NBER WORKING PAPERS SERIES

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Working Paper No. 4032

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1992

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ABSTRACT

This paper examines the effect of existing college scholarship rules on the incentive to save. The analysis shows that families that are eligible for college scholarships face "education tax rates" on capital income of between 22 percent and 47 percent in addition to regular state and federal income taxes. The scholarship rules also impose an annual tax on previously accumulated assets. Through the combination of the implied tax on capital income and the associated tax on previously accumulated assets, the scholarship rules that apply to a middle-income family reduce the value of an extra dollar of accumulated assets by 30 cents in four years. A similar family with two children who attend college in succession will see an initial dollar of assets reduced to 50 cents.

Such capital levies of 30 to 50 percent are a strong incentive not to save for college expenses but to rely instead on financial assistance and even on regular market borrowing. Moreover, since any funds saved for retirement are also subject to these education capital levies, the scholarship rules discourage retirement saving as well as saving for education.

The empirical analysis developed here, based on the 1986 Survey of Consumer Finances, implies that these incentives do have a powerful effect on the actual accumulation of financial assets. More specifically, the estimated parameter values imply that the scholarship rules induce a typical household with a head aged 45 years old, with two precollege children, and with income of $40,000 a year to reduce accumulated financial assets by $23,124, approximately 50 percent of what would have been accumulated without the adverse effect of the scholarship rules.

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College Scholarship Rules and Private Saving

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Economic analyses of individual saving behavior have focused on saving that is done to finance consumption in retirement and to offset unexpected fluctuations in income and expenses. These studies have indicated how existing social insurance rules reduce the need for such saving while current tax rules reduce the return on savings. Together these studies help to explain the very low level of household saving in the United States.

The present paper examines an important but neglected aspect of savings: accumulation to finance the expenses of children's college education. Such educational saving is an important component of total saving for a small number of relatively affluent households. But for a much larger number of households, the current college scholarship rules not only deter saving to pay children's future college bills but also discourage other forms of saving as well.

For households in which students are potentially eligible for financial assistance, the present scholarship rules at most American colleges and universities are equivalent to a substantial capital levy on the wealth that a family accumulates before and during the time that the family's child attends college. These scholarship rules reduce the financial aid to the student as a function of previously accumulated assets as well as of current family income. An incremental dollar of such assets may be "taxed" through reduced financial aid at a rate that exceeds 50 percent for a family with two children.

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*Professor of Economics, Harvard University and President of the National Bureau of Economic Research. The research reported in this paper is part of the NBER study of the economics of higher education and of my own study of factors affecting saving and investment in the United States. I am grateful to Jed Kolko for assistance with the research.

Parents with college-age or pre-college children who recognize that there is such a substantial capital levy implicit in college scholarship rules have a substantially reduced incentive to accumulate financial assets. The empirical evidence for a cross-section of households presented in this paper confirms that the prospect of this capital levy does indeed discourage household saving.[1] The results are important not only in relation to education finance but more generally as an indication that household asset accumulation is sensitive to tax-induced changes in the rate of return.

Section 1 of this paper describes the current financial aid rules and the implied tax rates. The next section discusses the incentive effects on saving and borrowing and presents a formal analysis that shows that, although an "educational capital levy" as such discourages accumulation, the effect on saving of more generous scholarship aid is ambiguous. Section 3 describes the date used in the present study and discusses the parametric specification and the estimation issues. The statistical estimates are presented in section 4. The fifth section looks briefly at the importance of these estimates for aggregate saving. There is a brief concluding section.

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[1]There has been surprisingly little attention to the issue of saving for eduction and the adverse incentive effects of existing scholarship rules. The only study of which I am aware is by Case and McPherson ((1986a) and (1986b)). They discuss the potential disincentive effects of the educational rules but do not offer any empirical evidence of its effect in practice. McPherson and Schapiro (1991) refer to the potential adverse effects but conclude that they are unlikely to be important although no evidence is cited.

1. *Scholarship Rules as a Capital Levy*[2]

American colleges and universities provide financial assistance on the basis of the difference between the expected cost of attending their institution and an estimate of the ability of the student's family to help finance those costs. The family's ability to pay is calculated using a common standard, the so-called "uniform methodology," administered by the College Entrance Examination Board. Although some of the scholarship funds received by a student may come from the federal government, as long as the college contributes any funds of its own the "uniform methodology" determines the incentive effects of the assistance. The current study therefore assumes that the "uniform methodology" is determinant.[3]

The essential feature of the "uniform methodology" is the calculation of the "expected parental contribution," a measure of the family's ability to pay that reflects estimates of "discretionary income" and "available assets." The measurement of the parents' discretionary income starts with adjusted gross income, adds back some of the deductions and exclusions allowed by the tax law, and then subtracts the sum of taxes, a minimum required consumption level for a family of that size and an adjustment if both parents are employed. The key point about this calculation for the current purpose is that an extra dollar of interest, dividends or capital gains is part of this measure of discretionary income.

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[2]For more details on these rules, see Case and McPherson (1986).

