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SUBOPTIMAL INVESTMENT AND LOCAL PREFERENCES: EVIDENCE FROM 529 COLLEGE SAVINGS PLANS

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ABSTRACT

We investigate whether and why households overinvest in local assets by studying their choice of state 529 college savings plans. We estimate that 67% of open accounts between 2010 and 2020 were suboptimally located, due to tax inefficiencies and high expenses. Over accounts' projected lifetimes, such investments yielded expected average losses of 8%, and $13.4 billion in 2020 alone. Household financial literacy and plan disclosure complexity appear to explain suboptimal investment patterns, while local information advantages do not. Our study presents novel evidence on households' local preferences and how information-processing frictions shape individuals' investment decisions, reducing their financial well-being.

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Introduction

Despite extensive evidence that households prefer local investments, an open question remains about whether they overinvest in local assets. This debate concerns whether households perform better or worse due to the overweighting of local assets in their portfolios. Some studies argue that individuals earn superior returns when they invest in local stocks that are familiar to them (e.g., Ivkovic and Weisbenner 2005, Massa and Simonov 2006), while others argue that they do not earn superior returns when investing locally (e.g., Seasholes and Zhu 2010, Døskeland and Hvide 2011). We examine whether and why households invest in local assets by studying their choice of 529 college savings plan.

U.S. states sponsor 529 plans to encourage households to save for their beneficiaries' (often children's or grandchildren's) future education costs; 529 plans have become increasingly popular, growing from $14 billion to $411 billion in assets between 2001 and 2022. Because few 529 plans have residency restrictions, most households can invest in any state's plan. However, little is known about the distribution of these assets across states' plans and whether households demonstrate a preference for home-state plans. Due to variation in plan benefits and costs, many local plans actually appear *ex-ante* dominated by nonlocal options. Accordingly, examining asset saving patterns in this context is critical to understanding household decision-making and its consequences for their financial well-being.

The 529 college savings plan setting offers several advantages for our analysis of households' decision-making regarding where they choose to invest. First, because households are exclusively the 529 account owners, our analysis of asset locations is unconfounded by institutional investors' allocation decisions. Second, plan characteristics and payoffs vary widely across state plans. For the same underlying investment option, different states may provide different benefits (e.g., tax deductions) or impose distinct costs (e.g., program management expenses). This variation allows us to evaluate whether plans produce suboptimal payoffs for households across different states.

We first model expected payoffs across all 529 plans available to households in each state, incorporating all information relevant to decision-making: portfolio offerings, state tax deductions, state matching grants, residency restrictions, asset-based percentage fees, dollar-based account maintenance fees,

and rollover restrictions. We define a "suboptimal" investment as opening an account in one state's plan when the household could earn a higher expected payoff in a different plan. Critically, a household is not restricted to investing in plans in its own state of residence. Although low fees and tax savings might make a home-state plan optimal for some households, the optimal plan for a household living elsewhere could be out-of-state, due to high fees and a lack of tax-savings for its home-state plan.

To implement the model, we obtain data on all 529 state plan characteristics, assets under management, open accounts, state tax rates, and state-level population characteristics from plan disclosure documents, the College Savings Plan Network, Morningstar, the National Financial Capability Survey, the Census Bureau, and the National Bureau of Economic Research. We identify a plan as suboptimal if it is suboptimal for a household in any state; this definition is free from assumptions about where any given household resides. Our sample spans 2010 to 2020, and it consists of 803 plan-years comprising 109 unique plans across the 50 U.S. states and the District of Columbia.

