-fold tax benefits, exemption from education tax as well as income tax deferral. Contributions in the retirement saving accounts are tax-deductible, and returns accrue tax-free, but this is not the end of the story. The money stashed in these accounts, unlike ordinary saving, does not affect the amount of the child's college financial aid. Ignoring the effect of education tax exemption leads to a significant underestimation of the relative tax advantage of IRAs and 401(k)s over ordinary saving: Kim(1997) presents estimates suggesting that for nearly half the middle income families education tax exemption is at least as important as income tax deferral.

This paper briefly reviews the debate on whether IRA and 401(k) contributions are a new saving. The literature focuses on the annual contribution limits, among the two key parameters of tax-based saving promotion programs, the other being the size of tax advantage. I discuss what are other potentially important policy questions that are ignored in the debate. The approach in Kim(1997) can be helpful to bridge the gap.

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Table 1. Tax Advantage of IRAs and 401(k)s

Panel 1. n=20

	Ordinary Saving w/ ed tax		Ordinary Saving w/o ed tax		IRA and 401(k)	
	V_{ORD}	r implied	V'_{ORD}	r implied	V_{RET}	r implied
τ_E=.2	1.34	1.5%	1.68	2.6%	2.31	4.3%
τ_E=.3	1.17	0.8%	1.68	2.6%	2.31	4.3%
τ_E=.4	1.01	0.0%	1.68	2.6%	2.31	4.3%

Panel 2. n=15

	Ordinary Saving w/ ed tax		Ordinary Saving w/o ed tax		IRA and 401(k)	
	V_{ORD}	r implied	V'_{ORD}	r implied	V_{RET}	r implied
τ_E=.2	1.09	0.6%	1.36	2.1%	1.73	3.7%
τ_E=.3	0.95	-0.3%	1.36	2.1%	1.73	3.7%
τ_E=.4	0.81	-1.4%	1.36	2.1%	1.73	3.7%

Panel 3. n=10

	Ordinary Saving w/ ed tax		Ordinary Saving w/o ed tax		IRA and 401(k)	
	V_{ORD}	r implied	V'_{ORD}	r implied	V_{RET}	r implied
τ_E=.2	0.88	-1.3%	1.10	1.0%	1.29	2.6%
τ_E=.3	0.77	-2.6%	1.10	1.0%	1.29	2.6%
τ_E=.4	0.66	-4.1%	1.10	1.0%	1.29	2.6%

Note: The table assumes marginal income tax rate of 28% that remains constant before and after retirement. It also assumes before-tax rate of return 6%.

Chapter 2

Implicit Taxes in College Aid and Family Saving

2.1 Introduction

College financial aid is a means-tested benefit program: if a family saves more, the children will get less financial aid. This program imposes an implicit tax on pre-college saving, and affects the timing and the amount of family saving, potentially discouraging accumulation of family assets. Understanding the size of this disincentive effect is important for the evaluation of different ways college financial aid is delivered[1]. It is also important for the understanding of how families react to means-testing in general.

While the existence of the disincentive has been recognized in the field for quite a while, the literature does not agree on the size of the effect. Feldstein(1995) suggests in his ground-breaking empirical research that the education tax might be responsible for about a 50% reduction in financial saving for a typical family. Edlin(1993)'s simulation-based study reaches a similar conclusion. On the other hand, Case and McPherson(1986), the first to raise the issue, conjecture that the reduction of family saving would be negligible. McPherson and Schapiro(1990) maintain the same. This

[1]Two major mechanisma are need-based financial aid and need-blind subsidy. Reduced tuition in public universities is the most important example of the latter.

debate parallels a much wider one regarding the sensitivity of family saving to tax-induced changes in the rate of return[2].

The main purpose of this paper is to measure the size of the disincentive effect of the education tax. For this purpose, I develop and solve a modified life cycle model to study family saving under the education tax. The solution of the model describes the growth of family assets over time with a simple nonlinear equation. The basic lesson from the model is simple: financial aid reduces pre-college family saving via two channels, the price effect and the wealth effect. Need-based financial aid penalizes post-college consumption, making pre-college consumption more attractive. As a result, families consume more pre-college, and save less. No less important, families are made richer by this transfer in the form of college financial aid. This leads to more consumption both pre-college and post. Again, financial aid reduces pre-college saving.

The solution of the model conveniently parametrizes these effects with two variables: first, the marginal increase in after-aid college costs due to an increase in pre-college saving, and second, the ratio of total after-aid college costs to the total amount of savings. This paper refers to them as the marginal tax rate and the average tax rate, respectively. Intuitively, we can think of the former as representing the price effect, and the latter the wealth effect. Need-based financial aid potentially discourages family saving both by raising the marginal tax rate and by reducing the average tax rate.

The major challenge for the empirical implementation of the model is how to correct for endogeneity bias in the tax variables, since they are determined in part by family wealth, even as they affect family decisions about saving. Errors in the tax rates aggravate the problem, since there is no exact way to determine the college costs facing individual families in the future, unless we have a reasonably long panel. My identification strategy overcomes these problems by using, as instruments, the spacing of children and the variation in college costs across states and over time. I argue that

[2]See Boskin(1978), Summers(1981), and Summers(1983), for instance, for results arguing for significant effects. See Hall(1978), for example, for an opposing evidence.

the instruments affect family savings only through their effects on the tax variables after controlling for the number of children. Tests of overidentifying restrictions fail to reject the hypothesis of joint orthogonality of the instruments.

My evidence based on the data from the Survey of Income and Program Participaion suggests that, for a typical family sending two children to college in succession, financial aid may reduce pre-college total wealth by as much as 20% through both price and wealth effects, mainly through the first. These effects are smaller than what Feldstein(1995) suggests, but still amount to a significant reduction. The effect on middle-income families is potentially bigger, since they face higher marginal tax rates on average.

One interesting provision of college financial aid is the exemption from the education tax of retirement saving assets including IRAs and 401(k)s: parents are not required to report these assets when they apply for their children's financial aid. This implies that the retirement saving accounts benefit from income tax deferral as well as education tax exemption. While the former has been the focus of a huge literature, the latter has been virtually ignored. Kim(1997) finds that the education tax exemption may be nearly as important as the income tax deferral in raising the combined tax advanage of IRAs and 401(k)s for a typical middle income family. Kim(1997) also finds using the data from the Survey of Income and Program Participation that the education tax exemption may be responsible for about 7% increase in the participation probability, and about 25% increase in balances in IRAs and 401(k)s for such a family.

Important as it is to understand how much the college financial aid rules reduce family saving, it is crucial to remember that this issue is a part of a larger question: Who should pay for higher education, and how? One way to ask this question is to compare the two currently most prominent student subsidies: need-blind tuition reduction by state governments and need-based federal aid. In addition to their effects on family saving, another important dimension is how effective they are in increasing the demand for college education[3]. In this regard, it is interesting to note that while

[3]Hanushek(1992) provides an excellent summary of the issues involved. McPherson and

the effectiveness of flat subsidy is well established, the literature says little about the effectiveness of need-based financial aid[4].

The remainder of the paper proceeds as follows. Section 2 describes the Federal Methodology of need analysis with emphasis on those features crucial for theoretical and empirical modeling. Section 3 develops and solves a simple life cycle model to derive a structural equation, describing the growth of assets over time before college starts. Section 4 discusses data and empirical strategy. Section 5 provides the results of estimation and discusses them. Finally, Section 6 concludes.

2.2 How It Works: Implicit Taxes in College Financial Aid

2.2.1 Need Analysis: Federal Methodology

While financial aid offices at individual schools are responsible for the actual administration of college financial aid, the Federal Government is in tight control with Federal Methodology(FM, henceforth) as defined in the Higher Education Act and its amendments[5]. Schools are mandated to follow FM if they are to use any federal funds for a given student's aid package. A federal agency, the College Scholarship Service, centrally processes financial aid applications from families to determine need for financial aid[6]. This section focuses on those features of FM crucial for the understanding of implicit taxes in college financial aid. Readers interested in other details and implications of FM are referred to Edlin(1992).

Schapiro(1990) advocate expanding need-based federal aid at the expense of need-blind state subsidy.

[4]See Kane(1995). Manski and Wise(1983) find that among 4-year college students most recipients of Pell grants, the most important of need-based subsidies, would have gone to college without the grants. I am currently planning to investigate the issue using the variation in after-aid college costs for families with differently spaced children. The rules of college financial aid require that after-aid annual costs remain the same regardless the number of siblings attending college at the same time. Two otherwise similar families may thus face substantially different after-aid college costs, when they have differently spaced children.

[5]See *United States Code Annotated* Title 20 Education, 1990 and 1995.

[6]This agency also publishes its own financial aid guidebook annually. The guidebook, *College Costs and Financial Aid Handbook,* gives a guided tour of the financial aid system.

Need for financial aid is determined by the difference between annual college costs and Expected Parental Contribution(EPC). The costs are the sum of tuition and fees, room and board, and other miscellaneous expenses, determined by each school. Given estimates of financial need, school aid officers set up individualized aid packages, striving to meet as much need as possible. Grant funds from the Federal Government are tapped first, then funds from the state and other sources. For students with remaining need, schools arrange government-subsidized loans and/or Work Study opportunities.

The assessment of EPC is similar to federal income tax calculation in many respects, except that EPC also taps family assets[7]. Starting from total income, FM subtracts an array of expenses to get the Available Income(AI). FM then multiplies the value of net assets minus an Asset Protection Allowance by 0.12 to get the Income Supplement from Assets(IS). The sum of AI and IS is the Adjusted Available Income(AAI), a concept analogous to the Adjusted Gross Income in the federal income tax. In the last step, FM applies a series of marginal tax rates to convert AAI into EPC. The following formula summarizes the determination of EPC.

$$\begin{aligned} EPC &= FM((INCOME - EXPENSES) + \\ &\quad 0.12 * (ASSETS - ALLOWANCE)) \end{aligned} \tag{2.1}$$

$FM(\cdot)$ is a progressive tax schedule with the marginal rate increasing from 0 to 0.47. The argument of the function $FM(\cdot)$ is AAI, the sum of AI and IS. $EXPENSES$ is the sum of federal income tax, Social Security tax, state and other taxes, an employment allowance[8], and an income protection allowance[9]. Among the

[7] One might worry about compliance. Can families not simply underreport their assets and income to get assigned lower EPC? Many schools guard against this possibility by requesting families to submit their IRS tax returns. See Edlin(1995).

[8] In a 2-parent family where both parents work, allow 35% of the lower salary to a maximum of $2,500; in a 1-parent family, allow 35% of the salary to a maximum of $2,500. No allowance for a 2-parent family in which only one parent works.

[9] The amount of income protection allowance depends on the size of the family.

items in *EXPENSES*, the amounts of the first three depend on income, but not the last two. *ALLOWANCE* is the Asset Protection Allowance, which depends on the age of the household head and the marital status of the parents, but not on the amount of assets. *ASSETS* refer to the sum of home equity, other real estate equity, business or farm equity, cash, savings, checking accounts, stocks, and mutual funds[10].

One important aspect of the Federal Methodology is that it exempts a wide class of assets from taxable assets. Broadly speaking, assets that might be regarded as retirement saving vehicles are not taxable. They include IRA, Keogh, and 401(k) accounts, variable annuities, life insurance policies, and private and public pensions. Families can reduce the education tax by shifting assets into these tax-favored categories. While they may not be perfect substitutes for ordinary saving vehicles, their relative attractiveness should increase with the marginal education tax rate. See Kim(1997) for a discussion of the importance and the implications of this exemption.

Figure 1 provides a rough idea of the distribution of EPC among different income groups. The estimates of percentiles of EPC are based on data from the Survey of Income and Program Participation 1984 through 1992. A wide distribution of EPC can occur within the same income bracket due to different levels of assets. As long as a student is choosing a school whose annual costs are higher than his EPC, he will receive financial aid, and thus be subject to a distortionary capital levy. One conclusion that we can draw from Figure 1 is that the proportion of the population susceptible to the distortion is very large. This impression is confirmed by the fact that about 50% of public 4-year and 70% of private 4-year students get financial aid(Congressional Budget Office 1991)[11].

---

[10]The 1992 Amendment to the Higher Education Act included one crucial change: starting from the award year 1993, home equity was excluded from assets in FM. It would be very interesting to see whether families adjust their balance sheets for greater home equity in the future. Families in the last data year, 1992, may have been influenced by the anticipation of this legislative change, while the adjustment involving home equity might plausibly take some time to show up. My estimates change only slightly when I exclude observations from 1992.

[11]If we take into account the fact that many aid packages include loans in addition to grants, estimates of after-aid costs should be revised downward. McPherson and Sharpiro(1991) and Feldstein(1995) estimate the real value of subsidized loans to be equivalent to 50 and 60 cents in grants, respectively. Edlin(1994) finds that about $\frac{2}{3}$ of aid is grant aid, and combining this finding with the 50 cents figure above, estimates that a one dollar increase in EPC is on average met by an 83 cents

2.2.2 College Costs: The Other Term

FM determines the need for financial aid as the difference between annual costs of a given school and EPC. It is crucial to note that when actual costs exceed EPC, additional saving will not increase the family burden, implying a marginal tax rate of zero.

Naturally, annual college costs vary across states, across types of institutions, and indeed over time. The significance of this point is that it provides potentially exogenous variation in education tax rates. Two otherwise similar families, one living in a low tuition state and the other in a high tuition state, may face different marginal tax rates. A similar thing may happen with within-state, over-time variation.

In this paper, we assume that students go to a hypothetical composite college within their state where annual costs are weighted averages of costs at public 4-year, public 2-year, and private 4-year institutions in that state. Of course, this is not an ideal assumption, introducing a serious measurement error problem. Errors in variables come from lack of information on two points. First, we do not know which kind of program the child will attend in the future. Second, we do not know whether she will remain in-state, or move to another state. Presumably, the second problem is not that severe, given that the overwhelming majority of students actually choose to remain in-state, especially when they are going to either a public 4-year or 2-year program. In addition, the problem may be mitigated by looking at the restricted sample consisting of only those states with high stay-in ratios. The first problem is dealt with by an instrumental variables strategy.

We find that there is a fair amount of variation in weighted state average annual costs, both between-state and within-state. See Table 1 for an illustration of between-state variation. Probably the most notable thing from the table is the degree of variation in weighted average college costs across states. The weighted average annual cost in Massachusetts is almost three times that of Arizona. There are two sources for this wide variation. The first is the difference in annual costs in a given kind

decrease in grant-equivalent aid.

of program. The differing relative size of public 4-year, public 2-year, and private 4-year programs reinforces this within-program variation: high-cost states tend to have smaller public programs. Another important thing to note in the table is the high stay-in ratios(%SI), in particular in public 4-year and public 2-year programs. Student migration is more active among those heading for private programs, but even among this segment of the student population, stay-in ratios are often higher than 70 %.

2.2.3 The Average and Marginal Tax Rates

The definition of both the marginal and average tax rates of the education tax starts from the *present value* of after-aid college costs discounted back to the time of college matriculation. We look at the present discounted value because we are going to model college costs as a one-shot capital levy to simplify the analysis. The next section will explain issues of timing, among other things, related to modeling the education tax and family saving.

There is one last crucial feature in FM that deserves mention, regarding siblings attending college at the same time. When a brother joins his sister already in college, the assessed EPC stays the same, meaning that EPC *per matriculated child* is halved[12]. For an illustration, let's suppose we have two similar families, the Joneses and the Smiths, the only difference being that the Jones sisters differ in age by two years, while the Smith brothers are four years apart. In this case, the Joneses will be done with their children's college education after paying their EPC for six years, whereas the comparable number for the Smiths is eight years. The bottom line is that it is the net duration of the college education for all children, known in the field as the *education window*, not just the number of children, that counts in determining the total amount of after-aid college costs.

