

The Impact of College Financial Aid Rules on Household Portfolio Choice^{*}

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Abstract

Households who save in anticipation of their child's college expenses reduce their child's eligibility for financial aid. The penalty of reduced financial aid eligibility acts as an implicit tax on household assets. At the same time, the federal algorithm used to compute the financial aid does not take into consideration the assets accumulated in retirement accounts or as home equity. Households can diminish their marginal financial aid tax rates by moving funds into retirement accounts or by increasing their home equity. Using the 2001 Survey of Consumer Finances, this study investigates the effect of the college financial aid rules on household portfolio choices. Our results show that households who have higher marginal financial aid tax rates have higher retirement assets and home equity compared to their taxable financial assets. However, the marginal financial aid tax rate does not have a significant adverse effect on the amount of taxable financial assets.

Keywords: College financial aid rules, portfolio choice

JEL Classifications: D12, H31

^{*} We thank the seminar participants at Purdue University and the University of Missouri-Columbia, the 2007 National Tax Association Annual Conference on Taxation, the 2007 Southern Economic Association, and the 2008 American Agricultural Economics Association (AAEA) and American Council on Consumer Interests (ACCI) Joint Meetings, as well as Peter Brady, Mark Long, two anonymous referees, and George Zodrow. This research was awarded the CFP Board ACCI Financial Planning Best Paper Award. We graciously thank the CFP Board for their recognition and support of this research. This research was also awarded the Academy of Financial Services (AFS) Best Paper Award. We graciously thank the AFS for their recognition and support of this research. The usual disclaimer holds.

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Households who save in anticipation of their child's college expenses reduce their child's eligibility for financial aid. The penalty of reduced financial aid eligibility acts as an implicit tax on household assets. At the same time, the federal algorithm used to compute the financial aid does not take into consideration the assets accumulated in retirement accounts or as home equity. Households can diminish their marginal financial aid tax rates by moving funds into retirement accounts or by increasing their home equity. Using the 2001 Survey of Consumer Finances, this study investigates the effect of the college financial aid rules on household portfolio choices. Our results show that households who have higher marginal financial aid tax rates have higher retirement assets and home equity compared to their taxable financial assets. However, the marginal financial aid tax rate does not have a significant adverse effect on the amount of taxable financial assets.

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1. Introduction

A high proportion of students enrolled in post-secondary degree-granting institutions receive financial aid from the federal government. The U.S. Department of Education reports that over 4.2 billion dollars were spent on need-based financial aid in the 2003-04 academic year, and need-based financial aid represented about 75 percent of all support dollars spent on post-secondary education (Digest of Educational Statistics, 2005). A high proportion of U.S. students rely on financial aid. Almost 34 percent of full-time undergraduate students and over 23 percent of part-time undergraduate students received non-returnable grants from the federal government in the 2003-04 academic year. Among the beneficiaries of the financial aid system, full-time undergraduate students received on average more than \$7,300 in federal financial support, \$3,247 of which was in the form of non-returnable grants (Digest of Educational Statistics, 2005). Even among full-time students from households with yearly incomes over \$100,000, average financial support from the government amounted to \$7,263, and \$1,659 of this sum were non-returnable grants.

The irony of the need-based college financial aid system is that it imposes an implicit tax on household assets and income, and thus penalizes households who save in advance for their child's college expenses. Consequently, the federal algorithm used to compute financial aid eligibility generates incentives for households to reduce their savings in order to increase the amount of financial federal aid that their children receive through federal grants or loans. At the same time, the federal algorithm does not take into consideration the assets accumulated in retirement accounts or as home equity, which makes these assets exempt from implicit financial aid taxation. Intensifying contributions to retirement accounts or reducing mortgage debt is among the frequent advice from Internet resources on how to fund a college education. For

example, “maximize contributions to your retirement fund” or “prepay your mortgage” are two of the tips offered by FinAid website (Maximizing Your Aid Eligibility, n.d.). CNNMoney.com also recommends that parents should “maximize retirement savings” and “watch their debt load” in order to maximize the student’s financial aid eligibility (Seid, 2005).

While previous literature investigates the effect of means-tested college financial aid on household asset accumulation (Dick & Edlin, 1997; Edlin, 1993; Feldstein, 1995; Long, 2003; Ma, 2005; Monks, 2004 and Reyes, 2007), little attention has been given to the portfolio choices of households that expect to have a child attending college in the near future. Households may mitigate the nuisance of implicit financial aid taxation by moving savings into retirement accounts or increasing home equity. Using data from the 2001 Survey of Consumer Finances, the purpose of this study is to investigate the effect of financial aid rules on household portfolio choices. Since investing in retirement accounts and having mortgage debt have federal income tax benefits, our empirical analysis also controls for marginal income tax rates. This approach enables us to disentangle the relationships between households’ portfolio choices, implicit financial aid tax, and income tax.

Our findings verify concerns that the methodology for computing financial aid eligibility distorts households’ composition of assets. We find that retirement assets and home equity compared to financial assets increase significantly with the marginal financial aid tax rate. At the same time, our findings show that the amounts of taxable financial assets or total assets are not significantly influenced by the marginal financial aid tax rate. We conclude that financial aid computation rules provide households with incentives to adjust their asset portfolios and, therefore, deserve more attention from policymakers. In order for the distribution of need-based financial aid to satisfy horizontal equity among households that have the same amount of wealth,

the assessment of needs should not be affected by households' abilities to deliberately or inadvertently conceal their taxable assets.

The remainder of the paper is structured as follows. Section 2 reviews the previous literature on the impact of the implicit financial aid tax on household assets. Section 3 provides a detailed explanation of marginal financial aid tax rate computations and summary statistics of the data. Section 4 presents estimates of the impact of financial aid rules on portfolio decisions and household savings. Finally, section 5 presents conclusions of our findings.

2. The impact of college financial aid rules on household portfolio decisions and savings

The federal methodology is the main methodology for assessing eligibility for need-based financial aid from the government. The financial need for each college student is assessed by the difference between the cost of college attendance and the Expected Family Contribution (EFC). EFC is the amount that the student and her family are expected to contribute towards educational expenses during each year of college. The U.S. Department of Education calculates a student's EFC using federal methodology based on the information the student provides on the Free Application for Federal Student Aid (FAFSA). The larger the EFC, the lower the assessment of student's financial need and the amount of aid that the student is eligible to obtain.

The federal algorithm used to compute financial aid can have adverse effects on household asset accumulation. The marginal financial aid tax rate on assets is the expected change in the amount of financial aid received by the student that results from a one dollar increase in parents' current assets. Early studies estimate a large effect of the implicit financial aid tax on household savings (Edlin, 1993; Dick & Edlin, 1997; Feldstein, 1995). Edlin (1993) is

the first to illustrate that although the maximum financial aid tax on parental assets is only 5.64 percent in any given year, families with only one child in college at a time for consecutive 8 years may face over 57 percent of cumulative tax on assets. In a follow up study, Dick and Edlin (1997) show that a typical family with a child at an average priced college may lose over \$2,000 in financial aid as a result of increasing their assets by \$10,000. Feldstein (1995) provides additional evidence that the implicit financial aid taxes on assets have a significant adverse effect on the accumulation of financial wealth. Using data from the 1986 SCF, Feldstein (1995) concludes that the assets of an average family can be taxed at a rate approaching 50 percent over the entire period of only one child's college education.

Long (2003) and Monks (2004) question the magnitude of the effect of the marginal financial aid tax rate on parental assets estimated by the previous literature. Long (2003) shows that the effect of financial aid tax on parents' assets is sensitive to underlying assumptions used in the computation of the financial aid tax. The magnitude of the effect of the financial aid tax on parents' assets varied substantially across models with distinct sets of assumptions regarding the probability of college attendance, college costs, future family income, contribution from students, and eligibility to simplified needs evaluation. Monks (2004) replicates the empirical analysis in Edlin (1993) and Feldstein (1995), using more recent data collected by the 1997 National Longitudinal Survey of Youth. Monks (2004) focuses on the homogenous sample of families with pre-college aged children and shows that the magnitude of the effect of the implicit financial aid tax on asset accumulation is significantly smaller than the findings of the previous two studies.