[3]Since the primary form of Federal government student aid (the Pell grant) implies lower marginal tax rates than the "uniform methodology," the application of the uniform methodology by schools that supplement government funds with their own scholarships or loans makes the "uniform methodology" tax rates the relevant ones.

The value of "available" assets is defined by subtracting from the value of all net assets (including real estate as well as net financial assets) the present value of the annuity at age 65 that, together with an estimate of expected Social Security benefits, is deemed to maintain the current standard of living. An additional dollar of accumulated wealth adds a dollar to this measure of available assets.

These two measures are next combined by adding 12 percent of the available net assets to the discretionary income. The combination, known as the "adjusted available income" is then subject to taxation at very steeply graduated "tax" rates to determine the family's ability to pay for college education. Note that an additional dollar of accumulated assets that is producing interest income at a 6 percent rate would raise the "adjusted available income" by 18 cents (i.e., by 12 percent based on the direct value of assets plus 6 cents of capital income.)

For the year corresponding to the data examined in this paper, the "tax rate" schedule applied under the "uniform methodology" to the adjusted available income to determine the "expected parental contribution" began with a 22 percent rate on the first $7,300 of adjusted available income and rose to a 47 percent rate on adjusted available income above $14,500. Case and McPherson (1986b) estimate that this $14,500 is roughly equivalent to total income (before taxes and other adjustments) of between $30,000 and $35,000.

Note that this uniform methodology implies an additional marginal tax rate on the parents' incremental labor earnings during the relevant year of between 22 percent and 47 percent. A couple subject to a Federal marginal income tax rate of 28 percent and a state income tax rate of five percent would then face a combined tax on incremental income of 80 percent. A second earner who paid a social security tax without receiving any incremental

benefits would face an even higher marginal tax rate of 86 percent on gross earnings and 92 percent on the marginal product of labor.[4] The labor supply effects of these remarkably high marginal tax rates will be investigated in a separate study.[5]

The focus of the current analysis is on the effect of the education levy on household capital accumulation. For a family facing the maximum 47 percent educational levy, an additional dollar of assets that earns 6 percent interest (or 6 percent in dividends plus capital gains) would raise the expected parental contribution by 0.47 (0.12 + 0.06) = 0.0846. Note that this is an annual levy. The same tax as a proportion of remaining assets would be levied each year that a child is in school.

Thus a couple that started with an initial dollar of assets just before their first child started college would see that dollar reduced to 91.5 cents during the first year of college. Applying the same factor in each of the next three years would leave only 70 cents at the end of the fourth year. If a second child began a four year college at that point, by the end of the second four year period the value of the initial dollar of assets would be depleted to 49 cents.

Note that this calculation of the eight-year capital levy ignores the federal and state income taxes. If the combined marginal tax rate on interest and dividends is 25 percent, the six percent earnings are subject to a 47 percent "education" tax on 75 percent of the 6 percent so that the combination of the education levy and ordinary income tax is a rate equal to [0.25 +

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[4]See Feldstein and Samwick (1991) for an analysis of the marginal tax rates implied by social security tax and benefit rules.

[5]There is a similar effect of the scholarship rules on the decision to realize capital gains because such gains are treated as part of income for the scholarship calculation.

0.47 (0.75)] 0.06 + 0.47 (0.12) = 0.093 per dollar of assets per year. One dollar of initial assets would decline to 68 cents after four years and 46 cents after eight years.

It is important to emphasize that the scholarship rules affect not only the incentive to accumulate to pay college bills but also the incentive of parents to accumulate during their children's precollege years to finance their retirement and other expenses to be incurred after their children have completed college. To calculate the full tax rate implied by the current system, it is therefore necessary to compare how a dollar accumulated just before a child enters college would grow in value in the absence of any tax with how it evolves under the combined effect of income taxes and the educational levy. With a 6 percent rate of interest and no tax, a dollar would grow in four years to $1.26 and in 8 years to $1.59. If the income were subject to federal and state taxes at a marginal tax rate of 25 percent (but not to an additional educational levy), the dollar would grow to $1.19 at the end of four years and $1.42 at the end of eight years. But with the combination of the income tax and the education tax (both the education tax on the interest income and the capital levy on the asset as such), the one dollar actually shrinks to 87 cents at the end of four years. The combined income tax and educational levy that converts a pretax $1.26 cents at the end of four years to 87 cents is equivalent to an income tax rate of 150 percent (since the combined tax takes more than all of the 26 cent pretax rise) or a capital levy of 31 percent on the initial dollar of accumulated assets. Alternatively, comparing the net 87 cents to the $1.19 that would have been available after four years with only the 25 percent income tax rate indicates that the educational levy alone implies an additional tax of 168 percent (i.e., the 32 cent reduction from $1.19 to 87 cents is 168 percent of the after-tax income of 19 cents).

With the eight year horizon that is appropriate to a family with two children who will attend college in succession, the relevant comparison is between the $1.59 that would accumulate with no tax, the $1.42 cents with just the 25 percent income tax and the 76 cents that would remain after both income taxes and the educational levy. The total tax is at a 141 percent rate on the 59 cents of pretax income, equivalent to a capital levy of 52 percent on the initial dollar of accumulated assets. The education levy alone taxes 157 percent of the after-tax capital income that would have accrued over the eight years and is equivalent to a capital levy equal to 47 percent of the initial capital.