Let $f(A_S)$ denote the present discounted value of total after-aid college costs as

[12]This provision introduces variation in after-aid costs for college education for families with differently spaced children. I am planning to look at the effects of targeted aid on college choice using this variation. The existing literature says little on this point, while the effectiveness of need-blind subsidy in the form of reduced tuition in state universities is fairly well established.

a function of A_S, savings accumulated up to time $t = S$ when college starts for the first child.

$$f(A_S) = \sum_{n=1}^{EW} \frac{\min\{CC_n, EPC_n(A_S)\}}{(1+r)^{n-1}} \tag{2.2}$$

CC_n refers to a hypothetical annual college cost at a composite state college. $EPC_n(A_S)$ denotes Expected Parental Contribution as specified by the Federal Methodology. The function "min" reflects the fact that after-aid expenses should not be more than annual college costs. EW is the length of the education window[13]. Once we settle on $f(A_S)$, the definition of the average tax rate, τ_A, automatically follows.

$$\tau_A = \frac{f(A_S)}{A_S} \tag{2.3}$$

The derivation of the marginal tax rate, τ_M, is more complicated. It is crucial to note that one more dollar in savings increases your AAI and EPC in two ways: directly by increasing the Income Supplement from Assets, and indirectly by increasing the Availr ble Income through increased capital income. For a family facing federal, FICA, and state marginal income tax rates of fed, $fica$, and $stat$, respectively, and rate of return on saving r, one more dollar in savings raises EPC per annum by the following amount[14].

$$\begin{aligned} \Delta(EPC) &= fm * \Delta(AAI) \\ &= fm * (\Delta(AI) + \Delta(IS)) \\ &= fm * \{r * (1 - fed - fica - stat) + 0.12\}\Delta(Savings) \end{aligned} \tag{2.4}$$

[13]This formula doesn't take into account the fact that as families pay college bills year after year, they are made poorer and their EPC falls. Part of the reason why we do this is practical: this way, we don't have to worry about saving and consumption during children's college education. In addition, there is some anecdotal evidence that families tend to get stuck with their initial assessment of EPC. Just as they hate filing tax returns, many families fail to file their financial aid application anew in subsequent years.

[14]We assume $r = 0.06$ in our empirical analysis, following Feldstein(1995).

where fm is the statutory marginal rate converting AAI into EPC in FM. Assuming a family facing combined marginal tax rates of 35 % on its income and r of 6%, we find that the amount inside the curly brackets above is 0.165, the sum of $0.06 * (1 - 0.35)$ and 0.12. One more dollar saved means an additional 16.5 cents in AAI to be taxed. If our hypothetical household faces the top marginal education tax rate fm of 47%, the increase in EPC due to additional saving will be 8 cents per dollar. Remember that the education tax is an annual levy lasting until the last child finishes college. This implies a value of τ_M given by the following.

$$\begin{aligned}
\tau_M &= \frac{d}{dA_S} f(A_S) \\
&= \sum_{n=1}^{EW} \frac{d}{dA_S} \frac{\min\{CC_n, EPC_n(A_S)\}}{(1+r)^{n-1}} \\
&= \sum_{n=1}^{EW} \frac{d}{dA_S} \frac{EPC_n(A_S)\, I\{CC_n > EPC_n\}}{(1+r)^{n-1}} \\
&= \sum_{n=1}^{EW} \frac{fm * (r * (1 - fed - fica - stat) + 0.12)\, I\{CC_n > EPC_n\}}{(1+r)^{n-1}}, \quad (2.5)
\end{aligned}$$

where I is an indicator function assuming the value of unity when the statement inside the brackets is true, and zero otherwise.

Figures 2 and 3 show the distribution of τ_A and τ_M in the population. Again, the percentiles are estimates based on SIPP data. For the estimates, we assume that every student is going to the hypothesized, in-state program. The estimates thus should be regarded as an illustration. The dispersion of tax rates within an income bracket comes mainly from three different sources: the differing amounts of assets, the differing sizes of education windows, and the variation in annual costs. We want to discuss the two figures, partly because they are the main variables of interest in our estimation, but also because they illustrate some important features of the education tax.

The first thing to note about τ_A is that it is a measure of the after-aid net burden for college education, normalized by ability to pay. Figure 2 shows that even after financial aid, the burden is substantial, especially for poorer families, but also for those relatively well-off. Even for families with income between $40,000 and $50,000, the median τ_A is as high as 30%.

τ_M measures how much financial aid reduces the post-college purchasing power of an additional dollar in savings. The distribution of τ_M in Figure 3 dramatically confirms our suspicion: it is middle-income families that are mostly strongly affected by the disincentive from the education tax. Poor families face low τ_M because they are poor and fall in low marginal education tax brackets. Rich families face low, actually zero, τ_M, because they pay the full sticker price for college education.

2.3 Education Tax and Family Saving in a Life Cycle Model

2.3.1 Setting Up the Problem

Let's suppose we have a family that lives for T years, and works for the first R years earning y every year. The family neither receives nor gives bequests. The sole purpose of saving is to finance consumption after retirement. What the family saves, it puts into bonds earning a risk-free return at the annual rate of r. The family derives an instantaneous utility according to the CRRA utility function. The family sends the child to college at time S, when it is subject to a one-shot education tax in the form of a capital levy. This family solves the following optimization problem.

$$max_c \int_0^T e^{-\delta t} \frac{1}{1-\sigma} c^{1-\sigma} dt$$

subject to

$$\begin{aligned} A_0 &= 0 \\ \dot{A} &= rA + y - c, \text{ if } 0 < t < S \\ A'_S &= A_S - f(A_S) \end{aligned}$$

$$\dot{A}' = rA' + y - c, \text{ if } S < t \leq R$$
$$\dot{A}' = rA' - c, \text{ if } R < t \leq T, \quad (2.6)$$

where A'_S denotes the amount of assets at time $t = S$ after the education tax, and $f(A_S)$ the after-aid costs for college education according to the Federal Methodology. Note that the law of motion equations divide the life cycle into three distinct phases: pre-college, post-college, and retirement. Before retirement, the family earns y in addition to interest income rA. After retirement, the earned income is gone. The family saves A_S by $t = S$, but after taxes, the amount of remaining assets is just $A_S - f(A_S)$.

We solve the problem recursively, proceeding backward. That is, we start with the retirement consumption problem, then move over to the post-college, and finally to the pre-college consumption problems. Solutions to preceding problems will feed into the next-stage problems. We first solve the retirement consumption problem, assuming that the family has retired with assets A_R. The maximized discounted utility thus obtained serves as the "salvage value function" for the post-college optimization problem. With the solution at hand for this post-college consumption problem, we will solve the pre-college problem, which is the main object of our interest. The maximized discounted utility from the post-college consumption problem, a function of after-tax assets at $t = S$, will provide the salvage value function for the pre-college problem.

2.3.2 The Model in a Life Cycle Diagram

Before proceeding, it helps to think of the life cycle optimization with the education tax in a canonical life cycle diagram. We turn to Figure 4 now, assuming $\delta = r = 0$ for convenience. Figure 4 deals with three different scenarios: life cycle saving without college education, college education without financial aid, and finally, life cycle saving with need-based financial aid.

In the simplest of possible worlds, the family works and earns y until retirement at $t = R$, and there is no college education to worry about. To smooth consumption and finance retirement, the family saves a certain portion of income while working. The amount of assets grows at the rate of $y - c_0$ each period, until it starts decreasing at retirement at the rate of c_0. The result is the familiar hump-shaped asset curve, OAT, marked by a thin unbroken line. The level of consumption c_0 can be determined from the life cycle budget constraint.

$$c_0 = \frac{y * R}{T}$$

In the second scenario, we consider college education without financial aid. The amount of life cycle resources is reduced by the college outlay. The result is a smoothed consumption, c_1, at a lower level than before.

$$c_1 = \frac{y * R - U}{T},$$

where U denotes the college bill. As a result of slower consumption, the amount of assets grows faster, along the dotted line OB, until it drops to C to pay the bill. We assume the price of education is measured by the vertical distance between B and C. After S, the family maintains the same fast rate of accumulation as before college[15]. Yet, the peak of post-college savings at $t = R$, D, will fall below the previous peak, A, simply because the family needs less savings to finance less consumption in the later years.

In the most interesting case of need-based financial aid, we should note that such aid will influence consumption, pre-college and post, in two distinct ways. First, it distorts the relative price of consumption before and after college, penalizing postponement of consumption. This effect prevents the family from achieving consumption smoothing, leading to more consumption earlier[16]. Second, such aid makes the family

[15] Note that the two line segments OB and CD are drawn to be parallel to each other.

[16] One might wonder why this is the case, since the capital levy is anticipated. It helps to imagine an extreme case of a capital levy: summary confiscation, say, one year from today. The optimal consumption choice would be to consume whatever you earn for the year and to resume your desired level of saving after the levy. Life cycle planning does not always lead to perfect consumption smoothing, just because an event is anticipated.

richer. Now it can afford to consume more both before and after college. Both effects lead to more consumption, and thus less saving, before college[17]. The pre-college asset path, marked here by the thick line segment OE, is accordingly shown as falling below OB. By how much? The remainder of the section answers this question with a solution to the life cycle optimization model set up in the preceding subsection.

2.3.3 The Solution to the Post-college and the Retirement Phases

For convenience, we assume the simplest case where $\delta = r = 0$[18]. We start with the retirement period.

$$max_c \int_R^T \frac{1}{1-\sigma} c^{1-\sigma} dt$$

subject to

$$\begin{aligned} A_R &\quad \text{given} \\ \dot{A} &= -c \end{aligned} \tag{2.7}$$

Notice that both the objective function and the law of motion have been simplified by the assumptions just made. While this simple problem could be solved without invoking the language of optimal control, we do so here, since the mechanics are going to prove useful later. Write the current-value Hamiltonian, denoting by λ the current-value costate variable.

$$H = \frac{1}{1-\sigma} c^{1-\sigma} + \lambda(-c) \tag{2.8}$$

The Maximum Principle of optimal control dictates that the consumption path should satisfy the following conditions.

[17] The direction of the combined effects for post-college consumption is not clear.

[18] Modigliani(1985) uses this bare-bone version of the life cycle model to find that the model is capable of adequately explaining aggregate family accumulation.

$$
\begin{aligned}
H_c &= c^{-\sigma} - \lambda = 0 && (2.9)\\
H_A &= 0 = -\dot{\lambda} && (2.10)\\
H_\lambda &= -c = \dot{A} && (2.11)\\
A_T &= 0 \text{ (Transversality)} && (2.12)
\end{aligned}
$$

From Equation 2.10, we learn that the costate variable is a constant. This implies in Equation 2.9 that consumption is also a constant[19]. Integrating both sides of Equation 2.11 with respect to t, and using boundary conditions given by transversality and initial conditions, we easily find the solution.

$$
\begin{aligned}
c &= \frac{A_R}{T-R}, \; R < t < T \\
V(A_R) &\equiv max \int_R^T c^{1-\sigma}\, dt \text{ subject to } A_R \text{ given, } \dot{A} = -c \\
&= \frac{A_R^{1-\sigma}}{1-\sigma}(T-R)^{\sigma} && (2.13)
\end{aligned}
$$

The solution says that the family consumes at a constant rate, so that it exhausts the given resource A_R by the terminal time. The solution feeds into the post college consumption problem in the form of a salvage value function. Equation 2.13 gives the maximized discounted utility from retirement consumption with retirement savings of A_R. Note that the salvage value function has the same convenient functional form as instantaneous utility. Consider the following program of post-college consumption.

$$
max_c \quad \int_S^R \frac{1}{1-\sigma} c^{1-\sigma}\, dt + V(A_R)
$$

subject to

$$
A'_S = A_S - f(A_S)
$$

[19]This property holds as long as we assume $\delta = r$.

$$\dot{A} = y - c \tag{2.14}$$

This time we denote the costate variable by μ. The current value Hamiltonian and the MP conditions remain the same as before, except that we have a different transversality condition. With a salvage value function, the transversality condition requires that the derivative of the salvage value with respect to the state variable be equal to the value of the costate variable at the terminal time, $t = R$. First, we look at the Hamiltonian.

$$H = \frac{1}{1-\sigma}c^{1-\sigma} + \mu(y - c) \tag{2.15}$$

Now the MP conditions are:

$$\begin{aligned}
H_c &= c^{-\sigma} - \mu = 0 && (2.16)\\
H_A &= 0 = -\dot{\mu} && (2.17)\\
H_\mu &= y - c = \dot{A} && (2.18)\\
V'(A_R) &= A_R^{-\sigma}(T-R)^{\sigma} = \mu_R \text{ (Transversality)} && (2.19)
\end{aligned}$$

Equations 2.17 and 2.16 again imply constant consumption. The transversality condition tells us that this constant consumption happens to be equal to the retirement consumption in Equation 13. Combining Equation 2.18 with the initial and transversality conditions, we get the following solution.

$$\begin{aligned}
A_R &= \frac{(T-R)(R-S)}{T-S}y + \frac{T-R}{T-S}(A_S - f(A_S)) && (2.20)\\
c &= \frac{A_R}{T-R} = \frac{R-S}{T-S}y + \frac{1}{T-S}(A_S - f(A_S)) && (2.21)\\
V(A_S - f(A_S)) &\equiv \frac{1}{1-\sigma}\left\{\frac{R-S}{T-S}y + \frac{A_S - f(A_S)}{T-S}\right\}^{1-\sigma}(T-S) && (2.22)
\end{aligned}$$

Several features in the solution above deserve comments. Equation 2.21 shows that the family evens out the sum of available resources, earnings $(R - S)y$ and "endowment" $A_S - f(A_S)$, over the remaining time to achieve consumption smoothing. The maximized value of the program in Equation 2.22 again has the same convenient form as the instantaneous CRRA utility.

All of the above has been preparation for our main analysis. We now turn to pre-college resource allocation.

2.3.4 Pre-College Saving with the Education Tax

Utilizing the salvage value function derived from the post-college consumption problem, we have the following pre-college program.

$$
\begin{aligned}
max_c \quad & \int_0^S \frac{1}{1-\sigma} c^{1-\sigma}\, dt + V(A_S - f(A_S)) \\
& \text{subject to} \\
A_0 &= 0 \\
\dot{A} &= y - c \qquad (2.23)
\end{aligned}
$$

This time we use ϕ to denote the costate variable. The form of the Hamiltonian and the MP conditions are exactly the same as in the post-college consumption case, except that we have a slightly different transversality condition due to a new salvage value function and, of course, a different initial condition.

We have the following MP conditions.

$$H_c = c^{-\sigma} - \phi = 0 \qquad (2.24)$$

$$H_A = 0 = -\dot{\phi} \qquad (2.25)$$

$$H_\phi = y - c = \dot{A} \qquad (2.26)$$

$$\frac{d}{dA_S} V(A_S - f(A_S)) = \phi_R \text{ (Transversality)} \qquad (2.27)$$

The solution follows in the same way as before. From Equations 2.25 and 2.24, we verify the constancy of both the costate and consumption variables. Then, the transversality condition tells us that the constant consumption is given by the following.

$$\begin{aligned} c_{pre-college} &= \{1-f'(A_S)\}^{-\frac{1}{\sigma}}\{\frac{R-S}{T-S}y+\frac{1}{T-S}(A_S-f(A_S))\} \\ &= (\frac{1}{1-f'(A_S)})^{\frac{1}{\sigma}}\, c_{post-college} \\ &\geq c_{post-college} \end{aligned} \tag{2.28}$$

The constancy of consumption that we have observed between the post-college and retirement phases does not hold any more[20]. The education tax in the form of a capital levy drives a wedge between the prices of consumption before and after college. The family gains by consuming more earlier, and postponing saving until after college. Again, we use the condition $(y-c)S = A_S$ deriving from the law-of-motion equation to solve for A_S.

$$\{y-(1-f'(A_S))^{-\frac{1}{\sigma}}\frac{R-S}{T-S}\,y-(1-f'(A_S))^{-\frac{1}{\sigma}}\,\frac{1}{T-S}(A_S-f(A_S))\}\,S = A_S \tag{2.29}$$

The equation above is a complicated linear differential equation in $f(A_S)$. But there is a convenient way to circumvent the computational complexity. Let τ_M denote the marginal tax rate, and τ_A the average tax rate as defined earlier. Note that the equation above can be rewritten as a simple linear equation in A_S involving the tax rates that apply in the year of college matriculation. We solve this equation for A_S.

$$A_S = \frac{1-(1-\tau_M)^{-\frac{1}{\sigma}}\frac{R-S}{T-S}}{1+(1-\tau_M)^{-\frac{1}{\sigma}}\frac{S}{T-S}(1-\tau_A)}\,S \tag{2.30}$$

Note that there is a simple linear relationship between A_S and A_t from the law of

[20]That is, unless $f'(A_S) = 0$, which is indeed the case of those rich enough. Thus we confirm that for those rich enough, there is no efficiency loss.

motion Equation 23.

$$A_S = \frac{S}{t} A_t \tag{2.31}$$

Let's call Equation 31 the asset projection equation. The trick is use the data on A_t to project A_S, rather than solve for A_S from the differential equation. The analytic solution can now be obtained in the following three steps.