The effect of the implicit financial aid tax on assets may be more complex than just a simple decrease in total savings. Retirement assets and home equity are exempt from the

calculations of financial aid and thus non-taxable under the federal methodology. The federal methodology represents strong incentives for families to adjust their portfolios in order to make their children eligible to receive financial support or to increase the value of financial aid packages.

Previous literature provides evidence that taxes affect the portfolio choices of households. Differences in tax rates on different assets alter after-tax returns on investments. Theoretical studies of the relationship between taxation and portfolio choices usually result in an intuitive conclusion that optimal portfolio decisions imply holding relatively highly-taxed assets in tax-protected accounts or shifting highly-taxed assets to tax-privileged assets (Auerbach & King, 1983; Tepper, 1981; Shoven & Sialm, 2002; Dammon, Spatt, & Zhang, 2004). Taxes affect not only the amounts invested in different assets but also the decisions about what assets to hold (Leape, 1987).

The complexity of the impact of taxation on household portfolios generates a substantial amount of empirical research. For example, using the U.S. President's Commission on Pension Policy data, Hubbard (1985) estimates the significant impact that income tax rates and mandatory participation in the social security pension system have on households' non-pension wealth. Using data from the Survey of Consumer Finances, Poterba and Samwick (2003) investigate whether families that face higher income tax rates invest more in tax-deferred accounts and conclude that households' income tax rates display a substantial correlation both with ownership of assets and with the share of the household's portfolio that is allocated to various asset categories. Scholz (1994) and Maki (2001) use the exogenous incentives introduced by the Tax Reform Act of 1986 to document that some families restructure household debt into tax-favored mortgages in response to tax policy. A tradeoff between mortgage prepayments and

tax-deferred retirement savings is discussed by Amromin, Huang and Sialm (2007), where they show that, under rational assumptions, reducing mortgage payments and increasing contributions to tax-deferred retirement account become a tax arbitrage, although their empirical investigation fails to document that a significant percentage of households takes advantage of this tax arbitrage.

3. Data summary

The empirical analysis uses data from the 2001 Survey of Consumer Finances (SCF). The SCF is a comprehensive triennial survey of U.S. household finances conducted by the Federal Reserve Board. It contains detailed information on household assets, liabilities, income, and demographic characteristics. The 2001 SCF is the most recent cross section of the survey that identifies the age of the children living in the household. The SCF uses multiple techniques of imputation to compensate for the missing data, which results in five replicates of data for all households. In this study, we use all five replicates and report the aggregated coefficient estimates and standard errors using the procedures described in Montalto and Sung (1996). The description of variables used in the empirical analysis is provided in Appendix A.

3. 1. Estimation of the marginal financial aid tax rate

The implicit financial aid tax on assets results from the reduction of the federal financial aid for households that have higher holdings of taxable assets. The Marginal Financial Aid Tax Rate ($MTR_{\text{financial aid}}$) is a hypothetical measure of the overall tax imposed on additional dollars of parents' assets. It accumulates the effect of annual tax rates that households expect to face for

each year of their children's college attendance. $MTR_{\text{financial aid}}$ depends on family's future income when each child is attending college, the number of children enrolled in college each year, the amount of financial aid displaced given a marginal increase in EFC, and the cost of college the children are enrolled.

To gather the effect of tax rates from all years when children attend college, we compute the marginal financial aid tax rate ($MTR_{\text{financial aid}}$) according to the following formula:

$$MTR_{\text{financial aid}} = 1 - (1 - MTR_{2001}) * (1 - MTR_{2002}) * (1 - MTR_{2003}) * \dots * (1 - MTR_{2021}), \quad (1)$$

where MTR_i represents the annual evaluation of the implicit college financial aid tax rate in year i . If the family does not expect to have a child in college in any particular year, their evaluation of the tax rate in this particular year will be zero and the multiplicative term $(1 - MTR_i)$ will be 1, and thus will not alter the overall $MTR_{\text{financial aid}}$. For example, a family with two children in 2001, 16 and 10 years old, both of whom will attend college, will have their overall tax evaluated by $MTR_{\text{financial aid}} = 1 - (1 - MTR_{2003}) * (1 - MTR_{2004}) * (1 - MTR_{2005}) * (1 - MTR_{2006}) * (1 - MTR_{2009}) * (1 - MTR_{2010}) * (1 - MTR_{2011}) * (1 - MTR_{2012})$.

Under the federal methodology, 12 percent of parents' discretionary net worth constitutes a contribution from assets. Parents' discretionary net worth is defined as the net worth minus the sum of educational savings and asset protection allowance. Assets in retirement accounts and home equity are not included in parents' net worth. Besides contributions from parents' assets, the federal methodology calculates contributions from income. Contributions from parents' income are computed using total income minus tax liabilities, allowance for social security taxes,

income protection allowance, and employment expense allowance.¹ Contributions from parents' assets and income add up to Adjusted Available Income (AAI), which is then used to compute EFC. The percentage of AAI that is included in EFC increases with the amount of AAI. See Appendix B for an overview of the federal methodology applied to compute EFC.

Families in the lowest bracket of AAI may end up with zero EFC, which means that they do not face any financial aid tax. Families in the upper bracket of AAI are expected to contribute \$0.47 of each additional dollar of discretionary net worth. Since exactly 12 percent of discretionary net worth is included in AAI, the maximum marginal tax rate that a household can face in any given year of their child's college attendance is 0.12 times 0.47, which results in the financial aid tax rate of 5.64 percent.² This implicit tax is reapplied every year while the student is enrolled in college. Thus, the cumulative multiple-year effect of the tax can be much larger than the maximum 5.64 percent annual rate.

We do not observe the children's actual college attendance in the SCF. Using data from the October Current Population Survey, we predict the probability that each child in our sample who is under the age 21 will attend college when s/he reaches college age.³

¹ Dividends and other capital gains that are included in total income may additionally increase the effect of the implicit financial aid tax on portfolio allocations. Dependent students are required to report, among other things, their parents' Adjusted Gross Income from their federal tax returns. Thus, dividends and other capital gains are included in the calculation of the federal methodology of need assessment. Although this additional income to earnings and salaries is included in our main proxy for the implicit financial aid tax rate, we do not attempt to separately quantify the importance of capital gains on the magnitude of the financial aid tax. For families that have high capital gains, the implicit tax on assets can be higher.

² We are interested in the impact of the marginal financial aid tax rates on parents' assets. Assets held in the student's name reduce the financial need and aid eligibility to a much greater extent than assets held under the parents' name. Up to 5.64 percent of parents' assets and up to 35 percent of the student's assets are included in the calculations of a dependent student's EFC (The EFC Formula Guide, 2000). Following a bulk of the previous literature, we ignore the student's assets due to data unavailability.

³ We model the probability of college attendance as a function of student's gender, father's race and the predicted family income when the student reaches the age of 18. We obtain the coefficient estimates of the equation that we use to predict the probability of college attendance using data from the October Current Population Survey for the

Using the ordinary least squares method to estimate the correlation between $MTR_{\text{financial aid}}$ and the portfolio choice is problematic since the implicit tax variable depends on the level of taxable assets. For instance, a decrease in the taste for asset accumulation decreases $MTR_{\text{financial aid}}$ and thus introduces a correlation between $MTR_{\text{financial aid}}$ and the error term. To prevent this potential endogeneity problem, we first predict parents' net worth based on the characteristics of the household head and spouse. The parameter estimates of the model are listed in Appendix C.⁴ We then use the predicted values of net worth to compute the contribution of assets to the EFCs calculated for each year between 2001 and 2021 when families in our sample expect to have a child in college. This method creates a good instrument for $MTR_{\text{financial aid}}$ and is uncorrelated with the error term. Note that this method is slightly different than the traditional instrumental-variable estimation procedure and has advantages relative to the instrumental-variable estimation since the resulting value of $MTR_{\text{financial aid}}$ reflects all information about future income, the number and the age of children, and the age of the parents to calculate the allowances from assets, college expenses and financial aid. However it is a rough estimate of the level of net worth and is not influenced by the taste for asset accumulation.