Our analysis produces several key insights. First, we find that suboptimal investment among 529 plans is widespread. On average, between 2010 and 2020, 67% of open accounts and 71% of assets under management were held in suboptimal plans. In 2020 alone, the aggregate projected dollar loss for households contributing to suboptimal plans was $13.4 billion, representing 6% of projected terminal payoffs. Most notably, significant suboptimal investment occurs across all types of state tax treatment, a key geographic feature that affects 529 investment payoffs. Suboptimal investment, on average, was lowest for plans in states with in-state tax deductions (60% of AUM and 52% of open accounts), suggesting welfare gains created by state tax benefits. Simultaneously, suboptimal investment was highest in states without state income taxes (95% of AUM and 94% of accounts) or with tax parity (97% of AUM and 91% of accounts), suggesting that households also exhibit local preference in the absence of tax benefits.

Next, we examine *why* suboptimal investment is so common. If households understand the benefits and costs of local versus nonlocal 529 investment, we expect home-state investment to be lower in states without an in-state investment tax benefit (i.e., no tax deductions, no state income taxes, or with tax parity). To test this hypothesis, we sent Freedom of Information Act (FOIA) requests to all 49 states and the District

of Columbia that sponsored 529 plans as of second-quarter 2023. We collect statistics about in-state versus out-of-state account owners and the frequency of account rollovers into and out of plans. Our analysis shows that the proportion of in-state investment is lower only for plans in states without income taxes, while the proportion of in-state investment is statistically indistinguishable between states without a tax deduction, with tax parity, or only offering an in-state tax deduction. This suggests that households avail themselves of the benefits of nonlocal investment only when these benefits arise due to no state income taxes. Furthermore, we find that households in states with no home-state tax benefit are equally likely to roll over their accounts to out-of-state plans, as are households in states with home-state tax deductions. Collectively, these results indicate that a meaningful proportion of households does not account for the potential benefits of investing out-of-state.

Previous studies have shown that limited financial knowledge can affect households' decision-making and financial well-being (e.g., Lusardi and Mitchell 2014). Therefore, we study household financial literacy, motivated by the hypothesis that more financially literate households should find it less costly to understand how state tax deductions, residency restrictions, asset-based management fees, and related factors affect the terminal payoffs of potential investment options. Our analysis shows that, in states with higher financial literacy, households open a lower proportion of accounts in suboptimal versus optimal plans.[1] Furthermore, these suboptimal plans are typically advisor-sold plans and have higher fees than direct-sold plans. Thus, a likely channel through which financial literacy affects suboptimal asset locations is through less financially literate households paying for more costly financial advice.

We also analyze the complexity of 529 plan disclosure documents as a moderator of information-processing frictions. States advertise and disclose information via multiple channels, some of which have faced criticism and lawsuits for being complicated and misleading (e.g., Baldwin v. Merrill Lynch 2019;

[1] Each state retains private account-level data not subject to FOIA, which precludes analysis of decision-making at the household-level. Here, we focus on states offering both a suboptimal and an optimal plan to control for across state investment. We assume that households investing optimally seek their best plan nationally, including out-of-state plans, and households investing suboptimally invest in an in-state plan (as opposed to a suboptimal out-of-state plan). This is a weaker assumption than applied in prior 529 studies (e.g., Alexander and Luna 2005), who assume that households invest only in home-state plans.

Sommer 2022). We hypothesize that complex plan disclosures, which average more than 65 pages of financial and accounting-related information, exacerbate suboptimal investment. Our analysis shows that households open a lower proportion of accounts in optimal plans having more linguistically complex disclosure documents. Through the tests, we provide evidence that financial literacy and plan disclosure transparency affect household portfolio choice and help explain their investment patterns in 529 accounts.

Finally, we address alternative explanations for our findings. Prior literature finds that investors in other settings prefer local investments due to local informational advantages (e.g., Coval and Moskowitz 1999, Ivkovic and Weisbenner 2005). In the case of 529 plans, households may possess local information advantages regarding the investing skill of their home-state's plan trustee or local asset management company's portfolio manager. We assess this explanation by comparing the realized risk-adjusted returns of model-identified *ex-ante* suboptimal plans to those of model-identified *ex-ante* optimal plans. Our results show that suboptimal plans statistically significantly underperform optimal plans, which is inconsistent with a local information advantage explanation and consistent with suboptimal plans having lower realized payoffs.