1. Project the future amount of assets at $t = S$ with the asset projection equation, using information on the values of A_t, S, and t.

2. Apply the Federal Methodology to the projected asset value A_S to calculate the marginal and average tax rates at $t = S$, τ_M and τ_A.

3. Use the time t asset equation, or its Taylor expansion, as we do in the subsequent sections, for empirical implementation.

Note that the time t asset equation is implied by the time S asset equation and the asset projection equation. In the following solution, the tax variables, τ_M and τ_A, are those applicable to A_S.

$$A_t = \frac{1 - (1 - \tau_M)^{-\frac{1}{\sigma}\frac{R-S}{T-S}}}{1 + (1 - \tau_M)^{-\frac{1}{\sigma}\frac{S}{T-S}}(1 - \tau_A)}\, t\, y \text{ for } 0 < t < S. \tag{2.32}$$

2.3.5 The Non-Zero Case

This subsection relaxes the restriction that both the discounting rate and the rate of return are equal to zero, retaining only the assumption that they are equal. We will not go through the derivation again. It suffices simply to note that the problem is solved similarly, and the suggested projection procedure works equally well in this more realistic case. For the sake of completeness, we report the derived asset evolution equation for the non-zero case.

$$A_S = \frac{1 - (1 - \tau_M)^{-\frac{1}{\sigma}\frac{1 - e^{-r(R-S)}}{1 - e^{-r(T-S)}}}}{e^{-rS} + (1 - \tau_M)^{-\frac{1}{\sigma}\frac{1 - e^{-rS}}{1 - e^{-r(T-S)}}}(1 - \tau_A)} \frac{1 - e^{-rS}}{r} y \tag{2.33}$$

$$A_t = \frac{1-(1-\tau_M)^{-\frac{1}{\sigma}\frac{1-e^{-r(R-S)}}{1-e^{-r(T-S)}}}}{e^{-rt}+(1-\tau_M)^{-\frac{1}{\sigma}\frac{e^{-r(t-S)}-e^{-rt}}{1-e^{-r(T-S)}}}(1-\tau_A)}\frac{1-e^{-rt}}{r}y \tag{2.34}$$

$$A_S = \frac{1-e^{rS}}{1-e^{rt}}A_t. \tag{2.35}$$

The solution works in three steps as before. First, use the asset projection equation to project the value of assets at $t = S$, given A_t. Second, apply the Federal Methodology to calculate the corresponding average and marginal tax rates for the projected amount. Third, use the estimated values of marginal and average tax rates to estimate the asset evolution equation.

I have also experimented with different functional form assumptions on preferences, such as CARA utility, quadratic utility, and Stone-Geary utility. Reassuringly, the fundamental features of the solution are robust to different functional form assumptions. First, the same variables, marginal and average tax rates, τ_M and τ_A, relative length of life cycle phases, $\frac{R-S}{T-S}$ and $\frac{S}{T-S}$, calendar age, t, and income, y, appear in all of the solutions. Second, the solutions share the same comparative static properties. For instance, the higher τ_M, the slower the asset accumulation, and the higher τ_A, the faster the accumulation, implying that the current financial aid rules reduce pre-college saving through both the higher marginal tax rate and the lower average tax rate.

2.4 Empirical Implementation

2.4.1 Specification

To motivate the empirical analysis that follows, consider the structural asset equation.

$$A_t = \frac{1-(1-\tau_M)^{-\frac{1}{\sigma}\frac{R-S}{T-S}}}{1+(1-\tau_M)^{-\frac{1}{\sigma}}\frac{S}{T-S}(1-\tau_A)}\, t\, y \text{ for } 0 < t < S.$$

The estimation equation is a first order Taylor expansion of this equation, with the addition of a group of covariates.

$$A = \beta_0 + \beta_1\tau_M + \beta_2\tau_A + \beta_3 LC_1 + \beta_4 LC_2 + \beta_5 AGE + \beta_6 INCOME + Z\gamma + \epsilon \quad (2.36)$$

τ_M and τ_A are the marginal tax rate and the average tax rate, respectively, as defined in Section 2. τ_M is the tax parameter that captures the degree to which the education tax penalizes pre-college saving. τ_A summarizes the wealth effect of financial aid. The higher the τ_A, the more the family will save pre-college. The model predicts a negative coefficient for τ_M and a positive one for τ_A. LC_1 and LC_2 are life cycle parameters that show up in the solution, Equation 31.

$$\begin{aligned} LC_1 &= \frac{R-S}{T-S} \\ LC_2 &= \frac{S}{T-S} \end{aligned}$$

LC_1 is the ratio of the length of (parents') working life after college to the length of (parents') total life after college[21]. The model predicts a negative sign for its coefficient. Intuitively, if parents have more time to recoup post-college, they can afford to save less pre-college, when the terms are not as good. LC_2 is the ratio of the length of pre-college life to that of post-college life. The model again predicts a negative coefficient for this variable. This needs a subtler explanation. Large values of LC_2 mean that the family faces relatively many years before the education tax is collected, with large values of S, the length of pre-college years. Because of the smaller number of years of consumption after the education tax in this case, the family is more willing to accept a lower annual consumption flow post-college. Hence, the lower saving pre-college. It is important to note that the variation in the two life cycle parameters comes via one variable, S, from two sources: when the family starts

[21]We assume that the exits from workforce and life are mandatory at $R = 65$ and $T = 75$.

working, and when it gives birth to its first child[22].

AGE and *INCOME* are predicted to have positive coefficients for obvious reasons. Z includes an extensive list of variables: parental education, marital status, race dummies, state and year fixed effects, and dummies for the number of children. There are no clear predictions from the theory for many of these covariates. τ_M and τ_A are the two most important variables in our investigation, as they parametrize the effects of the education tax. At the same time, they raise two serious specification issues: simultaneity bias and measurement error. Simultaneity bias arises, because the tax rates are determined partly by assets, even as they affect family decisions about saving. To look for instruments to deal with this issue, think of our empirical equation as a part of a three-equation system, the other two being definitions of τ_M and τ_A. Ideal instruments for simultaneity bias are those variables that are in the τ_M and τ_A equations, but excluded from the asset equation.

We now turn to discussion of measurement error. Recall that we assume that every student in a given state goes to a hypothetical composite school whose annual costs are a weighted average of 4-year public, 2-year public, and 4-year private costs in that state[23]. The tax rate variables estimated under this assumption are subject to measurement error on two accounts. First, we do not know which kind of program the child is going to attend in the future. Second, we do not know whether she is going to an in-state program, or one out of state. Presumably, the second problem is not that severe, given that the overwhelming majority of students actually choose to remain in-state, especially when they are going to either a public 4-year or a public 2-year program. This problem may be further mitigated by looking at the restricted sample consisting of only those states with high stay-in ratios. However, it is clear that we

[22]We assume that the family starts working at the end of the formal education for the household head and that a child goes to college at age 18.

[23]Another implicit assumption is that parents know the true annual costs that their children are going to face in the future. One of the consequences of this assumption is that we are assuming away the precautionary motive for saving. While it is difficult to tell what the effects would be if we relax this restriction of no uncertainty, it is interesting to note that τ_M and the degree of uncertainty may be positively correlated. This is because poor and rich families face a smaller degree of uncertainty on after-aid costs than middle-income families. If this is true, some of the price effects estimated below may be a precautionary action in disguise.

cannot completely avoid measurement error. An instrumental variables strategy can address this problem. Instruments ideal for measurement error are those variables that are correlated with the true regressors, but not with the errors in variables[24].

2.4.2 Instruments

Based on the discussion above, we argue that the following variables make good instruments[25].

- The education window.
- State-specific average annual costs for 4-year private programs.
- State-specific average annual costs for 4-year public programs.
- State-specific average annual costs for 2-year public programs.

One might argue that education window is correlated with unobserved family characteristics that affect family saving at the same time. However, since we have dummied out the number of siblings, it seems plausible that the variation in education window remaining after such controls is largely random.

A similar case may be made for the cost variables. States with more affluent residents are likely to have higher education policies different from others. To a lesser degree, higher education policies may change with a state's economic situation. This is why it is important to control for state and year fixed effects in our main equation. We argue that state college costs affect family saving only through education tax rates, τ_M and τ_A, once we control for state and year fixed effects.

[24]This claim depends on which we take to be the true regression, the nonlinear structural equation or the first-order Taylor expansion. Hausman, Newey, and Powell(1995) show that for nonlinear errors-in-variables models, Non-Linear IV does not provide consistent estimates. For this paper, we proceed assuming that our linearized empirical equation is the true equation.

[25]Definition equations for τ_M and τ_A include other variables that are also excluded from the main equation. They are (1) percent of state students going to 4-year private,4-year public, and 2-year public programs and (2) state and local income taxes as assumed by FM. The problem with these state-specific variables is that they do not vary over time. Since our main equation has state fixed effects, we do not use them as instruments.

Fortunately, we have more instruments than endogenous variables. This allows us to test overidentifying restrictions[26]. If our orthogonality assumptions are valid, we can identify the equation by any pair of the four instruments, and estimated coefficients should not vary much when we use different sets of instruments. The results of our tests fail to reject the orthogonality assumptions on our instruments.

2.4.3 Data

The main body of data comes from the Survey of Income and Program Participation from 1984 through 1992[27]. The major strength of the data set is its detailed information on family income and assets as well as education and other demographic characteristics. A feature of the data set crucial for our identification strategy is that it includes the state of residence. Using this data, we match state-level college data on annual costs from the Digest of Education Statistics and the Residence and Migration of College Students with individual observations. Estimates of education tax rates have been produced following the Higher Education Amendment Acts of 1986 and 1991.

To compute the actual regressors, we use Equation 32 to project the current value of assets at time $t = S$. For annual costs, we calculate the weighted average of state-specific costs of public 4-year, public 2-year, and private 4-year programs in each state. This calculation requires two sets of information: the proportions of students going to public 4-year, public 2-year, and private 4-year programs in each state, and the average annual costs in each of these programs. As for the proportions, we assume that they remain the same over time and use the weights from the school year 1979-80[28]. For the average costs, we use the numbers from various annual issues of the Digest of Education Statistics up to the school year 1993-94. For students who go to college in later years, we extrapolate the prospective annual costs, based on

[26]See Newey(1985).

[27]We are not using SIPP 1988 and 1989 due to inadequate information on assets.

[28]This is the latest year such data is available. See it Residence and Migration of College Freshmen 1979. The choice of the year presumably does not matter, since there has not been much variation over time since the 1970s.

regressions of annual costs on a time trend by states and types of institutions.

For the life cycle variables, we assume that people retire at the age of 65 and die at 75. In addition, we disregard a person's life before she starts working at the end of her formal education. Thus, a person with 16 years of formal education starts work at age 22, and if she gives birth to a child at 28, we infer that she is going to send her first child to college at the age of 24, *i.e.,* 6 plus 18, instead of the actual calendar age of 46. This treatment keeps life cycle milestones in sync with the derivation of our structural model. This applies to the regressors LC_1, LC_2, and AGE.

For the estimation of the education tax rates, we use income figures adjusted for inflation up to the year of college entrance. For the college years up to 1993-94, we use the actual CPI series to inflate income. For later college years, we assume an inflation rate of 3%.

The sampling scheme used for the data set consists of four criteria. It gets all the families in SIPP (1)with at least one child, (2)with the eldest child between 10 and 18 years of age, and (3)with parents aged over 35. In addition, we require that (4)τ_A be positive, but less than 10. Applying the criteria (1)-(3) reduces the number of families in the data set to 12,543, about a eighth of the total number of households in the original data[29]. We require (2), lest we should include families whose nest eggs have been tapped to pay college bills[30] Condition (3) is necessary, since younger families may beget more children in the future.

The condition (4) is crucial, and warrants a more detailed explanation. What it does is to remove extremely poor families in terms of assets. τ_A is negative if and only if household wealth is negative. τ_A is undefined if the reported wealth is zero. If household wealth is positive, but very small, τ_A gets extremely large, at times over 1,000. In fact, there are 151 families excluded by this condition[31]. There are at least four reasons why we want to delete these families from the data set.

[29] Many of the removed "households" consist of individuals.

[30] The lower bound age restriction at 10 is not crucial, but presumably parents with children closer to college entrance are better aware of the education tax. We also run regressions without the lower bound restriction and the results change only slightly.

[31] Asset-based selection, say, removing families with assets less than $ 1,000, $ 5,000 or $10,000 results in similar estimates.

First of all, these are families far less likely to send their children to college than the others. Second, they may have just gone through some unusual catastrophe, especially families with negative amounts of assets. Third, they may include families deliberately misreporting their assets, especially families with zero assets. Last, these observations give rise to extreme outliers in terms of a regressor, τ_A[32]. We are going to discuss consequences of different samples in detail in the next section.

See Table 2 provides descriptive statistics of key variables. One thing that deserves mention in the table is the huge difference between the means and the medians of the various wealth measures. The fact that the means are much bigger than the medians arises from the well-known skewedness in wealth distribution.

2.5 Results

2.5.1 Basic Results

Table 3 shows the OLS and IV regression results in comparison with Net Financial Assets and Taxable Assets as dependent variables. We are going to examine the evidence for asset shifting into non-taxable assets later in the section, focusing on IRA and Keogh accounts.

The main regressors in the equations are of course those structural variables we identified in Section 3. Even though we do not show the coefficients or the standard errors, all the equations include the following as covariates: dummies for the number of children, parental education, a dummy for marital status, and state and year fixed effects. Instruments are education window and state-specific average annual costs at private 4-year, public 4-year, and public 2-year programs.

The first thing to note in comparing OLS and IV results is that they have tax coefficients vastly different from each other. Furthermore, τ_A has the "wrong" negative sign in OLS, but the correct positive sign in IV. The results strongly suggest that

[32]When the amount of assets is positive, but extremely small, τ_A gets extremely large. When the amount of assets is negative and extremely close to zero, τ_A explodes to negative infinity. This is clearly unsavory.

orthogonality assumptions required for consistency of OLS estimates are violated. Before checking the validity of our instruments with rigorous tests, let us indicate how to interpret the coefficient estimates.

Consider Total Taxable Assets, for instance. Suppose that the family is at the mean in every respect. How does the education tax affect this family's financial assets? The education tax raises the family's τ_M from 0 to 0.13, since in the absence of need-based financial aid τ_M would be zero. What about τ_A? Without financial aid, the family would pay the full weighted average cost of \$ 10,279, instead of the EPC of \$9,474, implying an annual increase of \$800 for college outlay. Suppose the family has an education window of 8 years, sending two children to college in succession. The increase in the present discount value of total outlay will be about \$ 5266, assuming the discount rate of 6%. That is about 6% of the total wealth of this family. Thus we know that financial aid reduces τ_A by 6% for this family.

$$\begin{aligned}\Delta(\textit{Taxable Assets}) &= coeff(\tau_A) * (-0.06) + coeff(\tau_M) * (0.13) \\ &= 19495 * (-0.06) + (-108372) * (0.13) \\ &= -1170 - 13958 \\ &= -15128\end{aligned}$$

The reduction in Taxable Assets due to financial aid is about 16% of total wealth. Note that the bulk of the action comes through the coefficient of τ_M. Turning to regression coefficients on the dependent variable net financial assets, we find with a similar calculation that the reduction amount of about 7% of the net financial assets.

Table 4 shows the results of regressions on log-transformed dependent variables. These results are important, since we want to make sure that our results in Table 3 are not driven by influential outliers in the wealth variables. Presumably, the log-transformed wealth measures dampen excessive influence of outliers on coefficient estimates. First, we note that our IV coefficients have signs as predicted by the theory, whereas OLS coefficients don't. How much reduction in family savings do the

IV coefficients suggest? It is important to note that with log-transformed dependent variables, estimated coefficients have multiplicative effects on dependent variables. To interpret the values of coefficients, we do the following calculation.

$$
\begin{aligned}
\frac{\Delta(Taxable\ Assets)}{Taxable\ Assets} &= \exp(coeff(\tau_A) * (-0.06) + coeff(\tau_M) * 0.13) \\
&= \exp(0.413 * (-0.06) + (-2.265) * 0.13) \\
&= \exp(-0.025 - 0.294) \\
&= \exp(-0.319) \\
&= 0.726
\end{aligned}
$$

The calculation shows that, as a result of the price effect and the wealth effect of the education tax, Taxable Assets are now 72.6 % of what it would have been without those effects. That is about 27 % reduction in family savings. It also shows that the result is mainly due to the price effect. A similar calculation shows that net financial assets are about 50 % of what they would have been but for the education tax.