To compute the contributions to EFC from family income, we estimate the future path of income and wages. We use the same fitted age-income curve that we utilized in the estimation of

years 1996-2001. This method produces probabilities of college attendance ranging from 1.4 to 76.7 percent when the children in our sample are 18 years old. If the estimated probability of attendance exceeds 50 percent, we assume that the child attends college for the next consecutive 4 years. We predict the family income used as a covariate in the prediction of college attendance as follows. We fit a simple age-income curve to the data drawn from the 2001 SCF: $\log(Y_i) = \alpha + \beta_1 t + \beta_2 t^2 + \beta_3 t^3$, where Y_i = the household income in 2001, t = age of the father minus 15 if the father is not a high school graduate, 22 if the father is a college graduate, and 18 otherwise. Details of both the probability of college attendance and future income computations are available from the authors upon request.

⁴ The model fit statistic R^2 is equal to 0.569 and the median value of predicted net worth is \$52,136. We predict net worth as the exponent of the fitted value of the semi-logarithmic model. However, the exponent of the fitted value of the semi-logarithmic models tends to underestimate the dependent variables (Wooldridge, 2003, p.207). We check the robustness of our estimates by computing the predicted value of the net worth using the consistent estimator of the fitted value described in Wooldridge (2003, p.207). Our results are robust to use of this estimator of net worth in the calculation of EFC.

the probability of college attendance. The prediction of family income for each year between 2001 and 2021 when families in our sample expect to have a child in college is explained in footnote 3.

Although the need for financial assistance under the federal methodology is defined as the difference between the cost of college and the EFC, in reality the full amount of financial aid is rarely funded. This ‘gapping’ between the assessed and the actually financed need results from scarcity of aid funds, which are distributed on the first come - first serve basis or by averaging the amount of assistance among the beneficiaries.

We do not possess information on the actual amounts or the form of financial aid received by the households in our sample. We utilize the coefficient estimates of equation (3) in Long (2003, p.73) to estimate the amount of financial aid that each family in our sample receives when their child attends college.⁵ The parameters are estimated for the dependent students in the restricted-use version of the 1992–1993 National Postsecondary Student Aid Study (NPSAS). We predict the value of financial aid as a function of EFC, college cost, squared EFC, squared college cost and a number of interaction terms between the independent variables. We first predict the cost of college for each child using data from the 1999-2000 NPSAS.⁶ We next obtain MTR_i – the annual evaluation of the financial aid tax – by subtracting the value of financial aid computed using EFC when taxable assets are incremented by \$1 from the predicted value of financial aid without the increment in taxable assets. The average value of financial aid

⁵ We thank Mark Long for providing us the coefficient estimates and details of the equation.

⁶ We model the cost of college attendance as a function of student’s age, student’s gender, father’s race, father’s education, mother’s education, the size of the household, and family income. To account for the trend in college cost, we increment the predicted college cost by 5 percent every year, which corresponds to the average annual increase in college expenses in 1990s. The average predicted cost of college per household who has at least one child in college in 2001 amounts to \$15,906, with the median value equal to \$15,055. Details of the computations are available from the authors upon request.

for families in our sample who have a child in college in 2001 amounts to \$6,236 per household, while the median value amounts to \$5,314. It should also be noted that families might assign different values to the form of financial assistance that they receive. Non-returnable grants are clearly valued more than loans. Our approach takes into account the unmet need and varying valuation of types of financial aid received since the composite dependent variable is a sum of 100 percent of aid received in the form of grants and 50 percent of aid received in the form of loans.

In the final step we calculate $MTR_{\text{financial aid}}$ by compounding MTR_i for years when families expect to have a child in college.

Besides being exempt from the calculations of EFC, investing in retirement assets and holding a home mortgage have federal income tax advantages. The amounts contributed to retirement accounts are typically not subject to income tax until withdrawn from the account. Also, interest payments on mortgage loans are deductible on the federal tax return for households that itemize tax deductions. Therefore, federal income tax calculations may provide households with similar incentives as the implicit financial aid tax to restructure their assets. In order to rule out the possibility that $MTR_{\text{financial aid}}$ proxies for the effect of marginal income tax on household portfolio choices, we include the Marginal Income Tax Rates (MTR_{income}) in our empirical analysis.⁷

⁷ Household tax liabilities are not reported in the 2001 SCF. We calculate MTR_{income} using the detailed information on household income and demographic characteristics. We calculate the income tax rates using only income from wages and salaries and ignore all investment and interest income from other sources such as dividends, capital gains, tax-exempt interest earnings, etc. to prevent the bias resulting from the fact that MTR_{income} may itself be affected by portfolio choices. We subtract allowances for dependents from the adjusted gross income and assume that all households take advantage of standard deductions. In 2001, only 34.2 percent of tax return files were accompanied by Schedule A to itemize tax deductions (SOI Tax Stats, n.d.). Almost 28.3 percent of the total number of tax filers in 2001 itemized interest payments, which include interest payments on home mortgage loans.

3. 2. Summary statistics

The 2001 SCF includes 4,442 households. Several sample restrictions are imposed on the data. Specifically, 1,362 single-headed households, 1,514 households with no children younger than 25 or households with only independent children (living elsewhere), and finally 74 households with a retired spouse or partner are excluded from the sample. These exclusions are made because the marginal financial aid tax rate should not affect the saving behavior of households without (dependent) children, and households that include retired individuals may already have started liquidating their retirement assets. Additionally, 151 households that reported negative income, negative home equity, and/or households with total financial assets below \$100 are excluded. The working sample comprises 1,341 households.⁸

In the subsequent analysis of the effect of $MTR_{\text{financial aid}}$ on households' composition of assets, we estimate models that include retirement assets and home equity as dependent variables. We also investigate the effect of $MTR_{\text{financial aid}}$ on mortgage payments. Retirement assets include IRAs, Keogh, and any other retirement accounts from the current employer such as thrifts, savings, 401K, 403B, Supplemental Retirement Annuities, etc. Home equity is defined as the market value of a primary residence minus the outstanding mortgage debt. We are also interested in the effect of $MTR_{\text{financial aid}}$ on retirement assets or home equity relative to taxable financial assets or total financial assets. Taxable financial assets include cash, checking, saving, money market or call accounts, certificates of deposit, stocks, bonds, mutual funds, annuities, and the cash value of life insurance. Retirement assets are not included in taxable financial assets. Total financial assets include both taxable financial assets and retirement assets.

⁸ The sample size and the number of households excluded from the sample are reported for the first replicate of the data. However, the sample sizes of the remaining four replicates are almost the same as the first replicate.

Summary statistics of variables used in this study are presented in Table 1. The 2001 SCF identifies households that expect major financial expenditures for children's education within the next 5-10 years and households that save for these expenses. Households that expect expenditures for children's education constitute about half of our sample. Out of 690 households that expect expenditures for children's education, 169 report that they do not save and 521 report that they save for these expenditures. There are significant differences in financial measures across these groups. For example, households that expect expenditures for children's education but do not save for them have lower values of income, retirement assets, home equity, and total assets than households that save for these expenditures. Interestingly, however, the financial characteristics do not differentiate between those who do not expect educational expenditures and those who do not save for these expenditures.

Figure 1 presents the distribution of $MTR_{\text{financial aid}}$ by household income in 2001. The plotted area shows the distribution of $MTR_{\text{financial aid}}$ for households with incomes less than \$300,000. Households in our sample with incomes higher than \$300,000 always face zero $MTR_{\text{financial aid}}$ because EFC in any given year of their child's college attendance exceeds college costs. In our sample, 32 percent of households have non-zero $MTR_{\text{financial aid}}$. Our calculation of $MTR_{\text{financial aid}}$ ranges from 0 to 0.2475, with a mean value of 0.0628 for households that have non-zero $MTR_{\text{financial aid}}$. The greatest concentration of non-zero values is among households with incomes between \$20,000 and \$80,000.