The uniform methodology provides that a family with more than one child in college at the same time divides the expected parental contribution equally among all such children. The result of this process is a substantially higher tax on accumulated assets for a couple that has two children spaced with a four year interval that for a couple that has twins. For example, while a couple with two children spaced four years apart faces an educational levy equivalent to 52 percent of previously accumulated assets, the family with twins faces a capital levy of "only" 31 percent. The empirical estimates presented in section 4 recognize the actual number of children in the family and assume (for lack of specific information on their ages) that they are spaced at two year intervals.

A dollar's increase in the expected parental contribution is approximately but not exactly equivalent to a dollar's reduction in scholarship aid. When a college or university designs a package of financial assistance to fill the gap between the cost of education at that institution, it includes student loans as well as outright scholarship aid. Since the most common form of loan, the federally-sponsored "guaranteed student loan," has a below market rate of interest and

grants a deferral of payments until the student graduates, the loan component of the aid package involves a substantial element of subsidy, probably a grant-equivalent amount equal to about 60 percent of the loan with 1985 rules and interest rates. A financial aid package that consists of 50 percent scholarship and 50 percent student loan would thus be equivalent to a grant equal to 80 percent of the total financial aid package. In such a case, the implied education tax is only 80 percent of the tax rates calculated as if each dollar of expected parental contribution replaces a dollar of scholarship aid.[6]

One final point should be stressed. The educational levy applies as a marginal tax only to families that are eligible for financial assistance. When income and assets are high enough, the expected parental contribution exceeds the cost of education and no financial assistance is available. For such families, educational expenses are like other costs. A family with after-tax income of $40,000 and net assets of $50,000 will have an adjusted available income of approximately $35,000 and therefore an expected parental contribution of about $12,000. Such a family would be ineligible for aid if their child attends an institution in which annual costs are less than $12,000, an amount which in 1985 exceeded the average cost at public four-year institutions. As a result, there are relatively few families whose income and assets are large

[6]Some colleges and universities may not provide enough in scholarship and loans to eliminate the entire gap between the parents' expected contribution and the full cost of education at that institution. Whether this changes the marginal tax on assets depends on whether the residual gap is itself related to the expected parental contribution. For example, an institution may calculate aid based on the cost of a student who lives at home, requiring the family to pay more than the expected parental contribution if the student lives at college. Since a one dollar increase in expected family contribution still reduces aid by a dollar in this case, the marginal tax rates are unaffected by a funding gap.

enough to make them ineligible for financial assistance and that the educational levy therefore applies to a very large range of middle-income households.

2. *Effects on the Incentive to Save and to Borrow*

The most obvious effect of the educational tax is to encourage families that would be eligible for financial assistance on the basis of income alone not to accumulate any assets before their children start college. To the extent that the costs of education are not subsequently met by scholarship aid or student loans, it is better for the family to borrow at that time than to save in advance.

But reduced saving for future college bills is only part of the likely effect of the current system of scholarship rules. The saving disincentive implied by the implied education tax extends to all kinds of accumulation, including retirement savings, until the youngest child has graduated from college. A couple that has their last child when the husband is 30 years old will face an extremely high rate of tax on capital accumulation until the husband is in his fifties. Although the couple may then save at a greater rate than they otherwise would have, the optimal final accumulation of retirement assets will then be less than it would have been if the couple had not faced a high marginal tax rate on savings until they were in their fifties. The education tax thus distorts retirement consumption as well as saving to meet college expenses.

Although the educational tax as such can be expected to reduce capital accumulation, the provision of scholarship assistance that is not based on family assets could have the opposite effect. By lowering the potential cost of education, scholarship aid increases a family's desired total spending on education by making it more likely that a child will go to college and that the

chosen institution will be more expensive. A simple model demonstrates the separate effects of the educational capital tax and the scholarship subsidy and shows that individuals whose children are eligible for financial assistance might even accumulate more savings for college expenses under existing rules than higher income families that are not eligible for scholarship or loan assistance. This theoretical indeterminacy can only be resolved empirically and that is the subject of section 4.

Consider a couple that lives for two periods. In the first they earn Y_1 and consume C_1. In the second period, the combination of accumulated assets ($A = Y_1 - C_1$) and the second period wage income (Y_2) are divided between paying for a child's college education (an amount equal to E - S where E is the gross outlays on education and S is the scholarship aid received) and retirement consumption R. The analysis simplifies by assuming a zero interest rate and ignoring the special high tax on labor income while the student is in college.

The college scholarship rules can be described by

$$S = \alpha(E - \theta A) + \beta \qquad 0 \leq S \leq E \tag{1}$$

where S is the amount of the scholarship (or the scholarship equivalent of the combination of grants and subsidized loans) and θA is the expected parental contribution. The parameter θ is the marginal rate of tax on accumulated assets in calculating the expected parental contribution. The value of α is 1 if the scholarship aid is adjusted dollar for dollar for changes in the cost of education and in the expected parental contribution. More generally, $\alpha\theta$ is the effective marginal rate of educational tax on accumulated assets. The value of β measures any remaining financing gap (if $\beta < 0$) or lump-sum scholarship (not based on need) if $\beta > 0$.