We contribute to the literature in three areas. First, we provide novel evidence of how individuals make decisions regarding the geography of their investments. Some literature finds that investors prefer local investments due to local information advantages.[2] We complement those findings by offering information processing costs as an additional explanation for local preferences. Our results document that households appear to misjudge the benefits and costs of in-state versus out-of-state 529 plans, despite the absence of local information advantages in our setting.

Second, we add to the household finance literature by contributing evidence regarding how households make financial decisions for the next generation. Prior literature studies individuals' lifecycle

[2] For evidence of U.S. retail investors' local preferences, see Ivkovic and Weisbenner (2005) and Seasholes and Zhu (2010). Studies also document local preferences in other countries including Finland (Grinblatt and Keloharju 2001), Sweden (Massa and Simonov 2006), and China (Feng and Seasholes 2004). In addition, studies also find that U.S. institutional investors prefer local investments (e.g., Coval and Moskowitz 1999, Hau and Rey 2008, and Baik et al. 2010).

financial planning by focusing on student loan and retirement savings choices.[3] Our study examines household financial decisions that extend beyond the current generation's lifecycle to the next generation, where suboptimal choices affect combined financial welfare. Furthermore, prior papers studying 529 plans have focused on plan participation rates or the determinants of high plan fees. For example, Alexander and Luna (2005) study plan participation rates and argue that marketing efforts draw investors to high-fee funds, while Bullard (2006), Bogan (2014), Curtis (2020), and Balthrop and Cici (2022) contend that higher fees in 529 plans reflect moral hazard by state sponsors. We extend this literature by evaluating whether and why households make suboptimal decisions regarding 529 plan investments, including factors that impact their financial decision-making, such as their financial knowledge.[4,5]

Lastly, our findings will inform policymakers concerned with household financial well-being. The rise in defined contribution plans and individual retirement accounts has shifted portfolio choice and rebalancing decision-making away from employers offering defined benefit pensions to households (e.g., Lusardi and Mitchell 2011). Because suboptimal household financial decision-making in the choice of 529 plans proves to be quite widespread, policymakers may also wish to evaluate institutional factors that influence household savings patterns. Accordingly, our investigation can inform future research, policy, and suggest new tools – for example, educational guides and disclosure principles (e.g., Alexander et al. 2015) – that could enhance household decision-making for college savings and, as a result, improve the next generation's financial well-being.

1. Institutional Background and Modeling Suboptimal Investment

1.1. Institutional Background

[3] See Yannelis and Tracey (2022) for a review on student loans. See Campbell (2006); Guiso and Sodini (2013); Beshears et al. (2018); and Gomes et al. (2021) for reviews on household finance.

[4] In considering how our findings may generalize to households' overall financial decision-making, it is important to note that we focus on suboptimal investment across different 529 plans, conditional on the household deciding to participate in a 529 plan. Whether 529 plans dominate outside options for financing college (e.g., student loans or financial aid) or how households should weigh plans in a broader portfolio of financing options (e.g., Mueller and Yannelis 2019; Cornaggia and Xia 2023) are outside the scope of our study.

[5] See Hastings et al. (2013), Lusardi and Mitchell (2014), and Kaiser et al. (2021) for reviews on financial literacy, financial education, and their downstream effects. See von Gaudecker (2015), Brown et al. (2016), Clark et al. (2017), Anderson et al. (2020), Cheng et al. (2021), and Keys et al. (2023) for studies where financial literacy matters in other household finance settings.

In the U.S., state-sponsored 529 plans are tax-advantaged savings accounts designed to encourage household savings for beneficiaries' future education costs. Named for Section 529 of the U.S. tax code conferring their favorable tax treatment, they are an economically important component of household saving, reaching $411 billion in assets as of year-end 2022 (CSPN 2023). Plans are sponsored by state governments, which oversee them through politically-appointed boards. States contract with program managers who administer the plan and design the menu of available investment options. Program managers can be record keepers, asset management companies, banks, or in-house government agencies.