Additional information on the distribution of $MTR_{\text{financial aid}}$ by household income and taxable financial assets is provided in Table 2. At the lower levels of household income and taxable financial assets, $MTR_{\text{financial aid}}$ is an increasing function of both income and assets. However, when the increased contributions from income or assets raise EFC over the cost of

college, $MTR_{\text{financial aid}}$ becomes zero for a large number of households. This results in a regressive trend in the average $MTR_{\text{financial aid}}$ for households in the upper tails of the income and taxable financial assets distribution.⁹ For example, among the income group between \$25,001 and \$50,000, $MTR_{\text{financial aid}}$ equals 2.88 percent for households with taxable financial assets lower than \$10,000, then $MTR_{\text{financial aid}}$ increases steadily, reaching the average of 4.69 percent for households with taxable assets between \$20,001 and \$40,000, and falls to 2.38 percent for households with taxable financial assets more than \$160,000.

4. Results

4.1. Retirement assets

Table 3 reports the parameter estimates of the Tobit regressions for retirement assets. In the first model (Model I), we use the ratio of retirement assets to taxable financial assets as the dependent variable. The coefficient of $MTR_{\text{financial aid}}$ is positive and significant. At the sample means, a one-percentage point increase in $MTR_{\text{financial aid}}$ results in a 0.134 increase in retirement assets relative to taxable financial assets.¹⁰ It implies that a household that has \$20,000 in taxable financial assets and faces $MTR_{\text{financial aid}}$ equal to (say) 4 percent holds roughly \$2,767

⁹ Of course, calling $MTR_{\text{financial aid}}$ regressive is not totally accurate since households in the upper tails of the income and asset distribution do not usually receive financial aid.

¹⁰ To interpret the coefficient estimates of Tobit, we multiply the estimates by the adjustment factor given by $\Phi(x_i \hat{\beta} / \hat{\sigma})$, where $x_i \hat{\beta} / \hat{\sigma} = (\hat{\beta}_0 + \hat{\beta}_1 x_1 + \dots + \hat{\beta}_k x_k) / \hat{\sigma}$, $\hat{\sigma}$ is the estimated standard deviation of the error term and $\Phi(\cdot)$ denotes the standard normal cumulative distribution function. When we evaluate the adjustment factor at the sample means for the first model in Table 3, $\Phi(x_i \hat{\beta} / \hat{\sigma})$ is equal to 0.49. The estimated coefficient of $MTR_{\text{financial aid}}$ is 27.38, and multiplication of the estimate with the adjustment factor evaluated at the sample means is 13.42.

more in retirement assets than the identical household that faces $MTR_{\text{financial aid}}$ equal to 3 percent.¹¹

In the next model in Table 3 (Model II), we estimate an analogous equation with the log of retirement assets as the dependent variable. This specification supports the significant effect of $MTR_{\text{financial aid}}$ on retirement assets. On average, each additional percentage point increase in $MTR_{\text{financial aid}}$ increases retirement assets by almost 10 percent, other things being constant.

We next focus our attention on households that do not yet have a child in college but that might be preparing for college years. We limit the sample to households with only dependent children younger than 18 (Model III) and regress the retirement assets relative to taxable financial assets on the same set of independent variables. The coefficient of $MTR_{\text{financial aid}}$ is still significant and the magnitude of the effect is even slightly higher compared to Model I.

Finally, we regress the share of retirement assets in total financial assets using our initial sample and the set of control variables (Model IV). This specification reveals that one percentage point increase in the implicit financial aid tax rate is associated with an average increase of 73 basis points in the share of retirement assets in total financial assets. At the sample means, a household with $MTR_{\text{financial aid}}$ equal to 4 percent would hold about 33.2 percent of financial assets in retirement savings, while the identical household with $MTR_{\text{financial aid}}$ equal to 3 percent would have the share of retirement assets equal to about 32.4 percent of the financial assets.

¹¹ We compute the difference between Tobit fitted values evaluated at $MTR_{\text{financial aid}}=0.03$ and $MTR_{\text{financial aid}}=0.04$, respectively, with values of other explanatory variables fixed at sample means. The fitted value of the variable explained by Tobit model is given by $\hat{y}_i = \Phi(x_i \hat{\beta} / \hat{\sigma}) x_i \hat{\beta} + \hat{\sigma} \phi(x_i \hat{\beta} / \hat{\sigma})$, where $x_i \hat{\beta} / \hat{\sigma} = (\hat{\beta}_0 + \hat{\beta}_1 x_1 + \dots + \hat{\beta}_k x_k) / \hat{\sigma}$, $\hat{\sigma}$ is the estimated standard deviation of the error term, and $\Phi(\cdot)$ and $\phi(\cdot)$ denote standard normal cumulative distribution function and standard normal probability density function, respectively.

Consistent with the previous literature on income tax and portfolio choice (for example, Poterba and Samwick, 2003), MTR_{income} seems to encourage households to increase savings in tax-deferred retirement accounts. Regressing retirement savings on our set of explanatory variables (Model II) shows that a one-percentage point increase in the income tax rate results in retirement savings being higher by almost 12 percent. In reality, the marginal income tax rate has a discrete distribution, so a more realistic interpretation is that an average household in the 28 percent income tax bracket accumulates as much as 2.5 times more retirement savings than an identical household in the 15 percent income tax bracket.

In terms of other household characteristics, the estimated coefficients in Table 3 show that household income has a negative impact on the ratio of retirement assets to taxable financial assets and the ratio of retirement assets to total financial assets for the base sample (Models I and IV) and for the sample limited to households with dependent children younger than age 18 (Model III). However, household income is positively correlated with the amount of retirement savings (Model II). Retirement savings, regardless of being scaled by taxable assets or by total financial assets, are higher when an employer makes a contribution to the husband's (Models I-IV) or to the wife's retirement plan (Models I, II and IV). In addition, households that are headed by Hispanics have lower levels of ratios of retirement assets to taxable financial assets and retirement assets to total financial assets (Models I and IV). Hispanic households also have lower levels of retirement assets (Model II). Retirement assets increase with the age and education of the household head and decrease with the number of children (Model II).

4.2 Home equity

The coefficient estimates for Tobit models that investigate the relationship between home equity and $MTR_{\text{financial aid}}$ are presented in Table 4. $MTR_{\text{financial aid}}$ has a positive and marginally significant effect on the ratio of home equity to taxable financial assets (Model I). One percentage point increase in $MTR_{\text{financial aid}}$ results in 0.395 increase in the ratio of home equity to taxable financial assets at sample means.¹² It implies that a household with \$20,000 in taxable financial assets and $MTR_{\text{financial aid}}$ equal to 4 percent has about \$8,169 more in home equity than an identical household with $MTR_{\text{financial aid}}$ equal to 3 percent.

The magnitude of the impact of $MTR_{\text{financial aid}}$ on the ratio of home equity to taxable financial assets is higher when the sample is limited to include only families that have children younger than 18 (Model III). However, the reduced sample size elevates the standard error of the coefficients and results in the statistical insignificance of $MTR_{\text{financial aid}}$.

When we regress the log of home equity on our set of independent variables, we do not observe any significant effect of $MTR_{\text{financial aid}}$ (Model II). However, we believe that the effect of $MTR_{\text{financial aid}}$ should primarily be driven by the current or relatively recent financial decisions of households. The value of home equity, however, might reflect the fact that families have resided in their homes for a long period, which increases the value of home equity because a large part or even the entire mortgage debt had been paid. Also, using home equity as the dependent variable makes the estimation more vulnerable to macroeconomic conditions that affect the value of home and that we are unable to control. To address these problems and to

¹² The adjustment factor at the sample means for the first model in Table 4, $\Phi(x_i \hat{\beta} / \hat{\sigma})$ is equal to 0.536. The estimated coefficient of $MTR_{\text{financial aid}}$ is 73.73, and multiplication of the estimate with the adjustment factor evaluated at the sample means is 39.5.

account for the current decisions of households, we regress the log of the amount of mortgage payments on our set of independent variables (Model IV). A one-percentage point increase in the $MTR_{\text{financial aid}}$ is accompanied by about a 10.5 percent increase in annual mortgage payments.

In terms of other household demographics, household income is negatively correlated with the ratio of home equity to taxable financial assets (Model I) and the amount of annual mortgage payments (Model IV) but positively correlated with the amount of home equity (Model II). The marginal income tax rate has a sizable positive effect on both the amount of home equity and annual mortgage payments. Annual mortgage payments are higher for households whose heads approve borrowing for higher education. Home equity, the ratio of home equity to taxable financial assets, and annual mortgage payments increase with the age of the household head. Black and Hispanic households have lower home equity compared to households headed by Whites (Model II), and Blacks have lower annual mortgage payments (Model IV). Annual mortgage payments increase with the education of the household head (Model IV).