The couple chooses first period consumption, education and retirement consumption to maximize U = U (C, E, R) subject to the budget constraint

$$E - S + R = A + Y_2 \tag{2}$$

where S is given by equation 1 and $A = Y_1 - C_1$. Substituting these into the utility function yields the unconstrained maximand:

$$U = U[Y_1 - A,\ E,\ A + Y_2 - E + \alpha(E - \theta A) + \beta] \tag{3}$$

or

$$U = U[Y_1 - A,\ E,\ (1-\alpha\theta)A + Y_2 - (1-\alpha)E + \beta] \tag{4}$$

where the two variables of choice are the assets accumulated at the end of the first period (A) and the gross level of educational expenses (E).

The two first order conditions are:

$$\begin{aligned} -U_C + (1-\alpha\theta)U_R &= 0 \\ U_E - (1-\alpha)U_R &= 0. \end{aligned} \tag{5}$$

The first of these implies that $U_C/U_R = 1-\alpha\theta$ so that increases in either α or θ reduces U_C relative to U_R, which is likely to mean increasing first-period consumption (C) relative to

retirement consumption (R)[7], either because less is saved or because more of the accumulated assets are spent on education or both. The second of these first order conditions implies that $U_C/U_E = 1-\alpha$ and therefore that an increase in the rate of educational subsidy (α) is likely to increase gross education spending (E) relative to current consumption (R). Combining the two equations implies that $U_C/U_E = (1-\alpha\theta)/(1-\alpha)$. Thus an increase in the marginal rate of education tax (θ) reduces U_C/U_E, which is likely to mean an increase in C relative to E while an increase in the rate of educational subsidy increases U_C/U_E, which is likely to mean an increase in E relative to C.

What remains unclear from these comparisons of changes in ratios is how α and θ affect the actual level of asset accumulation. Totally differentiating the two first-order conditions with respect to A, E, θ and α yields (on the assumption that the utility function is strictly separable)

$$\frac{dA}{d\theta} = \frac{\alpha U_R[U_{EE} + (1-\alpha)^2 U_{RR}]}{U_{CC}U_{EE} + (1-\alpha)^2 U_{CC}U_{RR} + (1-\alpha\theta)^2 U_{RR}U_{EE}} \tag{6}$$

and

$$\frac{dA}{d\alpha} = \frac{\theta U_R U_{EE} - (1-\alpha)(1-\theta) U_R U_{RR}}{U_{CC}U_{EE} + (1-\alpha)^2 U_{CC}U_{RR} + (1-\alpha\theta)^2 U_{RR}U_{EE}} . \tag{7}$$

With non-increasing marginal utilities of consumption, education and retirement spending, the denominators of equations 6 and 7 are unambiguously positive. The numerator of 6 is clearly

[7]A sufficient condition to make this true is that the utility function is strongly separable so that U_C is a function only of C and U_E is a function only of E. Since C is general consumption and E is spending on college, this separability is not an implausible assumption.

negative, implying that an increase in the rate of education capital tax unambiguously reduces the level of capital accumulation. In contrast, the sign of the numerator in 7 can be either positive or negative, showing that an increase in the marginal scholarship subsidy rate can either raise or lower saving. A higher marginal scholarship rate will raise saving if the absolute value of θU_{EE} is small relative to the absolute value of $(1-\alpha)(1-\theta)U_{RR}$. More concretely, if increased education spending has little effect on the marginal utility of educational spending (the absolute value of U_{EE} is small), the individual is more likely to respond to an increase in the marginal scholarship subsidy by saving more in order to purchase more education.

The effect of θ and α on the level of educational spending are unambiguous (in the current case of a separable utility function):

$$\frac{dE}{d\alpha} = \frac{-[U_{CC} + (1-\alpha)(1-\theta)U_{RR}]}{U_{CC}U_{EE} + (1-\alpha)^2 U_{CC}U_{RR} + (1-\alpha\theta)^2 U_{RR}U_{EE}} > 0 \qquad (8)$$

and

$$\frac{dE}{d\theta} = \frac{\alpha U_R(1-\theta)(1-\alpha\theta)U_{RR}}{U_{CC}U_{EE} + (1-\theta)^2 U_{CC}U_{RR} + (1-\alpha\theta)^2 U_{RR}U_{EE}} < 0 \qquad (9)$$

Equation 8 shows that an increase in the marginal rate of educational subsidy (α) raises educational spending. Equation 9 indicates that a higher education capital tax reduces gross spending on education.[8]

[8]This is of course not true if the family pays nothing at the margin for education. In that case, $\alpha = 1$ (the scholarship pays all) and equation 9 implies that $dE/d\theta = 0$.