Investing in a 529 plan requires several steps. First, the household decides whether to use a 529 plan to save for college expenses versus outside options, such as non-529 savings and investment accounts, financial aid, or student loans. Having decided to use a 529 plan, the household next selects a state and plan in which to open an account. This decision is the focus of our paper. These plans are an investment vehicle, the distributions from which may be used to cover in-state or out-of-state college and university costs. Therefore, 529 asset locations offer a useful lens with which to examine investment behavior.

Households contribute to 529 plans after paying federal income tax. Withdrawals from these plans are exempt from federal income and capital gains taxation when used for qualified higher education expenses.[6] However, states differ widely in offering tax deductions/credits for contributions. Twenty-eight states offer tax deductions/credits for contributions only to in-state plans. Seven states offer tax parity, where contributions to any plan earn tax deductions. Seven states offer no tax benefits, and the remaining nine states have no state income taxes.[7] The state-level tax treatment of resident households is a critical dimension shaping investment payoffs, which can then affect household plan location choices.

There are two types of 529 plans: education savings plans, and prepaid tuition plans. Education savings plans allow the account holder to open an account to save for a beneficiary's future qualified higher

[6] The Tax Cuts and Jobs Act of 2017 enabled federal tax-free withdrawals for a beneficiary's K-12 education. However, many states do not consider K-12 education to be a qualifying expense, such that state taxes are still owed on withdrawals. The Secure 2.0 Act of 2022 allowed unused college savings to be transferred to the beneficiary's retirement savings, beginning in 2024.

[7] The District of Columbia (DC) also offers a 529 plan. Since DC offers tax deductions on in-state contributions, we include DC in the set of 28 states offering tax deductions.

education expenses at any educational institution, covering tuition, mandatory fees, room and board, and books and supplies. Households build portfolios from the mutual funds included in an education savings plan. By contrast, prepaid tuition plans allow the account holder to purchase units or credits for future tuition and mandatory fees at current prices for participating colleges and universities (usually only public and in-state), thus offering a direct hedge against tuition inflation. Since only a few states offer prepaid plans, whose value depends heavily on the tuition cost of a benchmark index of in-state colleges and universities, we focus below on the far more widely-offered education savings plans.

Education savings plans are either direct-sold or advisor-sold. In direct-sold plans, a household must open an account through the state and use its contracted plan manager. In advisor-sold plans, a household may only open an account through a financial advisor. Benefits and costs can differ substantially across states between direct-sold and advisor-sold plans, thus making plan type and associated characteristics key dimensions of asset location choice.

Our model incorporates all characteristics of these plans, including the frequency and amount of contributions as well as the investment options within the plan. Although the available investment menu may differ across plans, they all include two main types of investment options: age-based/target-enrollment investments, where the asset allocation changes over time based on the age of the beneficiary or expected year of college enrollment; and static investments, where the asset allocation remains fixed over the investment period. Unlike retirement plan advisers, program managers are typically not subject to fiduciary responsibilities, so some plans may be built using high-cost funds (Bullard 2006; Curtis 2020; Balthrop and Cici 2022).

1.2. Modeling the Terminal Payoff

We model 529 plans' terminal payoffs from the perspective of a representative household making a prospective investment for its beneficiary's future education. We posit that the household seeks to maximize the beneficiary's terminal payoff from its 529 contributions. Our model uses only publicly available – but costly to process – information relevant to these investment decisions. In particular, households have access to plan disclosure and participation agreement documents, which describe key plan

features: how to and who can open an account, portfolios available, fees, etc. We draw from these disclosure documents, which routinely assume that a household makes a $10,000 investment, the investment earns a 5% annual compounded rate of return on the amount invested throughout the holding period, and investments are redeemed for qualified higher education expenses only at the end of the period.[8] We also assume that the account is opened at the beneficiary's birth, implying an 18-year investment period (Leung and Wendell 2020). In Section 4, we assess the robustness of our results to variation in these assumptions.