4.3 Financial assets

Our findings in previous sections show that the ratio of retirement assets to taxable financial assets and the ratio of home equity to taxable financial assets increase with $MTR_{\text{financial aid}}$. Also, amounts of retirement assets and annual mortgage payments are positively correlated with implicit financial aid tax. We next investigate whether taxable financial assets or total assets decrease with $MTR_{\text{financial aid}}$. Total assets include financial assets and nonfinancial assets of the household. The estimation results are reported in Table 5. As the results show,

MTR_{financial aid} does not have a significant effect on the amount of taxable financial assets nor total assets.

An important finding from these estimations is that the expectancy of educational expenditures significantly increases the amount of taxable financial assets only if the household reports saving for these educational expenditures. Taxable financial assets of households that expect to have expenditures, yet do not report saving for this purpose, are on average 29.2 percent below the taxable financial assets of households that do not expect to have a child in college. Households that report saving for educational expenditures have on average 70.7 percent more in taxable financial assets than households that do not save. Consider a household that does not expect educational expenditures and holds taxable financial assets worth \$20,000. According to our estimate, the otherwise identical household that expects educational expenditures but does not report saving would hold taxable financial assets worth \$14,160. Furthermore, if the household with otherwise the same characteristics reports saving for college expenses, the taxable financial assets would be \$34,140.

This lack of the implicit financial aid tax's significant adverse impact on the total amount of taxable financial assets is consistent with recent literature (Long, 2003; Monks, 2004), and disagrees with earlier studies (Dick and Edlin, 1997; Edlin, 1993 and Feldstein, 1995). As argued by Long (2003), exemptions in the federal policies of aid distribution may have eliminated the saving disincentive for many families, but the same exemptions seem to have encouraged families to shift their assets to tax-advantaged assets. Our findings indicate that the impact of MTR_{financial aid} on household savings has evolved from the simple effect of a decrease in total assets to a more complex effect of portfolio adjustment.

5. Conclusions

Several important findings emerge in the analysis of the impact of financial aid rules on the portfolio choices of households. We fail to document any convincing evidence of the relationship between the marginal financial aid tax rates and the overall level of household savings measured as taxable financial assets or total assets. However, we find that the effect of financial aid tax on savings may be more complex than just a simple decrease in total savings. We find that the categories of assets, retirement assets, and home equity, which are exempt from financial aid taxation, are significantly correlated with marginal financial aid tax rates. In addition, annual mortgage payments significantly increase with the marginal financial aid tax rate. The analysis of portfolio choices with respect to retirement assets and home equity indicate that households may escape implicit financial aid taxation by maximizing their contributions to retirement assets and increasing home equity.

Findings of this paper validate concerns that the federal methodology for computing financial aid eligibility is at odds with incentives offered to households to maintain high levels of savings. Dynarski and Scott-Clayton (2006) criticize the present system of distributing federal aid dollars for complexity, lack of horizontal equity, and a tendency to produce high costs. They also argue that computing need-based aid eligibility based on the information from income tax returns is almost as effective as the federal methodology, yet much cheaper to implement and maintain. The findings of our study support the argument that the present system has, at least partly, evaded the intentions of policy makers to fairly distribute need-based student aid, and

that the use of income tax returns would partly reduce the adverse impact of the federal methodology on household portfolio choices.

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Table 1. Descriptive statistics.

Variable	Expect expenses for child's education=0			Expect expenses for child's education=1		Expect expenses for child's education=1	
	N=651	N=690		Save for expected expenses for child's education=0	Save for expected expenses for child's education=1	N=169	N=521
MTR _{financial aid}	0.0170	0.0203		0.0213		0.0199	
Age	40.1	43.0	***	43.2	†††	42.9	
Age in 20s or less	0.1599	0.0378	***	0.0350	†††	0.0391	
Age in 30s	0.3607	0.2615	***	0.2758	††	0.2549	
Age in 40s	0.2901	0.5045	***	0.4642	†††	0.5231	
Age in 50s or more	0.1893	0.1962		0.2250		0.1829	
Black	0.1073	0.0950		0.1012		0.0921	
Hispanic	0.0866	0.0760		0.0661		0.0805	
Number of children	2.8	3.0	**	3.2	††	3.0	c
Homeownership	0.7944	0.8288		0.8245		0.8308	
Annual mortgage payments	8,614	10,801	***	9,765		11,277	
Post-college degree	0.1395	0.1749	*	0.1251		0.1977	b
Completed college	0.2135	0.2473		0.1554	†	0.2896	a
Some college	0.2484	0.2584		0.2839		0.2467	
Completed high school	0.3153	0.2911		0.4003	††	0.2410	a
No high school	0.2229	0.2031		0.1604	†	0.2228	c
Self-employed	0.1478	0.1683		0.1450		0.1790	
Managerial or professional occupation	0.3700	0.4094		0.3001	†	0.4596	a
Approve to borrow for educational expenses	0.8513	0.9027	*	0.8590		0.9228	a
Approve to borrow for living expenses	0.4847	0.4965		0.4590		0.5137	
Long term planning horizon	0.5110	0.5545		0.4525		0.6014	a
Above average risk tolerance	0.3177	0.2974		0.2554		0.3168	
Income	87,204	116,888	***	87,623		130,341	a
MTR _{income}	0.2351	0.2519	***	0.2329		0.2607	a

Employer contributions to husband's plan		0.3373	0.3805		0.3123	0.4118	^b
Employer contribution to wife's plan		0.1801	0.2005		0.1961	0.2025	
Retirement assets	Mean	50,247	88,824	***	48,235	107,484	^a
	Median	8,500	18,000	***	4,900	29,000	^a
Home equity	Mean	88,140	115,571	***	75,490	133,996	^a
	Median	40,000	60,000	***	36,000	77,000	^a
Taxable financial assets	Mean	98,470	165,823		109,109	191,895	
	Median	12,500	20,380	***	8,530	25,350	^a
Total financial assets	Mean	149,981	258,862	*	161,742	303,509	
	Median	33,150	56,000	***	39,090	79,500	^a
Total assets	Mean	457,580	710,625	**	434,802	837,425	^b
	Median	210,400	284,000	***	217,500	335,730	^a

Note: Data are taken from the 2001 Survey of Consumer Finances (SCF). Descriptive statistics are weighted using the sampling weights.

Significance of differences in means (medians):

*** p-value<.01, ** p-value<.05, * p-value<.1 (comparison of Expect expenses for child's education=0 to Expect expenses for child's education=1),

† p-value<.01, †† p-value<.05, ††† p-value<.1 (comparison of Save for expected expenses for child's education=0 to Expect expenses for child's education=1),

^a p-value<.01, ^b p-value<.05, ^c p-value<.1 (comparison of Save for expected expenses for child's education=0 to Save for expected expenses for child's education=1). Note: Tests of medians is based on Mann-Whitney non-parametric test procedure.

Table 2. MTR_{financial aid} by household income and taxable financial assets in 2001.

Income in 2001	Taxable financial assets in 2001												
	\$0 - \$10,000		\$10,001 - \$20,000		\$20,001 - \$40,000		\$40,001 - \$80,000		\$80,001 - \$160,000		\$160,000 and more		All
	MTR _{f.a.}	% of sample	MTR _{f.a.}	% of sample	MTR _{f.a.}	% of sample	MTR _{f.a.}	% of sample	MTR _{f.a.}	% of sample	MTR _{f.a.}	% of sample	% of sample
\$0-\$25,000	0.0045	5.74	0.0000	0.82	0.0044	0.75	0.0000	0.30	---	---	0.0000	0.15	7.76
\$25,001-\$50,000	0.0288	10.74	0.0296	1.72	0.0469	1.64	0.0418	1.12	0.0335	1.27	0.0238	0.67	17.15
\$50,001-\$100,000	0.0251	10.96	0.0230	3.43	0.0265	4.70	0.0158	3.88	0.0245	2.68	0.0191	4.03	29.68
\$100,001 and more	0.0098	2.31	0.0074	2.01	0.0041	3.13	0.0051	3.65	0.0046	3.73	0.0019	30.57	45.41
All		29.75		7.98		10.22		8.95		7.68		35.42	100.00

MTR_{f.a.}=MTR_{financial aid}

Source: Authors' computations based on 2001 Survey of Consumer Finances.