Although the separate effects of α and θ on asset accumulation can be identified in theory, in practice data do not permit separate measurement of α. The "universal methodology" formula can be used (as it is in section sections 3 and 4 below) to calculate θ for a cross-section of households but the values of α cannot be observed or calculated. It follows of course that, with the scholarship rules implied by the "uniform methodology," $\alpha > 0$ if an only if $\theta > 0$, i.e., the marginal scholarship aid is effective ($\alpha > 0$) only for those individuals who face the educational capital tax ($\theta > 0$) and vice versa. But among households for which $\theta > 0$ there is no reason to expect any particular relation between the values of α and θ. In practice therefore, the estimates focus on variations in θ; although this contaminates the estimated effect of θ per se it gives an appropriate estimate of the combined effect of θ and α that determines the link between asset accumulation and scholarship rules.

Empirical research can test the predictions of this simplified theory and can examine actual behavior without the restrictive assumptions of the model. For example, the model does not deal with the fact that parents are uncertain at the time that they make their savings decisions about whether their child will qualify for financial assistance and how much that assistance will be. In addition, families may not understand fully how scholarship rules impose a large implicit tax on previously accumulated assets. This may be particularly true when saving for a child's education begins when the child is still very young. Other parents may object in principle to the idea of borrowing substantially to finance their child's education. Finally, those economists and others who believe that households are generally myopic and that saving behavior does not reflect rational intertemporal allocation will doubt the adverse effects of the educational level on capital accumulation that are suggested by the analysis in this section (see, e.g., McPherson and

Schapiro (1991)). Only empirical analysis can resolve these issues and it is to that analysis that the paper now turns.

3. *Data, Specification and Estimation*

The empirical analysis reported in this paper assesses whether families with precollege students accumulate a smaller amount of net financial assets when they face a higher prospective education tax on accumulated assets. The analysis uses the data collected in the 1986 Federal Reserve Board Survey of Consumer Finances. These data provide information on assets, incomes, and the demographic characteristics of the family including the current educational status of the children in the family.

Instead of trying to specify an elaborate nonlinear model that can relate asset accumulation to the age of the household head, the demographic composition of the family, and the full range of possible incomes as well as to the education tax rate, I have chosen to restrict the sample to a group of relatively homogeneous households so that attention can be focussed on the tax variable. For the reasons described below, the sample is restricted to households in which there is a married couple and in which the head is between 40 and 50 years old, there are children under 18 present in the household and no children in college, and total annual income is positive and not more than $100,000.

The age range of 40 to 50 years old for the head of the household is one in which children will generally soon be old enough to attend college and narrow enough so that the effects of age on saving can be approximated linearly. Couples without children are excluded not only because couples without children cannot face an education tax but also because the

saving behavior of childless couples may differ for other reasons.[9] Families with children already in college are excluded because such families are likely to have seen some of their previously accumulated assets depleted by college expenses. Families with incomes over $100,000 in 1985 were all ineligible for college financial assistance and therefore not subject to any educational tax.[10]

The econometric estimates reported in the next section relate the family's net financial assets (A_i) to income (Y_i), the educational capital tax rate (θ_i), the age of the household head (AGE_i), and the number of children under 18 living at home (N_i). The basic specification recognizes that the effect of the tax rate and of the other variables depends on the level of family income:

$$A_i = b_0 + (b_1 + b_2\theta_i + b_3 \mathrm{AGE}_i + b_4 N_i) Y_i + \epsilon_i \qquad (10)$$

Alternative specifications, including ones in which the number of children and other variables are included linearly (instead of or in addition to the interactive form of equation 10) are also presented in the next section.

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[9] Couples without children do not have the same bequest motives and cannot expect any financial support from children in their old age.

[10] Including these high income families would therefore provide no direct evidence on the effect of the education tax on accumulation. Keeping them in the sample might appear useful in principle if they could help to estimate the effect of income more precisely because that in turn would permit a more precise estimate of the tax effect. In practice however, asset accumulation increases very rapidly with incomes over $100,000 and the proper nonlinear specification is difficult to estimate because of ambiguities in measuring both incomes and assets of high income individuals.

The value of assets (A_i) is measured as the sum of all forms of financial assets minus all financial liabilities except the mortgage on the family residence. Net wealth in the family's home and any net assets in an operating business are excluded. Income (Y_i) is pretax cash income.

The education capital tax rate (θ) is calculated using the "universal methodology" rules described in section 1 above. The key measure of "available income" that is central to setting the tax rate on capital income is calculated by subtracting from reported annual income estimates of federal income tax liabilities on that income, social security tax liabilities, state and local taxes based on a national average state-local tax rate and an amount that the College Scholarship Service calls the "standard maintenance allowance." The standard maintenance allowance for 1986-87 scholarship calculations based on 1985 income is $8150 for a two person family, $10,160 for a three person family, $12,540 for a four person family, etc.[11]

To this "available income" is added an "income supplement" based on the family's assets. Assets include net financial assets, home equity, and the value of other real estate and investments. A separate treatment is given to farms and operating businesses, including a graduated amount from 40 percent or the first $60,000 of net value up to 100 percent for the net value in excess of $300,000. From this asset total is subtracted a "home and asset protection allowance" based on the age of the older parent; e.g., a forty year old had an "allowance" of $27,800 and a fifty year old had an $36,500. The resulting "discretionary net worth" is multiplied by 0.12 to derive the "income supplement."

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[11]Despite its very egalitarian and redistributive approach to financial aid, the College Scholarship Service also permits a deduction for expenses at private and parochial schools.