2.5.2 Tests on Instruments

We now turn to Tables 5 and 6 to explore how our instruments work. Table 5 shows the results of the first stage regression results for the two tax variables. The instruments have coefficients that are jointly significant. The degrees of freedom for the $F-$test statistic are the number of observations less the number of restrictions, that is, 12944.

Table 6 shows the results of the tests of overidentifying restrictions. The degrees of freedom for the χ^2-statistics are the number of instruments less the number of endogenous variables, that is, 2 in our case. The tests fail to reject the joint orthogonality of the instruments both with log and level regressions, regardless of the dependent variable. These test results do not prove that we have valid instruments. Rather, they just show that we cannot say our instruments are invalid. Furthermore, one might be concerned about the power of the tests in the current complicated setting. Still, these results give us the minimum level of confidence, so that we can proceed.

Table 7 illustrates how the education window might affect family savings. In the table, we compare family wealth as well as various demographic characteristics of two groups of families. Both the groups have two children, parents aged at least 35, children aged between 10 and 17, and family income between \$30,000 and \$50,000. The difference is that the first group has an education window of less than 8 years, while the second has a window of at least 8 years. The average Taxable Assets of the first group are larger than those of the second group by about \$10,000. The first group also has average financial assets larger than that of the second group by about \$1,000. In terms of parental age, parental education, and family income, the two groups look remarkably similar. One explanation of the difference in family wealth is of course that the first group faces on average lower τ_M and thus saves more, while alternative explanations might also be possible.

2.5.3 Evidence for Asset Shifting

As noted earlier, a wide group of retirement saving vehicles are exempt from the education tax. While the usual retirement saving vehicles are not perfect substitutes for ordinary savings, clearly the relative attractiveness of those assets non-taxable under the education tax should increase with τ_M. Table 8 presents some evidence that asset shifting into non-taxable assets indeed occurs, focusing on one important kind of non-taxable assets, IRA and Keogh accounts. While Edlin(1993) noted this possibility, ours is the first empirical evidence for such asset shifting.

The first two columns of Table 8 examine whether families with higher τ_M are more likely to hold either IRA or Keogh accounts, using the linear probability model. As before, we compare OLS estimates with IV results, using the same set of instruments. Instrumenting is still required, since holding of such accounts is highly correlated with wealth. Our IV estimate for the coefficient for τ_M, of an opposite sign from its OLS counterpart, suggests that with the education tax, a typical family is more likely to hold either IRA or Keogh account by 7% in probability[33]. It is reassuring to see the coefficient of the federal marginal income tax rate has a strong, positive value[34].

To examine how much increase in either IRA or Keogh balance the education tax is responsible for, look at the last two columns of Table 8[35]. Since the log regression can be run only on families with positive balance, the result should be interpreted as conditional on having an account. The coefficient estimates for τ_M and τ_A suggest that the education tax may account for about a 20% increase in IRA or Keogh balances.

The results in Table 8 suggest that the education tax encourages asset shifting into IRA or Keogh in two ways: by encouraging a family to hold such an account, and by encouraging it to contribute more, conditional on holding an account. Combined with earlier results, this evidence is reassuring, in that we have shown that the education tax reduces saving in taxable assets, and encourages shifting into non-taxable assets.

This evidence for asset shifting has intriguing implications. First, it suggests that IRAs, Keoghs and other financial assets are not perfect substitutes. Note that there has been an intense debate on the effectiveness of these tax-based saving promotion policies, which hinges on their substitutability in family portfolios. Second, our results on asset shifting may require a reinterpretation of both our estimates and Feldstein's on the reduction in family assets due to the education tax. Part of that reduction may be actually assets shifted away into non-taxable assets. The extent of asset shifting evidenced with IRAs and Keoghs is small compared to the reduction in taxable assets due to the education tax. Yet, it is important to remember that there are other kinds of non-taxable assets. SIPP covers only a small part of these non-taxables, providing a minimal information on pension wealth and life insurance, and ignoring other important non-taxable assets such as variable annuities.

[33] We are still assuming that the college aid increases τ_M by 13 % and reduces τ_A by 7%.

[34] The coefficients remain essentially the same, whether we include the federal marginal income tax rate or not.

[35] We feel more confident with our log regression result than with the level regression result, since it is less likely to be swayed by outliers. Unfortunately, 2SLS with the Huber-regression in the second stage fails to converge.

2.5.4 Looking at Different Samples

In Tables 9 and 10, we examine the robustness of our estimates by looking at different samples. The basic result is that our estimates remain fairly stable across different samples.

Compared to our basic sample, Sample A, Sample B, and Sample C select on wealth, instead of on the average tax rate. Sample A keeps only families with total wealth over \$1,000, Sample B over \$5,000, and Sample C over \$10,000. The comparison of the estimates of the tax coefficients show that as long as we remove very poor families, estimates do not change in any significant way. Compared to our previous estimates based on the Basic Sample, new estimates based on Samples A-C show slightly lower tax effects for Net Financial Assets, and either slightly lower or higher effects for Taxable Assets. The results suggest a 30% reduction in Taxable Assets, and about a 40% reduction in Net Financial Assets due to the education tax.

Sample D removes families from states with low stay-in ratios. Presumably, our tax estimates have more severe measurement error with these observations, since the weights in our state- and year-specific weighted average college costs are obtained assuming that students go to in-state programs. Comparison of the Sample D estimates with our basic estimates suggests that this is not a critical issue.

Sample E includes families with young children, meaning the first child aged less than 10. Presumably, families with children near college entrance are more aware of the education tax than others. Estimates based on Sample E confirm this conjecture. Families in Sample E, now including those with very young children too, are shown to be less sensitive to the education tax. Still, their reaction is not qualitatively different from our basic findings.

Table 10 repeats the same exercise as in Table 9. The only difference is that, with Table 10, we employ Huber-robust regression in the second stage of our 2SLS to reduce the influence of wealth outliers. The results are fundamentally the same as those in earlier tables.

2.6 Conclusion

In this paper, we investigate pre-college family saving under the influence of the education tax. Our modified life cycle model with the education tax shows that college financial aid reduces pre-college family saving through both price and wealth effects. Our estimates address endogeneity bias and measurement error with the tax variables by Instrumenting them with the family education window and state- and year-specific annual costs in different states. Tests of overidentifying restrictions fail to reject the joint orthogonality of our instruments. Our main empirical finding is that the education tax may be responsible for about 20 to 30 % decrease in family assets.

The paper also presents some evidence on asset shifting into non-taxable assets, focusing on IRA and Keogh accounts. Families facing higher marginal education tax rates are more likely to hold these accounts, and conditional on holding them, are likely to contribute more to these accounts. However, the magnitude of asset shifting could not be determined using SIPP data, since non-taxable assets in the education tax include almost the whole range of retirement saving vehicles including life insurance, pensions, variable annuities, and 401(k) and SIPP does not provide enough information on these assets to allow an adequate investigation.

Important as it is to understand how much the college financial aid rules reduce family saving, we should not forget that the issue is a part of a much bigger question: Who should pay for higher education, and how? In this respect, it is critical to examine the relative effectiveness of need-based financial aid and need-blind subsidy in altering the demand for college education. While the effectiveness of the latter is well established, the literature says little about the effectiveness of need-based financial aid. The author is currently planning to investigate the issue using the variation in after-aid college costs for families with differently spaced siblings.

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Table 1: Sample State Average College Costs: School Year 1990-91

State	W. A. Costs†	# Stdnts	Pub 4 Year			Pub 2 Year			Priv 4 Year		
			Cost	%CMP	%SI	Cost	%CMP	%SI	Cost	%CMP	%SI
MA	14061	127611	10070	29	83	8438	27	95	20198	44	77
NY	12053	351690	8872	31	85	8024	30	95	17829	38	77
PA	11100	161763	8905	36	86	6690	28	93	16779	36	74
MD	10276	76479	8717	38	80	7552	40	96	18147	21	36
OH	8403	153788	7311	46	88	6209	33	94	14369	21	71
CA	7230	676747	7597	19	92	5831	72	99	17455	9	81
FL	7145	136995	6286	29	85	5488	54	97	13759	17	60
WA	6652	104759	6455	19	88	5402	70	98	15324	11	64
MI	6567	171283	6895	38	93	4978	49	97	11714	13	70
NC	5800	100204	5013	36	91	4374	50	98	12891	14	76
TX	5480	242900	5257	40	95	4488	50	98	11370	10	78
AZ	4800	68490	5112	25	91	4239	68	96	9389	7	46

Note: Data on costs in different kinds of programs from *Digest of Education Statistics*. Data on the number of students in different kinds of programs from *Residence and Migration of College Students*. # Stdnts(Students) the number of freshman students from each state. W. A. Costs(Weighted Average Costs) author's calculation based on the data. %CMP(Composition) is the ratio of the number of state students going to the given kind of program in the state to the resident state student population. %SI is the ratio of the number of state students staying in the state to the resident state student population going to the given kind of program. Cost variables in dollars.

Table 2: Descriptive Statistics

Variable	Mean	St. Dev.	Median
AAI	26053	29899	18467
EPC	8861	12919	4046
Private 4-yr Cost	14876	4980	14245
Public 4-yr Cost	7117	2438	6622
Public 2-yr Cost	5852	1953	5536
Weighted Avg Cost	8081	3226	7423
τ_A	0.68	1.25	0.27
τ_M	0.14	0.17	0
Income	41770	26305	36677
LC_1	0.63	0.39	0.67
LC_2	1.08	2.32	0.84
Parental Age	42.56	6.31	41
Parental Education	13.41	3.09	13
Net Financial Assets	17175	53527	2600
Total Wealth	94065	137045	52895
Taxed Assets	83345	130136	44337
IRA & Keogh	3927	12565	0

Note: The number of observations is 12,948. See the text on how the sample is chosen. The variables, AAI, EPC, college costs, income, and assets, are all in terms of dollars.

Table 3: Family Saving- OLS and IV in comparison

Variable	Net Financial Assets		Taxable Assets†	
	OLS	IV‡	OLS	IV
τ_A	-3904	1748	-21350	19495
	(370)	(386)	(832)	(5302)
τ_M	-32075	-8244	-117441	-108372
	(2758)	(1818)	(6198)	(24994)
LC_1	-13806	1985	-85097	-9185
	(16042)	(1146)	(36039)	(15757)
LC_2	-2199	-330	-14342	1436
	(2596)	(193)	(6508)	(2651)
Age	708	65	2945	1929
	(81)	(8)	(181)	(107)
Income	0.508	0.053	1.427	0.76
	(0.021)	(0.003)	(0.047)	(0.040)
Parental Educ	1594	304	4856	5222
	(221)	(30)	(496)	(410)
Single Parent	6881	-879	6250	-11412
	(1254)	(185)	(2817)	(2553)
Black	-6931	-1558	-23714	-25780
	(1651)	(199)	(3710)	(2736)
American Indian	-4854	-997	-36028	-17316
	(5527)	(402)	(12417)	(2736)
Asian & PI	-1377	-147	742	-5298
	(2773)	(209)	(6230)	(2873)
CONSTANT	-28987	-5423	-33736	-97347
	(15633)	(1297)	(35120)	(17827)
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	12948	12948	12948	12948

*: Standard errors in parentheses. All equations include the following as covariates: dummies for the number of children, and state and year fixed effects.

†: Taxable Assets is the sum of financial assets, home equity, and equity in other real estate. Excluded are balance in IRA, Keogh, 401(k), life insurance, variable annuities, and pensions. Vehicle equity, luxury goods, and other collectibles are also excluded.

‡: Instruments used are education window, state-specific annual costs at private 4-year, public 4-year, and public 2-year programs.

Table 4: Log Family Saving– OLS and IV in comparison

Variable	Log Net Financial Assets		Log Taxable Assets†	
	OLS	IV‡	OLS	IV
τ_A	-0.535	1.146	-1.185	0.413
	(0.017)	(0.210)	(0.013)	(0.195)
τ_M	-0.282	-4.701	0.788	-2.265
	(0.102)	(0.992)	(0.076)	(0.919)
LC_1	0.284	0.555	-0.095	-0.105
	(0.695)	(0.725)	(0.493)	(0.648)
LC_2	0.054	0.110	-0.027	-0.020
	(0.118)	(0.124)	(0.084)	(0.110)
Age	0.041	0.057	0.041	0.057
	(0.003)	(0.004)	(0.002)	(0.004)
Income$*10^6$	27.3	23.4	22.2	18.1
	(0.766)	(0.157)	(0.570)	(1.460)
Parental Educ	0.147	0.247	0.087	0.160
	(0.009)	(0.016)	(0.006)	(0.015)
Single Parent	-0.013	-0.670	-0.125	-0.598
	(0.048)	(0.101)	(0.035)	(0.094)
Black	-0.594	-1.286	-0.377	-0.922
	(0.066)	(0.111)	(0.047)	(0.101)
American Indian	-0.675	-0.953	-0.529	-0.742
	(0.225)	(0.238)	(0.154)	(0.206)
Asian & PI	0.235	-0.018	0.047	-0.165
	(0.101)	(0.112)	(0.076)	(0.105)
CONSTANT	4.149	2.362	7.784	6.470
	(0.665)	(0.781)	(0.475)	(0.707)
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	11701	12948	12367	12948

*: Standard errors in parentheses. All equations include as covariates dummies for the number of children, and state and year fixed effects.

†: Taxable Assets is the sum of financial assets, home equity, and equity in other real estate. Excluded are balance in IRA, Keogh, 401(k), life insurance, variable annuities, and pensions. Vehicle equity, luxury goods, and other collectibles are also excluded.

‡: Instruments used are education window, state-specific annual costs at private 4-year, public 4-year, and public 2-year programs.

Table 5: First Stage Regression Results

Variable	τ_A	τ_M
Education Window	0.056	0.014
	(0.009)	(0.001)
Private 4-yr Cost$*10^4$	-0.205	0.07
	(0.151)	(0.02)
Public 4-yr Cost$*10^4$	-0.531	-0.05
	(0.312)	(0.04)
Pubic 2-yr Cost$*10^4$	0.709	-0.003
	(0.280)	(0.04)
LC_1	-0.44	0.03
	(0.38)	(0.05)
LC_2	-0.08	0.006
	(0.06)	(0.009)
Age	-0.02	-0.0009
	(0.002)	(0.0003)
Income$*10^6$	-1.71	-1.49
	(0.49)	(0.07)
Parental Educ	-0.07	0.0009
	(0.005)	(0.0007)
Single Parent	0.34	-0.03
	(0.03)	(0.004)
Black	0.37	-0.022
	(0.04)	(0.005)
American Indian	0.02	-0.044
	(0.13)	(0.018)
Asian & PI	0.07	-0.034
	(0.07)	(0.009)
N	12948	12948
F-test stat†	16.82	52.14
p-value	0.0000	0.0000

*: Standard errors in parentheses. All equations include as covariates dummies for the number of children, and state and year fixed effects.

†: F-test for the joint signicance of the instruments: education window and costs at private 4-year, public 4-year, and public 2-year programs.

Table 6: Tests of Overidentifying Restrictions

Variable	Net Financial Assets		Taxable Assets	
	Level	Log	Level	Log
χ^2 test stat†	0.586	5.347	3.607	3.608
p-value	0.746	0.069	0.165	0.164

†: χ^2-test statistics for tests of overidentifying restrictions. The degree of freedom for these tests are 2, the number of instruments less the number of endogenous variables.

Table 7: Education Window & Family Saving–The Case of 2-Children Families†

Variable	Educ Window< 8			Educ Window >= 8		
	Mean	St. Dev.	Median	Mean	St. Dev.	Median
Taxable Assets	82667	104356	50319	72762	87675	45220
Net Financial Assets	15845	38497	3700	14064	31100	3200
Father's Age	42.5	5	42	42.4	4.8	42
Mother's Age	40.1	4.3	39	40.2	4.3	40
Father's Education	13.6	2.8	13	13.6	2.5	13
Mother's Education	13.4	2.5	13	13.2	2.6	12
Income	39041	5729	39055	38987	5735	39083
Single Parent	0.12	0.33		0.09	0.29	
First Child Age	15.5	1.7	16	16.8	1.1	17
Second Child Age	13.4	1.7	13	12.2	1.1	12
Obs	661			279		

†: The families represented in this table are all 2-children families. To enhance the comparability between the two groups, we imposed two additional restrictions: (i)income between \$30,000 and \$50,000 and (ii)both the children between age 10 and 18.