Table 3. Tobit estimates for retirement assets.

Dependent variable:	Model I		Model II		Model III		Model IV	
	Retirement assets / Taxable financial assets		log(Retirement assets)		Retirement assets / Taxable financial assets		Retirement assets / Total financial assets	
Sample:	Full sample		Full sample		No families with children over 18 or independent		Full sample	
	N=1,341		N=1,341		N=622		N=1,341	
	Parameter estimate	Standard error	Parameter estimate	Standard error	Parameter estimate	Standard error	Parameter estimate	Standard error
Intercept	-2.7402	5.5496	-6.4673	1.6686 ***	5.8092	5.0145	0.6279	0.1350 ***
Expect expenses for child's education	0.3491	1.5438	-0.2858	0.4143	1.1087	1.6652	0.0044	0.0332
Save for expected expenses for child's education	0.9480	1.5944	1.1771	0.4126 ***	0.2915	1.6484	0.0318	0.0337
MTR _{financial aid}	27.3788	16.5186 *	10.2627	4.5377 **	28.9129	15.5536 *	0.9520	0.3493 ***
Age in 30s	2.9447	2.2681	0.7502	0.5863	1.1777	1.9239	0.0497	0.0473
Age in 40s	3.6066	2.3709	1.6904	0.5932 ***	3.4510	2.1465	0.1057	0.0478 **
Age in 50s or more	3.6075	2.5335	1.8969	0.6285 ***	6.9492	3.2753 **	0.0814	0.0509
Black	-2.7509	1.9918	-0.5385	0.5269	-1.2061	2.2141	-0.0535	0.0442
Hispanic	-3.9317	2.3406 *	-1.7485	0.6089 ***	-3.2539	2.3327	-0.1099	0.0504 **
Number of children	-0.4701	0.3233	-0.2412	0.0861 ***	-0.7600	0.6296	-0.0221	0.0070 ***
Homeownership	4.5731	1.7640 ***	2.5103	0.4669 ***	0.5897	1.8242	0.1624	0.0374 ***
Post-college degree	1.5540	1.6152	2.0414	0.4267 ***	2.3406	1.9582	0.1025	0.0348 ***
Completed college	1.1097	1.4817	1.4824	0.3935 ***	2.1150	1.8521	0.0618	0.0329 *
Some college	-0.3596	1.3869	-0.0703	0.3741	-1.0324	1.4561	-0.0103	0.0319
Self-employed	-0.9836	1.1851	0.0663	0.3384	-2.1775	1.1827 *	-0.0215	0.0280
Managerial or professional occupation	-0.3500	1.2628	0.2599	0.3271	-1.2444	1.5114	-0.0090	0.0269
Approve to borrow for educational expenses	0.7189	1.4523	0.2819	0.4154	0.3530	1.4247	0.0320	0.0328
Approve to borrow for living expenses	-2.3154	1.0147 **	-0.5168	0.2603 **	-1.2684	1.0070	-0.0285	0.0215
Long term planning horizon	0.6185	1.0443	0.5832	0.2742 **	2.1023	1.0471 **	0.0180	0.0223
Above average risk tolerance	-0.2309	0.9864	0.8855	0.2743 ***	0.7698	0.9503	0.0153	0.0221
log(Income)	-0.9557	0.5694 *	0.3588	0.1751 **	-1.2610	0.6158 **	-0.0773	0.0142 ***
MTR _{income}	14.9707	10.2456	12.2289	3.2767 ***	17.4578	11.8294	0.7155	0.2510 ***
Employer contributions to husband's plan	8.2828	1.0751 ***	3.7410	0.2899 ***	4.0915	1.0878 ***	0.2840	0.0232 ***
Employer contribution to wife's plan	3.8261	1.2274 ***	2.6522	0.3427 ***	0.8535	1.2644	0.1793	0.0277 ***
Sigma	15.7445	0.7898 ***	4.3908	0.1098 ***	10.3305	1.6711 ***	0.3530	0.0088 ***
Log Likelihood	-4,442		-3,267		-1,889		-632	
Proportion of + obs.	0.7627		0.7627		0.7792		0.7627	
Mean value of the dependent variable (positive values)	4.2594		11.0147		3.6398		0.4308	

Coefficient significance levels: ***p-value<.01, **p-value<.05, *p-value<.1

Table 4. Tobit estimates for home equity.

Dependent variable:	Model I		Model II		Model III		Model IV	
	Home equity / Taxable financial assets		log(Home equity)		Home equity / Taxable financial assets		log(Annual mortgage payments)	
Sample:	Full sample		Full sample		No families with children over 18 or independent		Full sample	
	N=1,341		N=1,341		N=622		N=1,341	
	Parameter estimate	Standard error	Parameter estimate	Standard error	Parameter estimate	Standard error	Parameter estimate	Standard error
Intercept	6.4069	12.4422	-6.1032	1.4353 ***	-0.4398	17.2227	5.3976	2.3366 **
Expect expenses for child's education	3.1167	3.5421	-0.1821	0.3609	2.0343	6.2629	0.1442	0.5830
Save for expected expenses for child's education	-5.0502	3.7153	-0.2069	0.3695	-6.8396	6.4285	-0.6011	0.5965
MTR _{financial aid}	73.7316	43.3217 *	4.9952	4.2308	99.6369	62.8716	13.3702	6.2911 **
Age in 30s	15.4137	5.0530 ***	3.0735	0.5172 ***	22.4101	6.4391 ***	4.1101	0.8393 ***
Age in 40s	20.9345	5.3674 ***	4.4881	0.5314 ***	29.7387	7.5784 ***	4.2843	0.8626 ***
Age in 50s or more	23.0307	6.0997 ***	5.0794	0.5562 ***	29.7795	10.7293 ***	2.7677	0.9052 ***
Black	-0.4343	6.5692	-1.9201	0.4793 ***	4.6718	12.5565	-1.5280	0.7693 **
Hispanic	-2.7162	4.8558	-1.2665	0.5207 **	-8.6054	7.5457	0.2660	0.8262
Number of children	-0.5920	0.6843	-0.0262	0.0740	-0.7915	2.1652	-0.0660	0.1202
Post-college degree	-1.5346	3.4687	0.2668	0.3840	-5.8154	5.3697	1.3247	0.6233 **
Completed college	-1.0911	3.3259	0.4483	0.3513	-1.9019	5.4137	1.5021	0.5682 ***
Some college	-0.8548	3.2933	0.2582	0.3343	2.9136	5.2426	0.8367	0.5387
Self-employed	4.4169	2.5134 *	0.1067	0.2794	3.1425	3.8412	-0.7847	0.4495 *
Managerial or professional occupation	1.5063	2.9872	0.4771	0.3083	2.4971	4.7363	0.7579	0.4737
Approve to borrow for educational expenses	1.6172	3.5419	0.2153	0.3436	1.1880	4.6577	1.2046	0.5635 **
Approve to borrow for living expenses	-1.3128	2.1321	-0.1360	0.2307	-1.2906	3.2703	0.0919	0.3733
Long term planning horizon	0.8251	2.5743	0.9896	0.2455 ***	-0.6096	3.7813	0.9085	0.3963 **
Above average risk tolerance	-4.6766	2.2914 **	0.0586	0.2451	-4.2168	3.5947	0.4484	0.3960
log(Income)	-2.4728	1.2719 *	0.5497	0.1528 ***	-2.2597	2.0717	-1.1811	0.2507 ***
MTR _{income}	28.0899	22.2595	16.0665	2.7621 ***	36.5701	44.6340	26.5363	4.3775 ***
Sigma	36.0286	3.0147 ***	4.0295	0.0945 ***	35.3568	5.1764 ***	6.3123	0.1707 ***
Log Likelihood	-5,778		-3,426		-2,660		-3,302	
Proportion of + obs.	0.8395		0.8395		0.8407		0.6568	
Mean value of the dependent variable (positive values)	9.5513		11.9344		10.2519		9.6961	