Our model for the payoff of a 529 investment, defined recursively for each time $t \in \{0, \dots, T\}$, is:

$$\begin{aligned} Payoff_0^{s,p} &= Contribution^{s,p} \\ Payoff_t^{s,p} &= \left(Payoff_{t-1}^{s,p}\right)(Return^{s,p}) - a^p \\ Terminal\ Payoff^{s,p} &= \left(Payoff_T^{s,p} - Contribution^{s,p}\right)(Distribution^{s,p}) + Contribution^{s,p} \end{aligned}$$

where s is the household's state of residence, p is the plan where the household opens an account, and a^p is the annual account maintenance fee. The terminal payoff at time $t = T$ accounts for distribution taxes on the growth of the contribution (if applicable), measured as the difference between the payoff and the contribution. Because a household in state s can invest in any plan that does not have residency requirements, we evaluate $Terminal\ Payoff^{s,p}$ for the cross-product of each residence state s and plan p.

We define $Contribution^{s,p}$, $Return^{s,p}$, and $Distribution^{s,p}$ as follows:

1) Contribution

We assume that a household makes a one-time $10,000 investment after it pays federal taxes on its income but before paying state taxes, as the household may earn a state tax deduction or credit from the contribution:

$$Contribution^{s,p} = 10{,}000(1-\tau^s) + \begin{cases} \pi^s\tau^s & \text{if} \quad \pi^s \le 10{,}000 \\ 10{,}000\tau^s & \text{if} \quad \pi^s > 10{,}000 \end{cases} + Matching\ Grant^{s,p}$$

τ^s is the effective tax rate for a household in state s. π^s is the state limit on the amount of contributions available to be used for tax deductions: if the limit is > $10,000, the full amount is deducted; if the limit is

[8] Internet Appendix IA-1 presents examples of disclosure documents describing these assumptions, which have remained consistent across plans and years.

≤ $10,000, only the limit amount is deducted. If the state does not offer tax benefits, $\pi^s = 0$. Some states offer state contributions or matching grants for their plans. Here, the state helps residents jumpstart their accounts with a small contribution or matches a resident household's contributions up to a cap. $Matching\ Grant^{s,p}$ is the state contribution or match amount if a household in state s contributing to plan p receives a state contribution or matching grant; it is set to 0 otherwise.[9]

2) Return

In 529 savings plans, the contribution is assumed to earn a 5% annualized return in typical prospectus illustrations. Additionally, an annual asset-based percentage fee is levied on the account's assets. The return is then calculated as:

$$Return^{s,p} = (1 + r^p)(1 - f^p)$$

where $r^p = 0.05$ is the common return assumption applied to investment options, and f^p is the annual asset-based percentage fee for plan p.[10]

3) Distribution

At the end of the period, the household redeems the account, which we assume is fully spent for qualified education expenses. Capital gains used for qualified education expenses are not taxed, such that the full account balance is available to spend on educational expenses at withdrawal. The exception is Alabama, which taxes capital gains on out-of-state plans. Accordingly, distributions here are calculated as:

$$Distribution^{s,p} = \begin{cases} 1 - \tau^s & \text{if } s \text{ is } Alabama \text{ and } p \text{ is not in } Alabama \\ 1 & \text{otherwise} \end{cases},$$

where τ^s is the effective tax rate for a household in state s.

1.3. Optimal Plans and Dollar Welfare Losses

[9] Some plans have share classes with initial sales charges (also known as front-end loads). Our primary analysis does not include sales charges, because plans routinely offer portfolios without loads for households to choose from. In untabulated robustness tests (available on request), we incorporate these charges in the calculation of $Contribution^{s,p}$. That is, suppose $\gamma^{s,p}$ is the sales charge for portfolios in plan s. Then, $Contribution\ after\ charge^{s,p} = Contribution^{s,p}(1 - \gamma^{s,p})$. Our inferences from these tests remain unchanged. Loads ultimately increases the dollar welfare loss from selecting a suboptimal plan, due to higher overall fees.