Table 8: IRA & Keogh: Evidence for Asset Shifting

Variable	Yes or No		Amt. IRA & Keogh		Log IRA & Keogh	
	OLS	IV†	OLS	IV	OLS	IV
τ_A	-0.041 (0.003)	-0.191 (0.070)	-519 (67)	-3004 (1594)	-0.392 (0.029)	-0.625 (0.497)
τ_M	-0.142 (0.021)	0.565 (0.257)	-3432 (492)	14055 (6013)	-0.184 (0.126)	1.167 (0.368)
Fed Inc Tax MTR	0.127 (0.065)	0.567 (0.276)	-14000 (1531)	11773 (5481)	.148 (0.356)	0.175 (0.472)
LC_1	-0.023 (0.126)	-0.059 (0.150)	-2623 (2907)	-2936 (3282)	-0.040 (1.318)	-0.489 (1.713)
LC_2	-0.004 (0.021)	-0.011 (0.025)	-431 (489)	-510 (552)	-0.012 (0.231)	-0.099 (0.300)
Age	0.007 (0.0006)	0.006 (0.001)	119 (15)	121 (25)	0.027 (0.004)	0.026 (0.006)
Income$*10^6$‡	3.32 (0.224)	0.053 (1.40)	0.124 (0.005)	0.080 (0.040)	15.8 (1.1)	51.9 (7.96)
Parental Educ	0.025 (0.002)	0.015 (0.005)	391 (40)	193 (123)	0.103 (0.013)	0.125 (0.033)
Single Parent	0.003 (0.009)	-0.008 (0.009)	137 (226)	1596 (746)	-0.372 (0.064)	-0.353 (0.142)
Black	-0.089 (0.013)	-0.014 (0.036)	-1135 (292)	388 (829)	-0.016 (0.098)	-0.253 (0.284)
American Indian	-0.059 (0.021)	-0.042 (0.056)	-491 (993)	1007 (1263)	-0.046 (0.335)	-0.143 (0.421)
Asian & PI	-0.059 (0.021)	-0.013 (0.031)	-1077 (487)	45 (706)	-0.044 (0.126)	-0.111 (0.162)
CONSTANT	-0.377 (0.122)	-0.287 (0.195)	-4190 (2807)	-6388 (4400)	5.756 (1.233)	8.270 (1.890)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	12948	12948	12774	12758	4366	4366

*: Standard errors in parentheses. All equations include the following as covariates: dummies for the number of children, and state and year fixed effects.

†: Instruments used are education window, state-specific annual costs at private 4-year, public 4-year, and public 2-year programs.

‡: For the dependent variable Amt. IRA & Keogh, the income variable is not rescaled.

Table 9: Log 2SLS & Sensitivity to Sample Choice

Sample	N	Log Net Fin Assets		Log Taxable Assets	
		τ_M	τ_A	τ_M	τ_A
Basic Sample		-4.70	1.15	-2.27	0.41
	11686	(0.99)	(0.21)	(0.92)	(0.20)
Sample A†		-3.03	1.16	-1.95	0.48
	11540	(1.07)	(0.27)	(0.73)	(0.16)
Sample B		-2.99	1.15	-1.75	0.31
	10688	(0.90)	(0.31)	(0.47)	(0.15)
Sample C		-3.30	1.11	-3.48	0.66
	9999	(1.16)	(0.29)	(1.06)	(0.23)
Sample D		-3.03	0.77	-3.31	0.55
	8786	(1.25)	(0.28)	(1.21)	(0.24)
Sample E		-2.84	1.20	-1.89	0.84
	13566	(0.81)	(0.18)	(0.54)	(0.12)

*: Regressions here all 2SLS with log dependent variables. Standard errors in parentheses. The list of covariates in all equations is the same as before.

†: Sample A–The same as the basic sample except for the additional restriction that total wealth> 1000. Sample B–The same as the basic sample except for the additional restriction that total wealth> 5000. Sample C–The same as the basic sample except for the additional restriction that total wealth> 10000. Sample D–The same as the basic sample except that we have removed states with student ratios lower than 85 % at public 4-yr programs. The excluded states are CT, NJ, RI, MA, MD, KS, MO, DC, AZ, VT, OH, NH, NM, HA, ND, IO, DE, AL, WY, ID, SD, ND, and ME, 22 in all. Sample E–The same as the basic sample except that we have eased restriction on the first child's age. We now only require that it be below 18.

‡: Instruments used are education window, state-specific annual costs at private 4-year, public 4-year, and public 2-year programs.

Table 10: 2SLS w/ Huber Regression in the 2nd Stage & Sensitivity to Sample Choice

Sample	N	Net Financial Assets		Taxable Assets	
		τ_M	τ_A	τ_M	τ_A
Basic Sample		-8244	1748	-108372	19495
	12932	(1818)	(386)	(24994)	(5301)
Sample A†		-7380	1856	-96154	20851
	12613	(2437)	(407)	(31957)	(5340)
Sample B		-7643	1991	-97367	17475
	11399	(3312)	(552)	(35887)	(5981)
Sample C		-6030	1869	-86777	13724
	10577	(4031)	(672)	(37801)	(6302)
Sample D		-5568	1280	-90628	15294
	9878	(2288)	(381)	(34088)	(5673)
Sample E		-5753	1567	-75562	18873
	15219	(1295)	(253)	(19781)	(3875)

*: Regressions here all robust IV. The second stage is done by Huber robust regressions. Standard errors in parentheses. The list of covariates in all equations is the same as before.

†: Sample A–The same as the basic sample except for the additional restriction that total wealth> 1000. Sample B–The same as the basic sample except for the additional restriction that total wealth> 5000. Sample C–The same as the basic sample except for the additional restriction that total wealth> 10000. Sample D–The same as the basic sample except that we have removed states with student ratios lower than 85 % at public 4-yr programs. The excluded states are CT, NJ, RI, MA, MD, KS, MO, DC, AZ, VT, NH, NM, HA, ND, IO, DE, AL, WY, ID, SD, ND, and ME, 22 in all. Sample E–The same as the basic sample except that we have eased restriction on the first child's age. We now only require that it be below 18.

‡: Instruments used are education window, state-specific annual costs at private 4-year, public 4-year, and public 2-year programs.

FIGURE 1. EXPECTED PARENTAL CONTRIBUTION BY INC BRACKETS

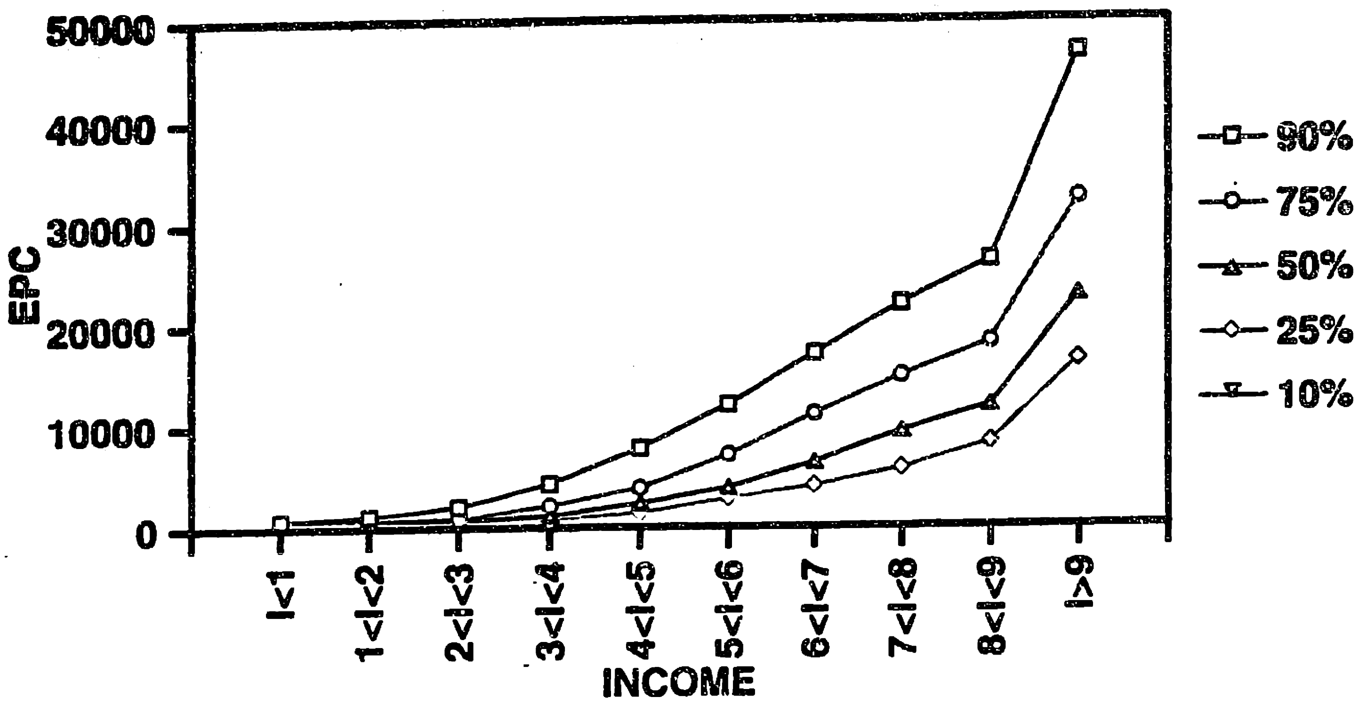


FIGURE 2. ATR BY INCOME BRACKETS

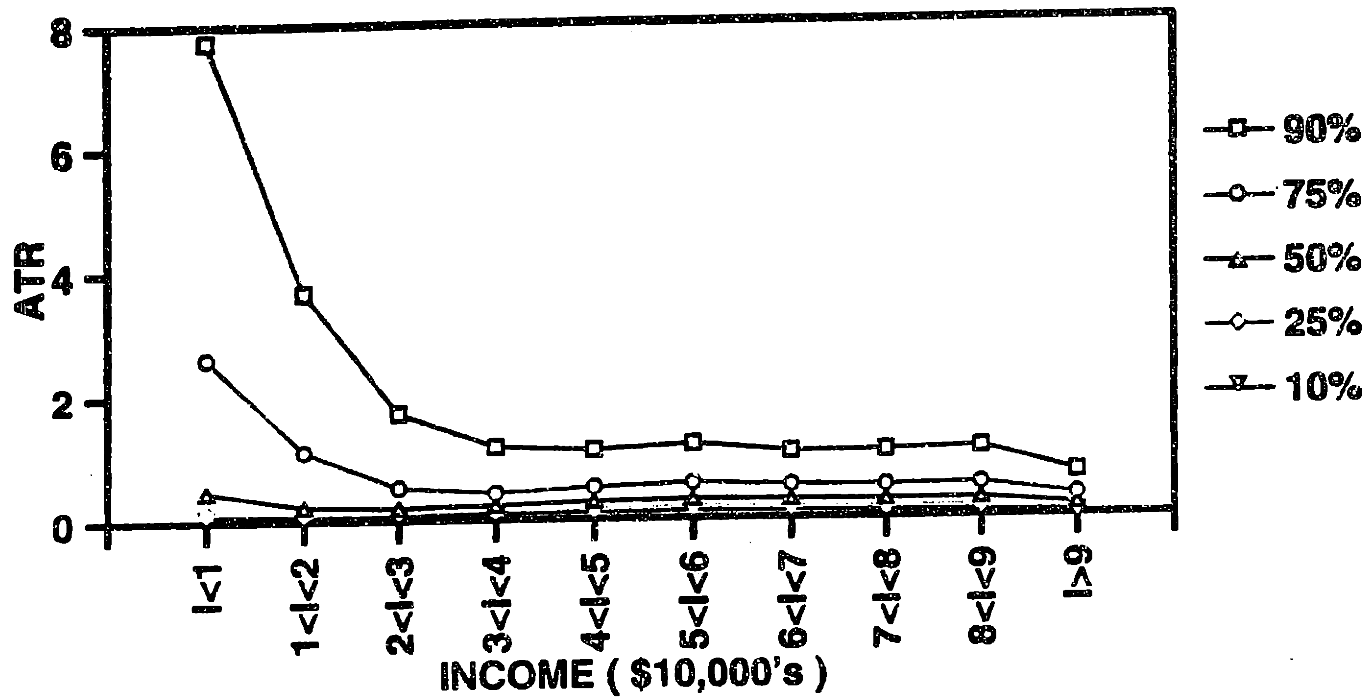
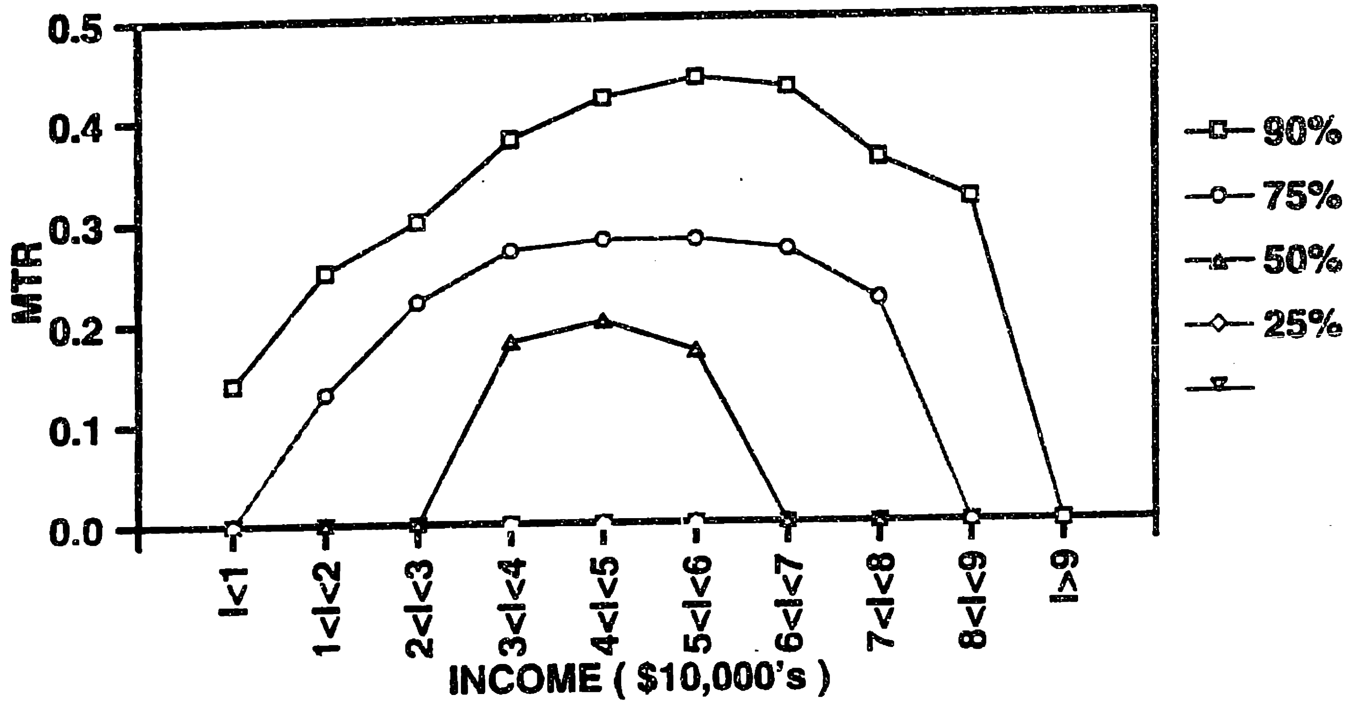