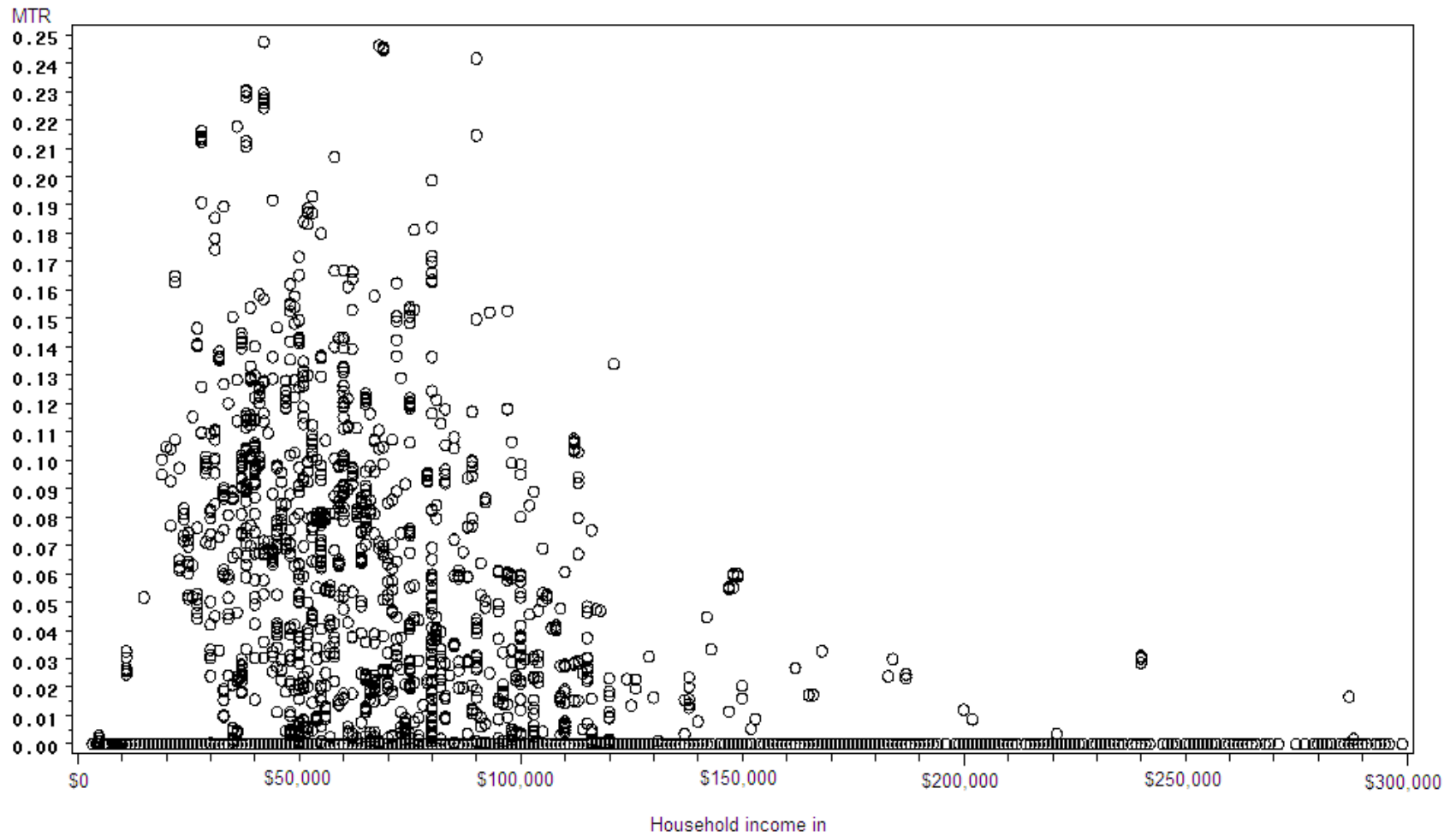
Coefficient significance levels: ***p-value<.01, **p-value<.05, *p-value<.1

Table 5. OLS estimates for Taxable financial assets.

Sample:	Model I		Model II		Model III	
	log(Taxable financial assets)		log(Taxable financial assets)		log(Total assets)	
	Full sample	No families with children over 18 or independent	Full sample			
	N=1,341		N=622		N=1,341	
	Parameter estimate	Standard error	Parameter estimate	Standard error	Parameter estimate	Standard error
Intercept	-4.3492	0.5396 ***	-4.6196	0.7637 ***	0.3825	0.3300
Expect expenses for child's education	-0.3454	0.1507 **	-0.4811	0.2513 *	-0.1005	0.0867
Save for expected expenses for child's education	0.5348	0.1503 ***	0.4960	0.2489 **	0.1523	0.0875 *
MTR _{financial aid}	-2.5825	1.7168	-2.9583	2.7130	-0.4713	0.9707
Age in 30s	0.0965	0.2028	0.0659	0.2568	0.0983	0.1178
Age in 40s	0.5049	0.2116 **	0.5166	0.2879 *	0.3651	0.1194 ***
Age in 50s or more	0.9898	0.2239 ***	0.9311	0.3550 ***	0.6601	0.1316 ***
Black	-0.1765	0.1876	-0.3861	0.3202	-0.2941	0.1103 ***
Hispanic	-0.6201	0.2036 ***	-0.4483	0.3221	-0.4090	0.1224 ***
Number of children	0.0378	0.0291	0.1624	0.0875 *	0.0503	0.0176 ***
Homeownership	0.4509	0.1473 ***	0.3824	0.2242 *	1.6801	0.0851 ***
Post-college degree	0.5516	0.1624 ***	0.7923	0.2394 ***	0.1312	0.0937
Completed college	0.5120	0.1450 ***	0.5996	0.2164 ***	0.2056	0.0839 **
Some college	0.1609	0.1395	0.3497	0.2085 *	0.0835	0.0790
Self-employed	0.1347	0.1146	0.2680	0.1804	0.5552	0.0674 ***
Managerial or professional occupation	0.1585	0.1195	0.0642	0.1753	0.2290	0.0684 ***
Approve to borrow for educational expenses	-0.1198	0.1420	-0.0155	0.2220	0.0078	0.0803
Approve to borrow for living expenses	-0.1063	0.1001	-0.0440	0.1412	-0.0763	0.0556
Long term planning horizon	0.2394	0.1006 **	-0.0534	0.1536	0.0802	0.0567
Above average risk tolerance	0.4407	0.0995 ***	0.3912	0.1460 ***	0.2625	0.0568 ***
log(Income)	1.1275	0.0569 ***	1.1325	0.0786 ***	0.8645	0.0357 ***
MTR _{income}	1.6664	0.9119 *	1.7952	1.4270	1.0713	0.5453 **
R2	0.6944		0.7072		0.8378	
Mean value of the dependent variable	10.9559		10.9074		13.2898	

Coefficient significance levels: ***p-value<.01, **p-value<.05, *p-value<.1

Figure 1. MTR_{financial aid} as the function of household income in 2001.



Note: Only the fraction of households with income ranging from \$0 to \$300,000 is graphed. For income greater than \$300,000 MTR_{financial aid} = 0 for all cases.