The sum of the "available income" and the "income supplement" based on the family's assets defines the "adjusted available income." The College Scholarship Service uses a graduated schedule to calculate the expected parental contribution. The family's expected contribution does not depend on the number of children in college and is not affected by other children in the family nearing college age. The contribution for each student in the family is determined by dividing the total parental contribution by the number of students currently in college.

The marginal rate at which additions to adjusted available income increase the expected parental contribution range from 22 percent on the first $7,300 of adjusted available income to 47 percent at $14,500 and above of adjusted available income. An additional dollar of financial assets increases adjusted available income by 18 cents (the 12 percent asset inclusion factor plus the 6 percent assumed return on assets). The annual capital levy (t_i) can therefore vary from 0.22 (0.18) = 0.0396 to 0.47 (0.18) = 0.0846.

This annual rate of capital levy is then applied successively for the number of years that the family can have a child in college. For example, since a family with only one child is subject to four successive applications of the annual capital levy, an initial dollar of capital is reduced to $\$(1-t_i)^4$. For such a single-child family, the education capital tax is defined as $\theta_i = 1 - (1-t_i)^4$. Similarly, since a family with two children that differ in age by two years is subject to six successive applications of the annual capital levy, the education capital tax for such a family is defined as $\theta_i = 1 - (1-t_i)^6$.[12]

[12] The expected parental contribution in a year is independent of the number of children in college. With two children in college at the same time, the expected parental contribution per child is half of what it would be with only one child in college. Since the ages of the individual

The effective value of θ_i increases sharply with income to a maximum at a relatively low income level,[13] then remains constant over a wide range and finally drops to zero when the adjusted available income level is too high for the family to be eligible for any financial assistance. More specifically, the effective value of θ_i is greater than zero only if the implied expected parental contribution is less than the annual cost of education. When the implied expected parental contribution exceeds the cost of education, the means-tested financial aid is zero and the value of θ_i is effectively zero.

The prospective cost of education depends on the educational institution at which the student enrolls. Although the family may have some knowledge about the institution or type of institution that its children will attend, the process of college admission means that there is some uncertainty for the family. As a practical matter, the present analysis assumes a common expected educational cost for all families and makes estimates conditional on three different levels of expected costs corresponding to average costs at three different types of institutions.[14] In general, the minimum of the sum of squared residuals for different asset accumulation equations corresponded to the assumption of the average costs at all private institutions.[15]

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children are not given in our data, we assume that the children are born at two year intervals.

[13]Recall that the maximum value of the annual capital levy rate (t_i) was reached at an adjusted available 1985 income of $14,000.

[14]In the 1986-87 academic year (for which scholarships are based on 1985 incomes), the total cost of tuition and other expenses averaged $12,278 at private universities, $9,276 at all private schools, and $4469 at public schools. See Higher Education Research Institute (1989).

[15]Under appropriate assumptions this is equivalent to a maximum likelihood estimate of the uniform expected educational costs.

It is clear from the method of calculating θ_i that although it is related to family income and the number of children in the family, the complex nonlinear rules that determine θ_i imply that there is likely to be very little multicollinearity among θ_i, Y_i, and N_i. Indeed, a regression of θ_i on Y_i and N_i has an R^2 value of only 0.116 for the cost value corresponding to the average cost at all private institutions.

There is a potential problem in using ordinary least squares to estimate equations like equation 10 because the tax variable depends in part on the level of assets. More specifically, the annual capital levy tax rate (t_i) is a function of the adjusted available income which includes 12 percent of an adjusted measure of wealth and net financial assets are part of that wealth. An increase in such assets therefore raises the adjusted available income and this can change the value of t_i and thus of θ_i. Although the influence of changes in A_i on θ_i is relatively weak (because most of the variation in adjusted available income reflects variation in labor income and because the link between t_i and θ_i also reflects the number of children in the family), ordinary least squares estimates of equation 10 are subject to a type of simultaneous equations bias. An increase in the taste for asset accumulation (i.e., an increase in ϵ_i in equation 10) will, other things equal, raise θ_i (unless it raises adjusted available income so much that makes the family ineligible for financial assistance and thus reduces θ_i to zero), thus introducing a correlation between θ_i and the behavioral disturbance (ϵ_i).

The potential problem can in principle be avoided by using an instrumental variable estimation procedure. A good instrument for θ_i must be closely related to θ_i but uncorrelated with ϵ_i, the unobserved taste factor that causes differences in asset accumulation. Such an instrumental variable estimator is easily constructed. The starting point is a regression equation

predicting the value of total family wealth as a quadratic function of income only. This predicted value of wealth for each family is then substituted for the actual value of family wealth in the calculation of adjusted available income (AAI) and the resulting value of AAI is used to calculate values of the annual capital tax levy rate (t_i^*) and the implied tax variable θ_i^* using the College Scholarship Service rules. Since the resulting value θ_i^* reflects all of the information about income and the number of children and a rough estimate of the level of wealth but is not influenced by the taste for accumulation, it is a good instrument for the tax variable. Since θ_i does not enter equation 10 by itself but only in combination with the income variable as $\theta_i Y_i$, a composite instrumental variable $\theta_i^* Y_i$ is used as the instrumental variable. Of course, the reduction in large sample bias achieved by using an instrumental variable procedure is obtained at the cost of an increased error variance of the estimate. Ordinary least squares estimates as well as instrumental variable estimates are therefore presented in the next section and the implications for minimum mean squared error estimates are discussed.