[10] We exclude money market and other money market-like portfolios, which focus on capital preservation and stability in the NAV as opposed to investment growth.

The optimal plan for a household in state s is defined as the plan with the highest terminal payoff across all plans accessible to that household. We define the dollar welfare loss for investing in plan p as the difference in payoffs between the optimal plan and plan p:

$$Dollar\ Welfare\ Loss^{s,p} = Terminal\ Payoff^{s,optimal} - Terminal\ Payoff^{s,p}.$$

Plans are labeled as suboptimal when $Dollar\ Welfare\ Loss^{s,p} > 0$ (e.g., Calvet et al. 2007). Appendix A shows an extract from our model of optimal and suboptimal investment for year-end 2020.[11]

2. Main Empirical Results

2.1. Data and Sample Selection

We empirically implement the model using data from several sources. State tax rate data are from the National Bureau of Economic Research (NBER). Plan fees and state tax distribution limits are from plan disclosure documents on state websites and in the Municipal Securities Rulemaking Board (MSRB) database. Data on plans' open accounts and assets under management are available from the College Savings Plan Network (CSPN). Internet Appendix IA-3 provides more detail about our data sources. The dataset covers 120 unique plans across all 50 states, including the District of Columbia, between 2010 and 2020. It includes 803 plan-year observations and 109 state-year observations. Tables 1A and 1B show summary statistics of plan-year-level and state-year-level variables, respectively. Internet Appendix IA-4 reports correlations.

2.2. Empirical Findings on Suboptimal vs. Optimal Plan Choices

We fit the model to the observed distribution of 529 plan assets, and we assign optimal and suboptimal labels to the cross-product of states s and plans p. We label a plan as suboptimal only if it is suboptimal for households across all states s. Due to the sensitive nature of household-level data on residency, data on household residency by 529 plan is only available in aggregate (see Section 3.1). Therefore, an advantage of our method is that it is free from assumptions about where each household

[11] Internet Appendix IA-2 presents a breakdown of how state taxes, matching grants, and other state and plan characteristics affect the terminal payoff, on average.

resides. Our conversations with state sponsors and industry professionals confirm the appropriateness of this modeling approach and assumptions.

Using data on the assets under management and open accounts for each plan-year, we compute the extent of suboptimal investment. Figure 1A plots the proportion of assets under management and open accounts in suboptimal plans over time, while Table 2A reports the proportion of assets and accounts held in suboptimal plans by year.[12] Over the period, the average proportion of assets under management and open accounts held in suboptimal plans was 71% and 67%, respectively. The proportions peaked in 2014 and trended down to 63% and 56% as of year-end 2020, respectively. Figure 1B plots aggregate expected $Dollar\ Welfare\ Loss^{s,p}$ by year, as well as welfare loss as a percentage of assets under management in suboptimal plans, while Table 2B reports the statistics. The average asset-weighted expected welfare loss percentage was 7.8% over our period, meaning that households investing suboptimally in a home-state plan could have earned an extra 7.8% return on investment over the modeling period if they had instead invested in optimal plans.[13] This welfare loss peaked at 9.8% in 2010 and trended down to 5.9% in 2020, suggesting that the difference in returns between suboptimal and optimal plans has declined over time. Although the percent welfare loss has dropped, the dollar amount of the loss has grown from $4.4 billion in 2010 to $13.4 billion in 2020, consistent with the growth in the number of households investing in 529 plans. Table 2B also reports the range of welfare loss percentages across suboptimal plans in each year. We find considerable variation in the percent welfare loss across suboptimal plans. Some suboptimal plans differ by only 0.1% in percentage welfare loss compared to the optimal plan, while other plans differ by as much as 33%.