APPENDIX A. Definition of variables

Variable	Description
Expect expenses for child's education	=1 if household is expecting major financial expenses for child's education within the next 5-10 years; =0 otherwise
Save for child's education	=1 if household is saving for those expenses; =0 otherwise
MTR _{financial aid}	Implicit cumulative marginal financial aid tax rate on parental assets
Age	Age of the household head
Age in 20s or less	=1 if the household head age is 20 or over but less than 30; =0 otherwise
Age in 30s	=1 if the household head age is 30 or over but less than 40; =0 otherwise
Age in 40s	=1 if the household head age is 40 or over but less than 50; =0 otherwise
Age in 50s or more	=1 if the household head age is 50 or over; =0 otherwise
Black	=1 if the household is head is African-American; =0 otherwise
Hispanic	=1 if the household is head is Hispanic; =0 otherwise
Number of children	Number of children of either the household head or spouse/partner
Homeownership	=1 if household owns a home; =0 otherwise
Annual mortgage payments	Amount of mortgage payments over one year.
Post-college degree	=1 if the household head has a post college degree; =0 otherwise
Completed college	=1 if the household head has a college degree; =0 otherwise
Some college	=1 if the household head has some college education; =0 otherwise
Completed high school	=1 if the household head has a high school degree; =0 otherwise
No high school	=1 if the household head has no high school degree; =0 otherwise
Self-employed	=1 if the household head is self-employed; =0 otherwise
Managerial or professional occupation	=1 if the household head holds managerial or professional occupation; =0 otherwise
Approve to borrow for educational expenses	=1 if the household head feels it is all right to borrow to finance educational expenses; =0 otherwise
Approve to borrow for living expenses	=1 if the household head feels it is all right to borrow to cover living expenses; =0 otherwise
Long term planning horizon	=1 if the household head plans saving and spending at least 5 years in advance; =0 otherwise
Above average risk tolerance	=1 if the household head takes above average financial investments risk; =0 otherwise
Income	Household income in 2000
MTR _{income}	Marginal income tax rate
Employer contributions to husband's plan	=1 if the current employer contributes to the husband's retirement plan; =0 otherwise
Employer contribution to wife's plan	=1 if the current employer contributes to the wife's retirement plan; =0 otherwise
Retirement assets	Retirement assets in 2001 (includes IRA, Keogh, and retirement accounts from current employer such as: thrifts, savings, 401K, 403B, SRA, or any other retirement account at the current employer)
Home equity	Home value - outstanding mortgage payments
Taxable financial assets	Financial assets in 2001 (including liquid assets such as checking, saving, money market or call accounts, certificates of deposit, stocks, bonds, mutual funds, annuities, cash value of whole life insurance, etc., and excluding retirement assets)
Total financial assets	Taxable financial assets + retirement assets
Total assets	Total assets (includes total financial assets and nonfinancial assets)

APPENDIX B. EFC & MTR_{financial aid} calculations

This section summarizes the federal methodology calculations of The Expected Family Contribution (EFC) and the Marginal Financial Aid Tax Rate (MTR_{financial aid}).

EFC is computed as follows:

$$\begin{aligned} \text{EFC} = & \text{Parents' contribution from parents' Adjusted Available Income (AAI)} \\ & \div \text{Number of household members in college} \\ & + \text{Student's contribution from student's available income} \\ & + \text{Student's contribution from student's assets.} \end{aligned}$$

Due to the limitations of our data, we ignore contributions from students' available income and students' assets in our calculations

Parents' contribution from AAI is calculated according to the following schedule:

If parents' AAI is:	The parents' contribution from AAI is:
-\$3,410 or less	-\$750
-\$3,409 to \$11,400	22% of AAI
\$11,401 to \$14,300	\$2,508 + 25% of AAI over \$11,400
\$14,301 to \$17,200	\$3,233 + 29% of AAI over \$14,300
\$17,201 to \$20,100	\$4,074 + 34% of AAI over \$17,200
\$20,101 to \$23,000	\$5,060 + 40% of AAI over \$20,100
\$23,001 or more	\$6,220 + 47% of AAI over \$23,000

Parents' AAI = Parents' Available Income (AI) + Parents' contribution from assets.

$$\begin{aligned} \text{Parents' AI} = & \text{Total income} \\ & - \text{2000 U.S. income tax paid} \\ & - \text{State and other tax allowance} \\ & - \text{Allowance for social security taxes} \\ & - \text{Income protection allowance} \\ & - \text{Employment expense allowance} \end{aligned}$$

The limitations of our data require us to ignore 'State and other tax allowance' in our calculations. Also, we assume that the amount of federal income tax paid is based on standard deductions for all households.

Allowance for social security taxes on the 2001/02 application was 7.65% percent of income, if the income earned from work is less than \$76,200. If the income earned from work exceeds \$76,201, the allowance for social security taxes is computed as \$5,829.30 + 1.45% of amount of income earned from work over \$76,200.

Income protection allowance depends on the number of family members and how many of them are college students. If the household includes less than 5 members, the amount of allowance is derived from the table below. For families with more than 6 members or more than

5 students, each additional family member raises the allowance by \$3,060, whereas each additional student subtracts \$2,170 from the allowance.

We use the age of children and the predicted probability of college attendance to identify the number of students in the household.

Number of family members	Number of students in the household				
	1	2	3	4	5
1					
2	\$12,760	\$10,580	---	---	---
3	\$15,890	\$13,720	\$11,540	---	---
4	\$19,630	\$17,440	\$15,270	\$13,090	---
5	\$23,160	\$20,970	\$18,800	\$16,620	\$14,450
6	\$27,090	\$24,900	\$22,730	\$20,550	\$18,380

Employment expense allowance is \$2,900 or 35% of the lesser of the earned income for families with two working parents, whichever amount is lower. Two-parent families, where only one parent works, have zero employment expense allowance. For one-parent families, employment expense allowance is computed in the same way as for families with two working parents.

We use parents' predicted income at the time the child is in enrolled in college to calculate the employment expense allowance.

Parents' contribution from assets is computed as $0.12 * \text{Discretionary net worth}$.

Discretionary net worth = Net worth - Educational savings and asset protection allowance.

Net worth = Cash, savings, checking accounts
 + Net worth of investments
 + Adjusted net worth of business or farm

Net worth of investments is computed as the net worth of money market accounts, call accounts, certificates of deposit, mutual funds, stocks, bonds, and land or real estate contracts on other than primary residence.

Adjusted net worth of business or farm is computed as follows:

If the net worth of a business or farm is:	then the adjusted net worth is
Less than \$1	\$0
\$1 to \$90,000	40% of net worth of business/farm
\$90,001 to \$275,000	\$ 36,000 + 50% of excess over \$90,000
\$275,001 to \$455,000	\$128,500 + 60% of excess over \$275,000
\$455,001 or more	\$236,500 + 100% of excess over \$455,000

Educational savings and asset protection allowance is the function of the age of the older parent, where the formulas differ depending on number of parents (for exact formulas see The EFC Formula Guide, 2001-02).

We use the age of the older parent when the child is enrolled in college to calculate the educational savings and asset protection allowance.

Federal methodology allows some families to be evaluated by the **Simplified Needs Test**. According to this procedure, if the household has less than \$50,000 in adjusted gross income and is not required to file tax return or is eligible to file forms 1040A or 1040EZ, it is automatically exempt from any contributions from assets and the marginal financial aid tax rate is zero.

Due to data limitation, in our computations we assume that a household qualifies for the Simplified Needs Test if the adjusted gross income of the household does not exceed \$50,000, the total income does not exceed \$100,000 and the household does not use itemized deductions.

APPENDIX C. Estimates for parents' net worth.

Variable	N=1,341	
	Parameter estimate	Standard error
Intercept	3.4031	1.3000 ***
Age	0.1564	0.0609 **
Age squared	-0.0012	0.0007
Black	-1.1573	3.8819
Hispanic	3.4472	3.7598
Post-college degree	0.4337	1.1179
Completed college	-1.5286	0.9940
Some college	0.7010	0.8685
Self-employed	2.1074	0.1508 ***
Managerial or professional occupation	1.0268	0.1619 ***
Black*Age	0.0966	0.1883
Black* Age squared	-0.0024	0.0022
Hispanic *Age	-0.2206	0.1850
Hispanic * Age squared	0.0027	0.0022
Age * Post-college degree	0.0200	0.0244
Age * Completed college	0.0585	0.0226 ***
Age * Some college	-0.0120	0.0203
Wife's age	0.0351	0.0256
Wife's age squared	-0.0003	0.0005
Wife's post-college degree	2.7489	1.2408 **
Wife completed college	0.5976	0.9686
Wife's some college	-0.3912	0.8430
Wife's age * Wife's age squared	-0.0289	0.0287
Wife's age * Wife completed college	0.0194	0.0232
Wife's age * Wife's some college	0.0154	0.0207
R2	0.5559	

Coefficient significance levels: ***p-value<.01, **p-value<.05, *p-value<.1

Note: Log of net worth is used as the dependent variable.

The above table reports the parameter estimates of the model for the first replicate of the data. For brevity, the parameter estimates from the models for remaining replicates are not reported.