4. *Estimated Effects of the Educational Capital Levy*

Equation 11 presents the basic ordinary least squares estimates of the asset accumulation equation:

$$A_i = -8785 + (\underset{(1.16)}{-2.12} - \underset{(0.48)}{1.71}\theta_i + \underset{(0.026)}{0.077}\mathrm{AGE}_i + \underset{(0.104)}{0.041}N_i)Y_i \qquad (11)$$

$R^2 = 0.30$
Adj. $R^2 = 0.28$
$N = 161$

The accumulated assets are an increasing function of income and age and are depressed significantly and substantially by the educational capital levy.

Before examining the coefficient values in detail, consider the effect of omitting the statistically insignificant variable relating to the number of children in the family:

$$A_i = -9190 + \underset{(1.14)}{(-2.03} - \underset{(0.38)}{1.59\theta_i} + \underset{(0.026)}{0.076\text{AGE}_i)\,Y_i} \qquad (12)$$

$R^2 = 0.30$
Adj. $R^2 = 0.29$
$N = 161$

There is little change in the other coefficients and the standard errors are somewhat smaller. If the number of children is added as a separate variable, its coefficient is small (accumulation of $1090 per child) and less than one-third of its standard error.

A re-estimate of equation 12 using the instrumental variable method described above is shown as equation 13:

$$A_i = -9934 + \underset{(1.14)}{(-2.04} - \underset{(0.60)}{1.41\theta_i} + \underset{(0.026)}{0.076\text{AGE}_i)\,Y_i} \qquad (13)$$

IV Estimate
$R^2 = 0.30$
Adj. $R^2 = 0.28$
$N = 161$

The coefficients are quite similar to those of the OLS estimates in equation 12.[16] The tax coefficient is somewhat smaller (-1.41 instead of -1.59) and its standard error is larger (although still small enough that its t-statistic is 2.3).

Before examining the effect of the capital levy, consider the effects of age and income. An additional year of age increases predicted assets by 0.076 Y_i; thus with family income of $40,000 (approximately the mean in the sample), an additional year of age would increase predicted assets by $3,040. Similarly, evaluating the effect of additional income at representative values of the other variables (a 45 year old head of household with two children and an educational tax variable of $\theta = 0.425$) implies that an additional dollar of family income would be expected to increase net financial assets by 78 cents.

To evaluate the magnitude of the effect of changes in the education capital levy, consider a family with income of $40,000, a head age 45 and two children who differ in age by two years. At that income level, the family would face the maximum annual capital levy of t_i= 0.0846. With two children, they also face six successive years of capital levies, implying that $\theta_i = 1 - (1-t_i)^6 = 0.41$. Equation 13 predicts accumulated assets of $22,142 for such a family. The implied effect of the educational capital levy is very large, depressing asset accumulation by $\theta_i Y_i$ = $23,124. Taken at face value, the equation implies that the family would have accumulated $45,266 if there were no capital levy but that the prospect that 41 percent of any accumulated capital would be lost in reduced scholarship aid causes the family to reduce its savings by $23,124.

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[16]If the specification of equation 11 is reestimated by the instrumental variable, the coefficient of number of children remains small and substantially less than its standard error.

If increasing the family income from $40,000 to $60,000 makes the family ineligible for financial assistance while only one child was in college (since the expected parental contribution exceeds the cost of education in even the most expensive type of school) but leaves the family eligible when both children are in college (since the expected parental contribution would then be divided equally between the two children and could therefore be less than the cost of education), the annual capital levy is applied in only two years. This implies that the value of θ_i is reduced from 0.41 to 0.16. Equation 13 implies that with $60,000 of income and θ = 0.16, the expected accumulated assets would be $59,330. Of the $37,188 increase in accumulated assets (from $22,142 with income of $40,000), more than half is due to the decline in the tax levy rate from 41 percent to 16 percent; (0.41-0.16) x $60,000 x 1.41 = $21,150 or 56.9 percent of the increased asset accumulation.

If an additional $20,000 of income made the family completely ineligible for financial assistance, the expected value of accumulated assets would become $100,466. Of the $41,136 increase, nearly half is due to eliminating the 16 percent educational capital levy; 0.16 x 80,000 x 1.41 = $18,048 or 44 percent of the increased asset accumulation.