[12] Our counts of suboptimal assets and accounts adjust for the possibility that some assets may be "captured" and cannot be relocated without penalty. Some states have rollover recapture provisions, where a household must repay a portion of previously earned tax deductions on invested principal if they rollover the account to an out-of-state plan. Our proxy for "captured" assets is year 2010 beginning assets and accounts, where we assume that the assets and accounts at beginning of our sample ("the principal") cannot be rolled over to an out-of-state plan without incurring repayment in these states. We apply this adjustment to produce a more accurate numerical estimate of suboptimally located investments; it does not affect our results and inferences.

[13] Suboptimal plans are labeled suboptimal only if they are suboptimal for any state's residents. To compute the welfare loss, we take the perspective of a household investing suboptimally in a home-state suboptimal plan instead of investing in that household's optimal plan.

Key factors affecting 529 investment payoffs include state tax deductions and credits, which create benefits for investing locally. Without tax deductions or state income taxes, households face uniform tax implications irrespective of the location of their 529 accounts. This elevates the importance of other plan characteristics and motivates households to search nation-wide for a 529 plan. Likewise, in states offering tax parity, households earn their state tax benefit irrespective of the location of their 529 accounts. Table 3A shows geographic variation in suboptimal investment by computing the proportion of assets and accounts held in suboptimal plans by state tax status. Our results show that states with tax deductions have the lowest proportion of suboptimally-located assets, suggesting that in-state tax benefits create welfare for households and spur in-state investment. Nevertheless, many accounts and assets in states with tax deductions are still suboptimally located (52% and 60%, respectively). Accordingly, tax deductions alone do not outweigh all other location-dependent features of 529 investments. Table 3A documents that the highest proportions of suboptimal accounts and assets are in states without state taxes and with tax parity. Table 3B shows dollar and percent welfare loss by state tax status. The percent welfare loss is highest among states without tax deductions, and lowest among states with tax parity.

3. Explanations for Suboptimal 529 Investment

To evaluate potential explanations for observed suboptimal 529 investment patterns, we first ask whether households appear to understand the benefits and costs of local versus nonlocal investment in the 529 plan setting, based on the insight that the optimal plan can be a nonlocal plan. Our second approach controls for local investment and focuses on households' information processing frictions. Both prove to be informative.

3.1. Empirical Findings on Local vs. Nonlocal Investment

One explanation for patterns of local and nonlocal 529 investments is that households may not understand state-level tax benefits, in which case they could misvalue the impact of tax benefits on investment payoffs. To investigate this, we collected statistics on the residency of 529 plan account owners or beneficiaries by sending FOIA requests to all 49 states and the District of Columbia sponsoring plans as

of second-quarter 2023.[14] We find that 529 plan information varies across states and is dispersed across multiple parties, since state treasurers and/or departments of higher education sponsor and monitor plans, asset management companies form the portfolios and invest the assets, and recordkeepers track client transactions and requests. Each state uses its own system. Due to the sensitive nature of household-level financial and personally identifiable information (not covered by FOIA), we inquired regarding the aggregate proportion of in-state and out-of-state account holders per plan each state sponsors. We also inquired about the extent of account rollovers between their plans and other plans. Thirty-four states representing 61 plans (out of 86 plans total) responded by providing in-state versus out-of-state residency proportions as of a month-end between December 2022 and June 2023 (most commonly, December 2022). States also provided rollover statistics for calendar year 2022 or a quarter between Q4 2022 and Q2 2023. We annualize all quarterly statistics to compare across states.

Table 4A shows average in-state residency across plans by state tax status. In-state residency is highest (68%) for plans in states with tax deductions, yet this proportion is insignificantly different from and similar in magnitude to the average in-state residency proportion for states without a tax deduction (mean = 60%; t = -0.696) or with tax parity (mean = 57%; t = -0.802). This indicates that a considerable proportion of households in the latter states demonstrate a preference for a local plan, even in the absence of state tax benefits. Only households in states without state income taxes consider home-state plans at a lower rate (mean in-state = 35%; t = -2.927), compared to households in states with tax deductions.