FIGURE 3. MTR BY INCOME BRACKETS



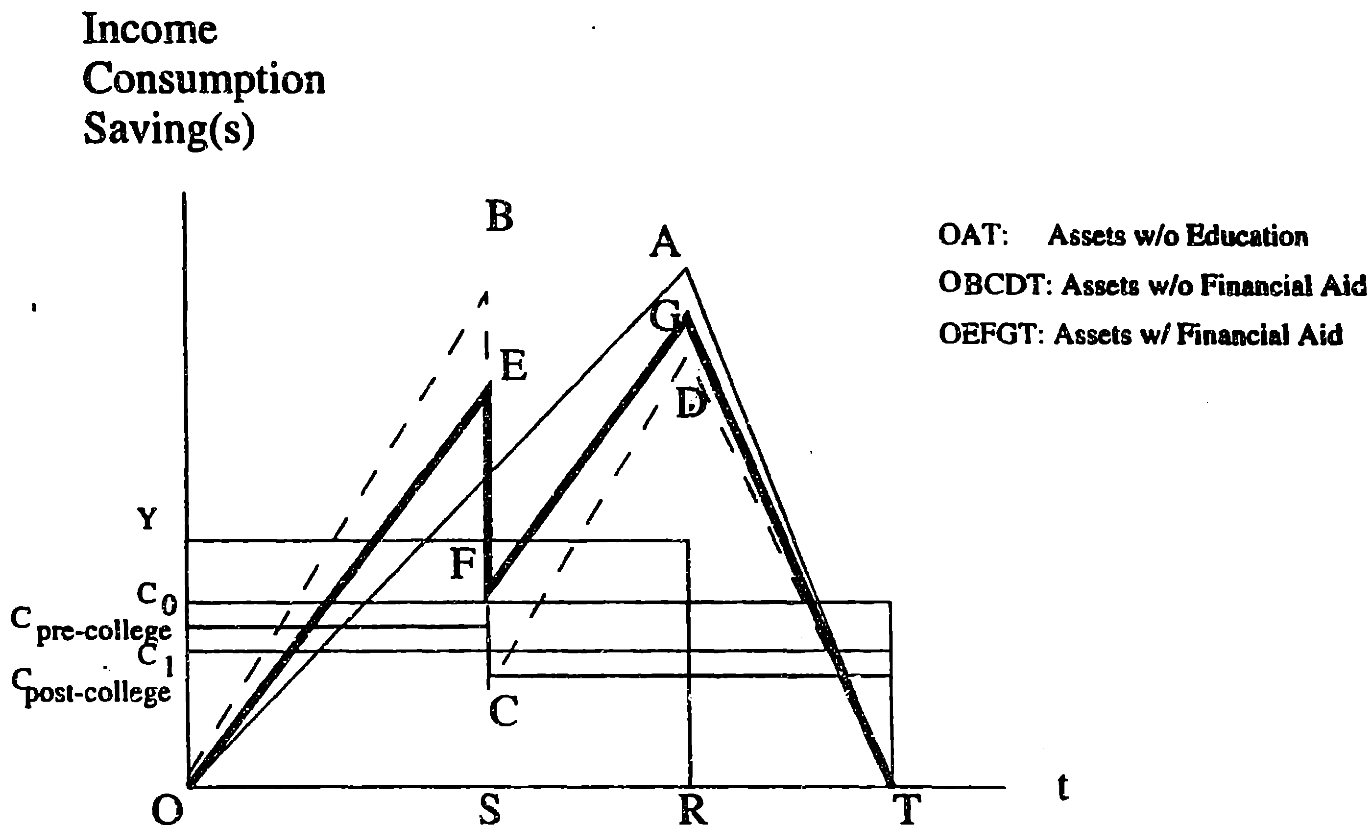


FIGURE 4. LIFE CYCLE SAVING WITH THE EDUCATION TAX

Chapter 3

College Financial Aid, Income Tax and Retirement Saving

3.1 Introduction

College financial aid imposes an asset levy on pre-college saving: if a family saves more, the child will get less financial aid in college. This implicit tax is known as the education tax. There is a small but growing literature examining the possible effects of the tax on family saving. Feldstein(1995) suggests that the penalty on pre-college family saving may be responsible for as much as 50% reduction in family saving. Edlin(1993) provides simulation results that support Feldstein estimates. Kim(1995) suggests somewhat smaller, yet still substantial reduction of about 20%, utilizing an identification strategy based on the variation of education tax rates due to different spacing between siblings. In an important exception to the means-testing principle, college financial aid allows a tax haven for a class of assets geared for retirement consumption. The class includes pensions, life insurance, annuities, and more importantly, IRAs, and 401(k) accounts. Parents are not required to include the value of these assets in reporting their assets and income in the federal financial aid application form.

The exemption means that IRAs and 401(k)s[1] enjoy two-fold tax benefits: education tax exemption as well as the better-known preferential income tax treatment. While the latter has been the subject of an intense debate in a huge literature[2], the effects of the education tax have been virtually ignored with the single exception of Edlin[3]. This paper is an empirical attempt to bridge the gap. The first task is to examine the interaction of college financial aid and income tax and document the importance of education tax exemption in enhancing the after-tax rate of return on IRA and 401(k) saving. My estimates based on the data from the Survey of Income and Program Participation suggest that education tax exemption may be at least as important as income tax deferral for nearly half the middle-income families.

In this paper, I measure the effects of the combined tax advantage on IRA and 401(k) saving, in terms of both participation and balances. The empirical specification is motivated by a stylized life cycle model featuring the choice between IRAs and 401(k)s *vs.* ordinary saving vehicles. The key identification strategy is using as an instrument the variation in the education tax rates due to differential spacing between siblings, known as *education window* among experts on college financial aid. I also use as instruments state- and year-specific college costs in different types of institutions. The instruments come from the observation that, among the two components determining the combined tax advantage of IRA and 401(k) saving, education tax exemption readily allows useful instruments, but not the income tax part: Recognizing the effects of the education tax has not just conceptual, but also practical benefits. The consistent IV estimates suggest that the education tax exemption may

[1]And pensions, too.

[2]There are two groups of researchers with opposing views on whether IRA and 401(k) contributions represent a new saving. Venti and Wise(1992) and Poterba, Venti, and Wise(1992, 1997) present evidence for the new-saving view. See Gale and Scholz(1990) for evidence against the view. Skinner(1991) provides an excellent survey of the literature.

[3]See Edlin(1992) and Edlin(1993). While his main focus in the papers is on simulating the size of saving reduction due to the education tax, he also examines various implications of the tax from the viewpoints of families, schools, and the government. He points out that families may employ various strategies for education tax avoidance. In addition to saving in retirement saving vehicles, they may invest in stocks that pay little dividend, since capital gains are not taxed in college financial aid, and purchase precious stones or metal, since the financial aid application form does not require that these be reported.

be responsible for about 7% increase in the participation probability, and more than 25% increase in balances in IRAs and 401(k)s for a typical middle income family.

My results have public policy implications for IRA and 401(k) saving in three important areas. The first two have to do with the design of subsidy for higher education; the last with possible effects of income tax reform. First, since the attraction of IRAs and 401(k)s over ordinary means of saving partly comes from their exemption from the education tax, changes in college financial aid might lead to changes in IRA and 401(k) saving, even if income tax treatment of those accounts remains the same. Possible reforms in college financial aid, such as equal treatment of retirement and ordinary assets or reducing marginal tax rates implicit in means testing[4], would lead to a reduction in the combined benefits of IRA and 401(k) accounts and might result in a substantial reduction in saving through these accounts.

Second, the results suggest that two apparently unrelated phenomena—the ongoing tuition inflation and the increasing popularity of IRAs and 401(k)s—might be more than a mere coincidence. Parents rich enough in terms of income and wealth should expect to pay the full tuition for their child's college education: the effective marginal education tax rate for them is zero. The recent pace of tuition inflation in the recent past implies that the number of such "rich" parents is shrinking fast. As a result, more and more parents may be discovering the additional merits of IRAs and 401(k)s as the education tax haven.

Lastly, but probably most importantly, the results might be helpful in predicting the change in IRA and 401(k) saving in case of a future income tax reform. The huge and growing literature on IRA and 401(k) saving is, sensibly, focused on the most important question: whether it represents a new saving or not. The policy question in the background has been whether an increase in the annual contribution limit would lead to an increase in personal and national saving. However, the received literature is not be so helpful in predicting the change in IRA and 401(k) saving in case of, say,

[4]Even a total repeal of means testing is not such a radical idea as it might sound. In European and Asian countries, subsidy to higher education does not involve means testing. Even in the U.S., subsidy from state governments for public universities is not need-based.

an income tax cut. My estimates, focused on the combined tax advantage from both education tax exemption and income tax deferral, can be useful for the purpose.

It should be mentioned that the results reported in this paper are not directly concerned with the new *vs.* old saving controversy. Rather, the paper complements the existing literature. A tax-based saving promotion policy can be summarized mainly in terms of two parameters, the annual contribution limit and the size of tax advantage. The contribution of the paper is to call attention to the role of tax advantage, and also to the general interaction of two important public policy areas, college financial aid and tax-based saving promotion.

The remainder of the paper proceeds as follows. Section 2 documents the saving incentives as affected by both college financial aid and income tax deferral. The emphasis is on the tax advantage of IRA and 401(k) over ordinary saving. Section 3 develops a stylized life cycle saving model with uncertainty, which motivates the empirical specification to be used later. Section 4 discusses empirical strategy and data. Section 5 provides the results of estimation and discusses them. Section 6 concludes.

3.2 Education Tax, Income Tax, and Incentives for Saving

3.2.1 A Double Whammy against Incentives for Saving

Incentives for ordinary saving in the U.S. are hurt by the education tax as well as the personal income tax. If the before-tax rate of return on assets is r, personal income tax reduces the after-tax rate of return to $(1 - \tau_{FED})r$, where τ_{FED} is the marginal income tax rate. Savers are penalized once again, when they send their children to college, in terms of reduced college financial aid. IRA and 401(k) accounts provide tax relief on both fronts: income tax deferral and education tax exemption. The next subsection briefly explains how the education tax adversely affects the rate of return on ordinary saving, but not on retirement saving.

3.2.2 Federal Methodology and the Education Tax

Federal Methodology, the current federal rule governing college financial aid, is essentially a progressive tax schedule on income and assets. The Methodology[5]. first calculates *Adjusted Available Income*, the equivalent of Adjusted Gross Income in personal income taxation, based on income and assets[6] reported in the financial aid application form. AAI is the sum of income after adjustments and *Income Supplement*, 12% of assets. *Expected Parental Contribution*, after-subsidy costs for college education, is then calculated by applying a series of increasing marginal rates on AAI[7]. Colleges provide financial aid packages covering the difference between actual costs and the EPC using funds from the federal and state governments as well as institutional funds[8]

One additional dollar in assets in the year when you send your child to college then adds to EPC by increasing AAI in two ways. First, the ensuing increase in capital income increases AAI dollar for dollar. Second, the additional dollar in assets directly increases AAI by 12% via *Income Supplement.*

Three special features of the Methodology are worth mentioning, since they separate the education tax from a typical tax. First, the education tax is an annual levy that parents have to pay every year as long as at least one child is attending college. Later, we are going to treat the tax as if it is a one-shot levy by focusing on its present discounted value.

Second, the Federal Methodology includes an interesting, rather curious clause for the case when two or more children are attending college simultaneously. Under FM, EPC stays the same regardless the number of children in college. Combined with the duration of the education tax, discussed in the previous paragraph, this means

[5]For details of Federal Methodology, see Feldstein(1995), Edlin(1993), or Kim(1995). A popular guide book, *College Costs and Financial Aid Handbook*, is published every year by the College Scholarship Service, the federal agency responsible for the execution of Federal Methodology. The ultimate reference would be it United States Code Annotated, Title 20 Education, 1985, 1990, and 1995.

[6]The savings in retirement saving accounts need not be reported.

[7]The marginal rates range from zero to a high of 47%.

[8]The amount of need-based financial aid is roughly $50 billion, two thirds of which comes from the federal government.

that two otherwise similar families may end up paying vastly different total amounts for college education, just because of the difference in the spacing of their children. For example, a family with two children two years apart pays its *EPC* for six years; a similar family with two children four years apart for eight years. A family with twin children could in principle buy their college education at the price of one. It is the net duration of college education for all the children without double-counting the overlapping years that matters. This net duration is known as education window among experts on college financial aid[9] In our example, education window is 6 years for the first family, and 8 for the second. The family with twin sisters faces education window of just 4 years. This clause introduces a (partly) random variation in the education tax rates faced by individual families due to education window[10]. This observation is crucial for my identification strategy, to be discussed later.

Finally, if *EPC* is greater than actual annual college costs(C), parents pay the full "sticker" price. That is, they should expect to pay the full tuition and expenses. For them, the marginal education tax rate will be zero.

The following equation summarizes the determination of the marginal education tax rate, τ_E. *EW* stands for education window. A_S denotes the amount of taxable family assets in the beginning year of college education. $I(\cdot)$ is an indicator function assuming the value of unity when the statement inside the brackets is true, and zero otherwise. r is the before-tax rate of return on assets. *fm* is the marginal rate of the Federal Methodology converting AAI into *EPC*. τ_{FED}, τ_{FICA}, and τ_{STATE} represent marginal rates of federal income tax, Social Security tax, and state income tax, respectively.

$$\tau_E \;=\; \sum_{n=1}^{EW} \frac{d}{dA_S} \frac{EPC_n(A_S)\, I(C_n > EPC_n)}{(1+r)^{n-1}}$$

[9]The terminology helps to graphically conjure up the image of a government poking hand remaining in the family coffer as long as the window stays open.

[10]Note that education window is only partly correlated with the number of children, which is, in all likelihood, an endogenous variable. Even with the number of children, one could acknowledge some randomness The randomness, I argue, is even greater with education window, especially when we control for the number of children.

$$= \sum_{n=1}^{EW} \frac{fm * \{(1 - \tau_{FED} - \tau_{FICA} - \tau_{STATE})r + 0.12\}\, I(C_n > EPC_n)}{(1+r)^{n-1}}$$

The formula above calculates the present value of the stream of additional education taxes when parents have one more dollar in their assets in year S when they send their first child to college. The duration is of course given by EW, education window. We are this way modeling the education tax as a one-shot asset levy for simplicity.

The expression inside the curly brackets on the second line gives the marginal increase in AAI due to one more dollar in assets. The increase comes in two ways, first through the increase in capital income, $(1 - \tau_{FED} - \tau_{FICA} - \tau_{STATE})r$ after income tax-related adjustments, and second through *Income Supplement*, 12% of the additional asset. The marginal increase in AAI multiplied by fm gives the marginal increase in EPC, which of course will be zero, if actual costs are smaller than EPC.

It is middle-income families that face the highest range of τ_E. Low income families benefit from low values of fm; rich families are likely to find $C < EPC$, getting τ_E effectively reduced to zero. Within the same income bracket, τ_E is chiefly a function of education window. Kim(1995) provides estimates of τ_E across different income brackets, based on the data from the Survey of Income and Program Participation. For families with annual income between $40,000 and $60,000, the median of τ_E is about 20%. 25% of the families face τ_E of 30% or above. For the unlucky 10% of the same group, τ_E goes beyond 40%.

The following subsection compares net saving incentives for ordinary *vs.* IRA and 401(k) saving. Our focus is the role played by the education tax in enhancing the relative attraction of IRA and 401(k) over ordinary saving. Two related themes will be emphasized. First, ignoring the education tax results in significant overestimates of the after-tax rate of return on ordinary saving, understating the advantage of IRA and 401(k). Second, the relative advantage of IRA or 401(k) saving dramatically hinges on the marginal education tax rate.

3.2.3 IRA and 401(k) *vs.*. Ordinary Saving Vehicles

Compared to ordinary saving, IRAs and 401(k)s provide partial protection against the income tax and total protection from the education tax. IRAs and 401(k)s allow families to save their before-tax dollar, deferring income tax payment until after retirement. The marginal income tax rate applicable after retirement is likely to be lower than that during the prime saving age. In addition, returns accumulate tax-free. When parents send their child to college, assets in IRAs and 401(k)s are exempt from the education tax, since they are not considered taxable assets in the Federal Methodology.