This predicted pattern in which the amount of accumulated assets rises sharply with income is of course consistent with common observation. Moreover, adding a quadratic term in income to equation 13 does not alter the basic results of equation 13 and the quadratic term itself is not significantly different from zero:

$$A_i = \underset{}{-22840} + \underset{(1.30)}{(-1.33} - \underset{(0.69)}{1.67\theta_i} + \underset{(0.026)}{0.077\mathrm{AGE}_i)Y_i} - \underset{(0.0062)}{0.0071\,10^{-3}Y_i^2} \quad (14)$$

$R^2 = 0.xx$
Adj. $R^2 = 0.xx$
$N = 161$

This suggests that the observed increase in the ratio of assets to income among families with incomes less than $100,000 is not the result of rising income per se but reflects the effects of the educational capital levy (as well as such things as the role of social security wealth).[17]

These estimates have been based on the value of θ that was calculated on the assumption that each student's educational costs will be the average cost in all private colleges and universities. Of the alternative assumptions that I tried, this was the one with the greatest ability to explain the observed asset accumulation. Substituting the assumption of lower educational costs corresponding to the average cost at public institutions reduces substantially the income level at which the tax variable becomes zero (because the expected parental contribution exceeds the cost of education at a lower family income). The explanatory power of the equation declines substantially; the adjusted R^2 value drops from 0.28 to 0.23. The coefficient of the tax variable becomes -1.26 (s.e. = 0.53) and thus not very different from the estimate of equation 13.

Substituting the alternative education cost assumption (the higher costs corresponding to private major universities) increases the income level at which the tax variable becomes zero. Here again the adjusted R^2 value drops from 0.28 to 0.23. Although the coefficient of the tax

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[17]Social security benefits rise with previous earnings up to a limit but the increase is much less than proportional. Above that limit, there is no increase in social security benefits. The resulting social security "wealth" can therefore replace a much larger proportion of ordinary wealth accumulation among lower income households than among those with incomes above the maximum level. This implies that ordinary wealth should rise more than proportionally with income. Social security wealth was not included in the current analysis because of the difficulty of developing reliable measures of this variable for the Survey of Consumer Finances data.

variable declines to -0.94 (s.e. = 0.40) it would apply to a greater range of incomes and therefore might have as large an aggregate effect as the higher coefficient of equation 13 applied to a narrower range of incomes. However, since the equations explanatory power is much lower than the standard estimate of equation 13, this will not be explored further.

5. *Aggregate Saving Effects of the Education Capital Levy*

An indication of the aggregate importance of scholarship rules as an influence on saving can be calculated with the help of equation 13 and the estimation sample. Since the sampling weights are known for each observation in the Survey of Consumer Finances, the aggregate change in saving can be calculated for the households that correspond to the estimation sample.

Of course, since the education tax depresses saving in families that are not represented in the sample, this calculation provides an underestimate of the reduction in aggregate saving. For example, although the sample is limited to households in which the older parent is between the ages of 40 and 50 so that the effect of age on asset accumulation can be approximated linearly, the scholarship rules also affect asset accumulation among both younger and older households. Similarly, the sample is restricted by excluding households in which a child is already in college although that too is a group in which scholarship rules will depress asset accumulation.

The restricted sample represents 5.5 million households with total financial assets of $131 billion, an average of $23,785 per household. Equation 13 implies that the scholarship rules depress each household's accumulation by 1.41 times the product of the household's tax rate and its income. Aggregating this over all of the households in the sample using the sampling weight

for each household gives a total reduction in accumulated assets of $66 billion or $11,985 per household. This represents fifty percent of their existing stock of financial assets.

6. *Conclusion*

This paper has examined the effect of existing college scholarship rules on the incentive to save. The analysis shows that families that are eligible for college scholarships face "education tax rates" on capital income of between 22 percent and 47 percent in addition to regular state and federal income taxes. The scholarship rules also impose an annual tax on previously accumulated assets. Through the combination of the implied tax on capital income and the associated tax on previously accumulated assets, the scholarship rules that apply to a middle-income family reduce the value of an extra dollar of accumulated assets by 30 cents in four years. A similar family with two children who attend college in succession will see an initial dollar of assets reduced to 50 cents.

Such capital levies of 30 to 50 percent are a strong incentive not to save for college expenses but to rely instead on financial assistance and even on regular market borrowing. Moreover, since any funds saved for retirement are also subject to these education capital levies, the scholarship rules discourage retirement saving as well as saving for education.

The empirical analysis developed here, based on the 1986 Survey of Consumer Finances, implies that these incentives do have a powerful effect on the actual accumulation of financial assets. More specifically, the estimated parameter values imply that the scholarship rules induce a typical household with a head aged 45 years old, with two precollege children, and with income of $40,000 a year to reduce accumulated financial assets by $23,124, approximately 50

percent of what would have been accumulated without the adverse effect of the scholarship rules.

These powerful adverse effects on saving suggest that the design of the scholarship rules did not take into account the potential effect on the national saving rate. It seems likely on the basis of the literature on college financial aid that the scholarship rules were designed on the assumption that observed income and assets are a good measure of the family's ability to pay educational expenses and that distorting effects on behavior were ignored. To the extent that the rules depress asset accumulation (as well as earned income and realized capital gains during the years when the student is in college), the basis for the scholarship calculations are poor measures of the family's ability to pay.

Lessons from the theory of optimal taxation might provide the basis for improving the design of college scholarship rules to reduce the adverse economic effects and improve the measure of the ability to pay. Further research on the effects of the existing rules on family labor income and realized capital gains would provide useful information for this analysis.

Cambridge, MA
February 1992

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