For a family with n years to go before retirement, the at-retirement value of one more dollar in IRA or 401(k) saving today, V_{RET}, is given by the following equation. For simplicity, I am going to call IRA and 401(k) accounts retirement saving vehicles. Hence the subscripts on V_{RET}. I assume that τ_{FED} remains constant throughout the life cycle. The family can contribute its before-tax dollar, which grow at the untaxed rate of r. At retirement, the withdrawal will be taxed at the regular income-tax rate.

$$V_{RET} = (1 - \tau_{FED}) * (1 + r)^n. \qquad (3.1)$$

On the other hand, the equivalent value of one more dollar in ordinary saving, V_{ORD} will be:

$$V_{ORD} = (1 - \tau_E) * (1 - \tau_{FED}) * \{1 + (1 - \tau_{FED})r\}^n. \qquad (3.2)$$

In ordinary saving accounts, you start with an after-tax dollar. The annual rate of return will be $(1 - \tau_{FED}) * r$, not r. During children's college years, the value will be slashed by the factor of $(1 - \tau_E)$, capturing the impact of the education asset levy. The past literature on incentives for IRA and 401(k) saving has ignored this factor. As a result, incentives for IRA and 401(k) saving over ordinary saving vehicles have been understated.

Table 1 illustrates how important the education tax exemption is in raising the return on retirement saving vehicles *vis-à-vis* ordinary saving. Panels 1 to 3 describe saving incentives for people at different stages of their lives: Panel 1 a person who is 40 years of age with 20 more years to go, Panel 2 45, and Panel 3 50 years of age[11]. Each panel compares two alternative means of saving, ordinary *vs.* retirement, in terms of both at-retirement values of one before-tax dollar saved today(V_{ORD} and V_{RET}) and implied annualized rates of return. The calculation assumes that $\tau_{FED} = 0.28$ and that $r = 0.06$.

V_{ORD} in the first column and V_{RET} in the fifth column are calculated according to the two equations above. V'_{ORD} in the third column represents the traditional estimates in the literature ignoring the impact of the education tax. Alternatively, V'_{ORD} can be construed as at-retirement values of one dollar saved today for families without a pre-college child. That is,

$$V'_{ORD} = (1 - \tau_{FED}) * \{1 + (1 - \tau_{FED})r\}^n. \tag{3.3}$$

For a family with a college-bound child, V_{ORD} gives the true return to be expected from an ordinary saving account, not $V_{ORD'}$.

Once the at-retirement value gets determined, the implied annualized rate of return, r^*, is calculated as a solution to the equation: $V = (1 + r^*)^n$. V and r^* represent the same information, as one is a positive monotonic transformation of the other, given n.

Row-wise, each panel compares families facing different marginal education tax rates. Kim(1995) provides estimates of τ_E based on the data from the Survey of Income and Program Participation. For middle income families earning between \$30,000 and \$60,000 a year, the median of τ_E is about 0.2. About a quarter of the same group face τ_E of 0.3 or above. Some unlucky families with large education window–about 10 % of the group–may face τ_E of 0.4 or up.

Panel 1 considers the case of a person from the middle income group, 40 years old with \$1 fund before tax. Suppose she faces $\tau_E = 0.2$ (row 1). She could contribute the dollar in her retirement saving account, either an IRA or a 401(k), enjoy deduction

[11] IRAs and401(k)s allow withdrawal without penalty once the contributor gets $59\frac{1}{2}$ in age.

from income tax, and see the money grow tax-free. The only tax she should be concerned about is the income tax to be paid on withdrawal when she gets 60. After the tax, \$1 today will have grown into \$2.31 in 20 years of time(column 5). The implied compound annual interest rate is 4.3%(column 6). On the other hand, if she decides to save it through an ordinary saving vehicle, there will be no income tax deduction, interest income will get taxed in the future, and there will be an asset levy of 20% down the road. In 20 years of time, the saving will be worth only \$1.34 after all the taxes(column 1). Accordingly, the implied annual rate of return will be only 1.5%, about a third of what's available via retirement saving vehicles(column 2). There will be about 50% of people with a comparable amount of income who find the disparity even larger. For instance, the person at the upper quartile of the distribution of τ_E in the same group, with τ_E=0.3, may find ordinary saving provides less than one sixth of the annual return available from IRA or 401(k) saving(row 2). About 10% of middle income families with τ_E 0.4 or up(row 3) would be lucky to barely get back their principal from an ordinary account in 20 years.

The first row in Panel 2 describes a "typical" person who might be anxious about the choice between different means of saving. Aged 45, he has a daughter going to college in three years. From the tax point of view, the choice should be obvious. He can expect 3.7% annualized return from an IRA, but only 0.6% from an ordinary account. It is interesting to note that ignoring education tax results in 2.1% for annual return, halfway between 0.6% and 3.7%.

As a person gets older, the disadvantage of ordinary vehicles of saving gets aggravated, as saving there is allowed less and less time to recover from the shock of the education asset levy. A person 50 years old with a child to go to college later, from tax considerations alone, should not choose ordinary saving before he has exhausted contribution limits for retirement saving. After-tax rates of return on ordinary saving for such a person can be negative for a wide range of values for τ_E(Panel 3, columns 1 and 2). This analysis suggests the possibility of an unconventional explanation for why IRA contributors are predominantly older people.

Lessons from Table 1 seem loud and clear. A substantial portion of the attraction of retirement saving vehicles is accounted for by the education tax exemption. The older the family, and also the larger the education window(implying higher τ_E), the more significant the role of education tax exemption becomes. The traditional approach in the IRA and 401(k) literature ignoring the effect clearly understates the relative advantage of retirement saving vehicles. It would be surprising if this much difference in net rates of return due to the differing education tax rates does not affect portfolio choices regarding IRA and 401(k) *vs.* ordinary saving.

Tax advantage notwithstanding, retirement saving vehicles do not necessarily dominate ordinary instruments of saving, because of relative illiquidity. Early withdrawal before the age of $59\frac{1}{2}$ is penalized by a 10% charge as well as the regular income tax. The next Section introduces a stylized 2-period saving model, allowing a choice between two different vehicles of saving, retirement(S_R) and ordinary(S_O). The first enjoys a higher rate of return due to a tax benefit denied to the second. which we will use to motivate the reduced-form empirical equation to be estimated.

3.3 A Stylized Life Cycle Model of Saving with Retirement Saving Vehicles

3.3.1 Set-up

This section develops a stylized life-cycle saving model allowing the choice between two saving vehicles, retirement and ordinary. The model recognizes two essential features of IRA and 401(k) accounts, namely the higher rate of return due to the combined tax advantage and the relative illiquidity due to the early withdrawal penalty. It ignores, however, the annual contribution limit to focus on the tax advantage variable. The approach is complementary to the existing literature. This may not be such an outrageous abstraction, since the empirical analysis focuses on 401(k) saving or the sum of IRA and 401(k) saving, and with 401(k)s, annual contribution limit seems less a problem than with IRAs. As the purpose is to motivate the reduced form equation to be estimated, the emphasis will be on the description of the conceptual set-up.

The consumer lives two periods, the first period working and earning y, and the second in retirement, consuming the accumulated assets. The consumer starts with an initial wealth, A_0. There is no bequest motive: In the last period, the consumer simply consume everything that she has. In the first period, she has control over three choice variables: c, consumption, S^R, contribution to a retirement saving accounts and S_O, saving in an ordinary account. The money saved in a retirement saving account earns the after-tax rate of return, r, the money in ordinary saving $(1-\tau)r$. Note that τ accounts for the total tax disadvantage of ordinary saving due to the education tax as well as the income tax, or the combined tax advantage of a retirement saving account-the key variable of interest. It is natural to calculate the variable from the relationship between V_{RET} and V_{ORD}, the at-retirement values of \$1 saved in IRA or 401(k) plan and in an ordinary saving account, respectively. From equations in Section 2, we have the following:

$$\begin{aligned}\tau &= 1-\frac{V_{ORD}}{V_{RET}} \\ &= 1-(1-\tau_E)\{\frac{1+(1-\tau_{FED})r}{1+r}\}^n, \qquad (3.4)\end{aligned}$$

where n is the number of years remaining until retirement at age 60.

To recognize the relative illiquidity of retirement saving due to the early withdrawal penalty, introduce a random emergency in the second period. The emergency could be modeled as a binomial random variable with probability p. If the emergency occurs, and if the amount of liquid assets in the ordinary saving account is less than a certain amount X, the consumer suffers a disutility, an increasing function $K(\cdot)$ of the shortfall, $\{X-(1+(1-\tau)r)S_O\}$. X could represent a larger-than-expected college bill, or a medical emergency in the family. The consumer might have to earn a second wage to make up the shortfall. Hence the disutility.

The trade-off between ordinary *vs.* IRA and 401(k) saving is clear even in this simplest setting. While earning a higher rate of return, IRA and 401(k) saving makes a poor provision for a rainy day tomorrow.

The consumer then maximizes the following expected life-time utility

$$
\begin{aligned}
max_{\{c_1,\, c_2,\, S_O,\, S_R\}} & \quad u(c_1) + \beta u(c_2) + pK(X - (1 + (1 - \tau)r)S_O) \\
A_0 & \quad given, \\
c_1 & \leq A_0 + y, \\
c_1 + S_R + S_O & = A_0 + y, \\
c_2 & \leq (1 + r)S_R + (1 + (1 - \tau)r)S_O.
\end{aligned}
\tag{3.5}
$$

3.3.2 Solution: Reduced-Form Equations

The first order conditions for the problem could be solved for a closed-form solution by assuming a simple utility function, such as quadratic utility. Since the focus is on motivating reduced form empirical equations to be used, we would rather proceed by thinking of the first order solutions implicitly defining optimal solutions, c_1^*, c_2^*, S_O^*, and S_R^* as functions of (1) the budget parameters, y,A_0, and most importantly, τ, (2)individualized emergency parameters, p and X, and finally (3)preference parameters. We focus on S_R^*, and to a lesser extent, on c_1^* in the following. Ignore the time subscript from now on, for there is no worry for confusion.

Linearized, the solutions provide the following reduced-form empirical equations.

$$
S_{Ri}^* = \gamma_0 + \gamma_1 \tau_i + \gamma_2 y_i + \gamma_3 A_{0i} + \Gamma Z_i + \eta_i + \epsilon_i, \tag{3.6}
$$

$$
c_i^* = \delta_0 + \delta_1 \tau_i + \delta_2 y_i + \delta_3 A_{0i} + \Delta Z_i + \lambda_i + \zeta_i, \tag{3.7}
$$

(3.8)

where Z_i represents a vector of covariates, η_i and λ_i are unobservable individual effects, which could come from the preference or emergency parameters or other individual variables not considered above, and ϵ_i and ζ_i residual error terms. The empirical focus of the following Section 4 will be on the first, retirement saving equation.

The second, consumption equation, which I am not going to estimate due to lack of suitable data, points at an interesting possibility. The equation might suggest a way to approach the new *vs.* old saving controversy from a different angle by directly looking at consumption as a function of the combined tax advantage variable. Admittedly, the equation as it stands is too simplistic, in that it ignores the annual contribution limit, for instance. Yet, a more refined version of the equation might lead to a fruitful reexamination of the controversy, with a suitable data with consumption.

3.4 Empirical Implementation

3.4.1 Specification

The main purpose of this paper is to estimate the following empirical retirement saving equation derived in the previous section.

$$S^*_{Ri} = \gamma_0 + \gamma_1\tau_i + \gamma_2 y_i + \gamma_3 A_{0i} + \Gamma Z_i + \eta_i + \epsilon_i \tag{3.9}$$

The variable of interest is of course τ, the combined tax advantage of IRA and 401(k) over ordinary saving. As for the asset variable A_0, we use the measure of household total net wealth. Z, a vector of covariates, includes parental education, marital status, dummies for each different number of children, and race dummies. To control for income nonlinearities, regressors also include the income squared term.

OLS estimates of the portfolio equation will be biased at least for three reasons. First of all, the tax variable suffers from endogeneity. Family portfolio decision affects the tax advantage through their effects on the marginal education tax rate. To a less extent, the marginal income tax rate may also be affected by the portfolio decision. Second, unobserved individual effects are almost certainly correlated with regressors.

One example might be unobserved propensities to save, which would affect the tax variable, income, and assets. Third, we also have the measurement error problem, especially with the tax variable. The measurement error comes chiefly from the fact that we have to estimate the marginal education tax rate, τ_E. Focusing on the subsample of families with pre-college children only, I calculate college costs, C, as the weighted average of costs at different types of institutions in a given state, assuming every child goes to a hypothetical college within their state of residence where the annual college cost is the weighted average of college costs in the state of public 4-year, public 2-year, and private 4-year programs. See Kim(1995) for a detailed description of the procedure to estimate τ_E and related issues.

All the specification issues discussed above require an instrumental variables strategy for identification. The issue of suitable instruments will be discussed in the next subsection.

3.4.2 Instruments

An ideal instrument is a variable that is correlated with the tax advantage term, τ, but uncorrelated with the unobserved individual effects or the measurement error. There are two key components of τ, τ_E and τ_{FED}. I look for instruments among the determinants of τ_E, which reflects some interesting, even curious, dictates from the Federal Methodology. Recall the equation defining τ_E.

$$\tau_E \;=\; \sum_{n=1}^{EW} \frac{fm * \{(1-\tau_{FED}-\tau_{FICA}-\tau_{STATE})r + 0.12\}\, I(C_n > EPC_n)}{(1+r)^{n-1}}.$$

First of all, I argue that education window makes a suitable instrument. It is very important to distinguish between education window and the number of children. Two families with the same number of children, differently spaced, can wind up with vastly different values of τ_E. While the number of children might appropriately be regarded as a result of rational choice, the spacing between siblings, after controlling for the number of children, is to a large extent randomly determined. Couples who have got their first child after a long waiting period, or those with a child born unplanned might more strongly agree on that.

I also use as instruments the variation in college costs across states and over time. Higher education policies differ vastly among states. Some have affordable, high-quality public programs; some don't. Two otherwise identical families, one living in a high-cost state and the other in a low-cost state, might face different values of τ_E. The latter, sending the child to a relatively cheap school, might have to pay the full price–$C < EPC$– and thus face $\tau_E = 0$, while the former might be faced with a high positive marginal education tax rate. In estimating τ_E, I calculate C as the weighted average of state- and year-specific college costs of 4-year public, 2-year public, and 4-year private institutions. That means I have three college cost variables that are correlated with τ_E, which I use as instruments.

This variation in college costs may not be random. States with more affluent residents are likely to have higher education policies different from others. Fortunately, we have more instruments than endogenous variables. This allows us to test overidentifying restrictions. Utilizing the idea, I later run an informal specification check by comparing two estimates, one instrumented by education window only and the other by all four instruments.

To sum up, the following is the list of instruments to be used[12].

- The education window.
- State-specific average annual costs for 4-year private programs.
- State-specific average annual costs for 4-year public programs.
- State-specific average annual costs for 2-year public programs.

[12] Kim(1995) uses the same set of instruments.

3.4.3 Data

The main body of data comes from the Survey of Income and Program Participation from 1985, 1990, 1991, and 1992[13]. The major strength of the data set is its detailed information on family income and assets as well as education and other demographic characteristics. A feature of the data set crucial for my identification strategy is that it includes the state of residence. Using this data, I match state-level college data on annual costs from the Digest of Education Statistics with individual observations. Estimates of education tax rates are obtained following the provisions in the Higher Education Amendment Acts of 1986 and 1991.

The sampling scheme used for the data set consists of three criteria. It gets all the families in SIPP (1)with at least one child, and (2)with the eldest child less than 18 years of age. In addition, I require that (3) family net wealth be over $1,000. Applying the criteria (1)-(3) reduces the number of families in the data set to 12,540 about a quarter of the total number of households in the original data[14]. We require condition (2), lest we should include families whose nest eggs have been tapped to pay college bills. While condition (3), eliminating families with a negative or a very small amount of wealth, is not strictly necessary, it seems a sensible restriction for the following reasons. First of all, these are families far less likely to send their children to college than the others. Second, they may have just gone through some unusual catastrophes, especially families with negative amounts of assets. Third, they may include families deliberately misreporting their assets, especially families with zero assets[15].

Table 2 provides descriptive statistics for the retirement saving variables, regressors, and instrumental variables. Taxable assets include home equity, stocks and bonds, saving and checking accounts, and equity in other real estate.

Table 3 describes participation in retirement saving programs of the families in the

[13]SIPP 1988 and 1989 do not have adequate information on asset holding. SIPP 1984, 1986, and 1987 do not have adequate information on retirement saving accounts.

[14]Many of the removed "households" consist of individuals.

[15]I have tried different cut-off points such as $5,000 and $500, but the results do not change significantly.

Survey of Income and Program Participation. Note that while overall participation ratios are similar for IRAs and 401(k)s, conditional on being offered a chance to join a 401(k) program, the take-up ratio for 401(k) is as high as 67%. The patterns shown in the table seem comparable to those in earlier studies[16].

3.5 Results

3.5.1 Participation

Table 4 presents the estimation results for a linear probability model of the participation decision in 401(k) plans, the first column giving OLS estimates and the second IV. The third and fourth columns repeat the same exercise, this time including τ_{FED} among the regressors. Even though not shown in the table, the regressors include dummies for each different number of children, and a dummy for a single-parent family.

The main variable of interest is τ, the combined tax advantage of IRA and 401(k) over ordinary saving. In view of the complicated definition of τ, some explanation is in order on how to interpret the tax coefficient estimates. Assuming $\tau_{FED} = 0.28$, $r = 0.06$, and $n = 20$, that is, parents 40 years of age, we can see from the equation for τ that college financial aid raises τ by about 0.1, for a family facing the mean marginal education tax rate of $\tau_E = 0.15$: without the implicit tax in college financial aid, this 'typical' family would face $\tau_E = 0$[17]. For this typical family, the IV estimate suggests that due to the education tax, the probability for this family to join a 401(k) plan is raised by about 6%, 0.1 times 0.595, the coefficient estimate. On the other hand, the OLS estimate is insignificant and of the "wrong" sign. I consider the IV estimate consistent. Later, Table 6 will present some results of a specification check.

Including τ_{FED} somewhat reduces the value of the coefficient estimate for τ. Yet, the coefficient estimate is still statistically significant. Strong negative effects assigned

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[16] See Poterba, Venti, and Wise(1992) and Gale and Scholz(1990), for example.

[17] Alternatively, one could think of a thought experiment in which means testing in college financial aid is repealed, to be replaced by need-blind subsidies, *a la* subsidies from the state governments.

to the new variable τ_{FED} is a puzzle. The variable may be picking up some income non-linearity.

Note that in principle τ_{FED} need not be included among the regressors, since τ takes into account the tax advantages coming from both education tax exemption and income tax deferral.

Table 5 considers the participation decision in a general retirement saving program, be it an IRA or a 401(k). It is reassuring to see the same general patterns repeated as in the previous table. OLS estimates of the τ coefficient are small or insignificant. Consistent IV estimates of the τ coefficient suggest that the education tax raises the probability for a typical family to join by about 7 to 8%, comparable to or slightly bigger than the estimated effects in Table 4.

Table 6 shows the results of an informal identification check. Columns 1 and 3 use as instruments the same four variables as in the previous tables; Columns 2 and 4 education window only. If the orthogonality assumptions about the instruments are valid, the estimates should be similar, which is what the table shows.

3.5.2 Balances in 401(k)s and IRAs

Table 7 shows the estimation results for balances in 401(k)s as the dependent variable. The estimation has the same set of regressors and instruments as the participation equations discussed earlier. Again, OLS and IV return significantly different tax coefficient estimates. The consistent IV estimate in column 2 suggests that the education tax raises 401(k) balances for a typical family by about $1,350, the product of the coefficient estimate and the 0.1 factor discussed above. This is about 30% of the average 401(k) balances(See Table 2). Including τ_{FED} does not markedly change the results, even though the coefficient estimate for τ get smaller.

Table 8 considers the sum of balances in IRA and 401(k) accounts. Now that the dependent variable is the sum of balances in two similar accounts, it is perhaps no wonder that coefficient estimates for τ are about twice as big as in the previous table. The IV estimate in column 2 suggests that the education tax may be responsible for about $2,000 increase in the combined balances of IRA and 401(k) accounts. Table

2 tells us that this is about 25% of the sum of mean IRA and 401(k) balances.

Calculations to interpret the estimated τ coefficients have so far assumed that the education tax raises τ_E from 0 to 0.15, the average τ_E. Obviously, actual effects could differ across different segments of the population, as they face different marginal education tax rates. For instance, middle income families face on average higher education tax rates than the population as a whole: the median τ_E is about 0.2 for them. Thus for a substantial portion of middle income families, the actual effects could be significantly larger.

The economically and statistically significant estimates suggest a possible linkage between two seemingly unrelated phenomena: tuition inflation and increasing popularity of retirement saving accounts. College costs at both private and public universities have been increasing about 4

3.5.3 Using the estimates to analyze the effects of a tax reform

For illustration, I consider a case of an income tax cut. If the marginal income tax rate τ_{FED} is cut from 0.28 to $\tau'_{FED} = 0.20$, the resulting change in τ, $\Delta\tau$ is given by the following.

$$\begin{aligned}\Delta\tau &= \tau' - \tau \\ &= (1-\tau_E)[\{\frac{1+(1-\tau_{FED})r}{1+r}\}^n - \{\frac{1+(1-\tau'_{FED})r}{1+r}\}^n]. \end{aligned} \quad (3.10)$$

Assuming $\tau_E = 0.15$, $r = 0.06$, and $n = 20$, we can verify that $\Delta\tau = -0.06$. Multiply the change in τ by the τ coefficient estimate 0.595 in column 2, Table 4, and we could predict that such an income tax cut might reduce participation in the 401(k) program by about 3.5%. In a similar way, one could use the τ coefficient estimates from the balances equation to forecast a reduction in contributions.

The discussion in this subsection is only for illustrative purposes. Even though τ

summarizes the combined tax effects from the education tax as well as income tax, the estimates in this paper are obtained mainly by using variation in the former. Caution is in order before applying the results to analyze the effects of income tax changes. Yet, I believe that the estimates in this paper or some similar measure could be used for the purpose at least on a tentative basis. This is especially so, in that there seem to be precious few estimates existing.

3.6 Conclusion

Retirement saving vehicles, such as IRAs and 401(k) plans, enjoy two-fold tax benefits, exemption from education tax as well as income tax deferral. Contributions in the retirement saving accounts are tax-deductible, and returns accrue tax-free, but this is not the end of the story. The money stashed in these accounts, unlike ordinary saving, does not affect the amount of your child's college financial aid. Ignoring the effect of education tax exemption leads to a significant underestimation of the relative tax advantage of IRAs and 401(k)s over ordinary saving: my estimates show that for nearly half the middle income families education tax exemption is at least as important as income tax deferral.

The main purpose of the paper is to measure the effects of the combined tax advantage on family decisions on IRA and 401(k) saving, which is a function of both marginal income and education tax rates. While it is not easy to find an instrument for the marginal income tax rate, I have good instruments for the marginal education tax rate in education window, *i.e.*, the spacing between siblings, and college cost variation between states and over time. This is the key observation that allows identification of the model. The estimates suggest that the implicit tax in college financial aid might be responsible for raising the participation probability by about 7%, and the typical balances in the retirement saving plans by about $2,000.

These estimates highlight the hitherto ignored linkage between two important public policies: tax-based retirement saving promotion and college financial aid. Changes in financial aid could affect retirement saving behavior, and *vice versa*. Two seemingly unrelated phenomena, tuition inflation and the increasing popularity of retirement saving accounts, may be closely related. All these are a cautionary tale illustrating the potential perils of designing one set of public policies while ignoring other policy areas.

A tax-based saving promotion program such as IRAs and 401(k)s can be defined mainly in terms of two parameters: the annual contribution limit and the size of tax advantage. This paper complements the existing literature by focusing on the effects of tax advantage. On the other hand, since it abstracts from the contribution limit, it cannot directly deal with the new *vs.* old saving controversy.

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Table 1. Tax Advantage of IRAs and 401(k)s

Panel 1. **n=20**

	Ordinary Saving w/ ed tax		Ordinary Saving w/o ed tax		IRA and 401(k)	
	V_{ORD}	r implied	V'_{ORD}	r implied	V_{RET}	r implied
τ_E=.2	1.34	1.5%	1.68	2.6%	2.31	4.3%
τ_E=.3	1.17	0.8%	1.68	2.6%	2.31	4.3%
τ_E=.4	1.01	0.0%	1.68	2.6%	2.31	4.3%

Panel 2. **n=15**

	Ordinary Saving w/ ed tax		Ordinary Saving w/o ed tax		IRA and 401(k)	
	V_{ORD}	r implied	V'_{ORD}	r implied	V_{RET}	r implied
τ_E=.2	1.09	0.6%	1.36	2.1%	1.73	3.7%
τ_E=.3	0.95	-0.3%	1.36	2.1%	1.73	3.7%
τ_E=.4	0.81	-1.4%	1.36	2.1%	1.73	3.7%

Panel 3. **n=10**

	Ordinary Saving w/ ed tax		Ordinary Saving w/o ed tax		IRA and 401(k)	
	V_{ORD}	r implied	V'_{ORD}	r implied	V_{RET}	r implied
τ_E=.2	0.88	-1.3%	1.10	1.0%	1.29	2.6%
τ_E=.3	0.77	-2.6%	1.10	1.0%	1.29	2.6%
τ_E=.4	0.66	-4.1%	1.10	1.0%	1.29	2.6%

Note: The table assumes marginal income tax rate of 28% that remains constant before and after retirement. It also assumes before-tax rate of return 6%.

Table 2. Descriptive Statistics

Variables	Mean	St. Dev.
401(k) Balances	4178	13861
IRA Balances	4485	14658
τ	0.37	0.15
τ_{FED}	0.25	0.08
τ_{E}	0.15	0.16
Income	51242	31092
Taxable Assets	71991	101217
HH Net Wealth	88570	135340
Parental Education	13.7	2.8
Parental Age	37	7
Education Window	6.5	2.5
Public 4 Yr. Costs	9683	3663
Public 2 Yr. Costs	7801	3019
Private 4 Yr. Costs	20058	7142
Number of Kids	1.96	0.91

Note: Number of observations 12,540.

Table 3. Participation in IRA & 401(k)

	Yes	No
Own an IRA Account?	23%	77%
Own a 401(k) Account?	20%	80%
401(k) conditional on offered?	67%	33%

Table 4. Participation in 401(k)

Variables	w/o τ_{FED}		w/ τ_{FED}	
	OLS	IV	OLS	IV
τ	-0.004	0.595	0.083	0.305
	(0.031)	(0.197)	(0.032)	(0.151)
τ_{FED}			-0.696	-0.894
			(0.086)	(0.157)
income * $10^{(-6)}$	5.70	3.86	8.28	8.41
	(0.35)	(0.7)	(0.47)	(0.48)
income^2 * $10^{(-11)}$	-1.76	-0.93	-2.62	-2.60
	(0.20)	(0.34)	(0.22)	(0.23)
wealth * $10^{(-7)}$	-2.02	-0.94	-1.90	-1.49
	(0.31)	(0.47)	(0.31)	(0.41)
Parental Age	0.028	0.008	0.003	0.005
	(0.006)	(0.002)	(0.0006)	(0.001)
Parental Edu.	0.007	0.012	0.008	0.010
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-0.104	-0.418	-0.086	-0.185
	(0.031)	(0.105)	(0.031)	(0.072)

Note: number of observations, 12540. Regressors include a dummy for a family with 2 children, a dummy for a family with 3 children, etc., race dummies, and a dummy for a single-parent household. Instruments used are education window and state- and year-specific college costs in 4-year public, 2-year public, and 4-year private institutions.

Table 5. Participation in 401(k) or IRA

Variables	w/o τ_{FED}		w/ τ_{FED}	
	OLS	IV	OLS	IV
τ	0.055	0.713	0.104	0.795
	(0.033)	(0.213)	(0.035)	(0.253)
τ_{FED}			-0.388	0.335
			(0.093)	(0.542)
income * $10^{(-4)}$	7.40	5.38	8.83	3.75
	(0.38)	(0.75)	(0.51)	(2.73)
income^2 * $10^{(-11)}$	-2.58	-1.67	-3.07	-1.08
	(0.21)	(0.36)	(0.24)	(1.02)
wealth * $10^{(-7)}$	4.45	5.64	4.51	5.81
	(0.34)	(0.51)	(0.34)	(0.58)
Parental Age	0.007	0.013	0.007	0.013
	(0.0006)	(0.002)	(0.0006)	(0.002)
Parental Edu.	0.025	0.031	0.026	0.032
	(0.002)	(0.003)	(0.002)	(0.003)
Constant	-0.375	-0.719	-0.365	-0.793
	(0.033)	(0.115)	(0.033)	(0.166)

Note: number of observations. 12540. Regressors include a dummy for a family with 2 children, a dummy for a family with 3 children, etc., race dummies, and a dummy for a single-parent household. Instruments used are education window, state- and year-specific college costs in 4-year public, 2-year public, and 4-year private institutions.

Table 6. Participation in 401(k) or IRA

Variables	w/o τ_{FED}		w/ τ_{FED}	
	IV(1)	IV(2)	IV(1)	IV(2)
τ	0.713	0.589	0.795	0.581
	(0.213)	(0.299)	(0.253)	(0.298)
τ_{FED}			0.335	-0.812
			(0.542)	(0.277)
income * $10^{(-6)}$	5.38	5.76	3.75	9.10
	(0.75)	(0.99)	(2.73)	(0.54)
income^2 * $10^{(-11)}$	-1.67	-1.84	-1.08	-3.00
	(0.36)	(0.47)	(1.02)	(0.25)
wealth * $10^{(-7)}$	5.64	5.38	5.81	5.33
	(0.51)	0.62	(0.58)	(0.61)
Parental Age	0.013	0.012	0.013	0.011
	(0.002)	(0.002)	(0.002)	(0.003)
Parental Edu.	0.031	0.029	0.032	0.029
	(0.003)	(0.003)	(0.003)	(0.003)
Constant	-0.719	-0.652	-0.793	-0.573
	(0.115)	(0.158)	(0.166)	(0.132)

Note: number of observations, 12540. Regressors include a dummy for a family with 2 children, a dummy for a family with 3 children, etc., race dummies, and a dummy for a single-parent household. Instruments used in IV(1) are education window. state- and year-specific college costs in 4-year public, 2-year public, and 4-year private institutions. IV(2) uses only education window as an instrument.

Table 7. Balances in 401(k)

Variables	w/o τ_{FED}		w/ τ_{FED}	
	OLS	IV	OLS	IV
τ	-4353	13449	-1737	8060
	(967)	(6238)	(1024)	(4797)
τ_{FED}			-2074	-2591
			(2718)	(4974)
income	0.126	0.072	0.203	0.207
	(0.011)	(0.022)	(0.015)	(0.015)
$income^2 \cdot 10^{(-7)}$	-1.89	0.58	-4.47	-4.41
	(0.62)	(1.06)	(0.71)	(0.71)
wealth	0.0007	0.004	0.001	0.002
	(0.0009)	(0.001)	(0.0009)	(0.001)
Parental Age	168.4	319.5	186.6	234.9
	(19.3)	(55.7)	(19.4)	(43.5)
Parental Edu.	276.5	430.3	298	348.2
	(50.2)	(73.5)	(50.2)	(64.3)
Constant	-7470	-16749	-6922	-9488
	(978)	(3353)	(979)	(2276)

Note: number of observations, 12540. Regressors include a dummy for a family with 2 children, a dummy for a family with 3 children, etc., race dummies, and a dummy for a single-parent household. Instruments used are education window and state- and year-specific college costs in 4-year public, 2-year public, and 4-year private institutions.

Table 8. Balances in 401(k) & IRA

Variables	w/o τ_{FED}		w/ τ_{FED}	
	OLS	IV	OLS	IV
τ	-9019	20353	-4508	12547
	(1391)	(8997)	(1471)	(6890)
τ_{FED}			-3576	-4571
			(3903)	(7145)
income	0.191	0.101	0.323	0.330
	(0.016)	(0.032)	(0.021)	(0.021)
$\text{income}^2 \cdot 10^{(-7)}$	-1.66	2.41	-6.11	-6.00
	(0.89)	(1.53)	(1.02)	(1.02)
wealth	0.033	0.039	0.034	0.036
	(0.001)	(0.002)	(0.001)	(0.002)
Parental Age	275.4	524.6	306.8	398.8
	(27.8)	(80.5)	(27.9)	(62.5)
Parental Edu.	750.4	1004.2	787.4	883.1
	(72.1)	(106.0)	(72.0)	(92.4)
Constant	-16070	-31399	-15125	-20023
	(1406)	(4836)	(1405)	(3269)

Note: number of observations, 12540. Regressors include a dummy for a family with 2 children, a dummy for a family with 3 children, etc., race dummies, and a dummy for a single-parent household. Instruments used are education window, and state- and year-specific college costs in 4-year public, 2-year public, and 4-year private institutions.