Next, we examine household rollovers of accounts across plans, which can indicate movement (or lack thereof) to plans with higher expected payoffs. Table 4B presents the annualized proportion of 529 accounts that are rollovers into and out of plans, aggregated by state tax status. Across all states, the frequency of plan rollovers is extremely low, below 1% of accounts per year. In view of the suboptimal investment documented in Section 2.2, this evidence indicates that households do not often relocate their

[14] Wyoming was the only state without a 529 plan in second-quarter 2023. States use different names for their freedom of information/public records laws (e.g., Sunshine Act, Public Records Act, Open Records Act, Right to Know Law, etc.). We use FOIA as a general term to refer to these statutes.

suboptimal accounts. The rate of outbound rollovers also does not differ meaningfully by tax status: average annual rates of outbound rollovers range from 0.55% to 0.70% of all open accounts. We do notice that states with tax deductions and tax parity have a higher rate of inbound rollovers than do outbound rollovers, while states without tax deductions or without state income taxes have a higher rate of outbound rollovers than inbound rollovers. This is consistent with a small fraction of households moving their 529 investments across states and considering tax deductions in their decision.[15]

3.2. Information Processing Frictions: Household Financial Literacy

The observed preference for in-state plans documented in Section 3.1 also suggests that households may experience information processing frictions affecting their investment decisions, perhaps due to lack of awareness that they could invest in out-of-state plans, or information acquisition and integration frictions impeding their ability to compare plans.[16] Such frictions could result in households choosing local plans even when they might earn higher payoffs by choosing a nonlocal one. To evaluate this hypothesis, we use a within-state design to assess whether investment in a suboptimal plan versus an optimal plan in the same state differs according to information-processing frictions. The first friction we examine is a lack of financial literacy: savvier households may better understand how state tax deductions, residency restrictions, asset-based management fees, and other components affect terminal payoffs given a menu of investment options. For example, Hastings and Tejeda-Ashton (2008) and Hastings and Mitchell (2020) document positive correlations between financial literacy and investment in lower-cost funds. The financial literacy literature generally shows that less savvy individuals make less optimal decisions regarding choosing and paying off loans, and contributing to savings and retirement plans (Hastings et al. 2013; Lusardi and Mitchell 2014).

If financial literacy enhances households' understanding of the benefits and costs of different plans, we expect a positive relationship between state levels of household financial literacy and the relative

[15] Not all responding states had available rollover statistics, so the rollover dataset has fewer observations than the residency dataset used in Table 4A. The number of observations limits our ability to compute *t*-statistics.
[16] See Blankespoor et al. (2019) for a framework of sequential steps and frictions to using information and Blankespoor et al. (2020) for a review of the information processing costs literature.

proportion of within-state 529 accounts invested in optimal plans. To test this, we use household financial literacy data from FINRA's National Financial Capability Study (NFCS). The state-by-state NFCS surveys are conducted for a nationally representative sample of U.S. adults including approximately 500 individuals per state plus the District of Columbia. The NFCS reports two indices of financial literacy: (1) an objective measure based on the proportion of correct responses to several objective test questions, and (2) a subjective measure based on individuals' self-assessed financial literacy levels. We anticipate that the more objective measure assesses financial knowledge more accurately than the subjective self-confidence measure (Lusardi and Mitchell 2014). To test whether financial literacy is related to suboptimal 529 asset locations, we focus on the subset of states with multiple plan offerings, where one plan is model-identified optimal and the others are suboptimal plans. Focusing on this subset of states allows us to isolate the extent of suboptimal investment without confounds such as variation in household decisions to invest in a particular state. We regress the within-state proportion of optimal accounts on measures of the financial literacy of the state's households. Our constructs are measured at the state-year level.[17]

Table 5 confirms that states with higher levels of financial literacy have a higher proportion of open accounts invested in optimal home-state plans. A one standard deviation increase in a state's financial literacy level, measured by the proportion of NFCS questions answered correctly, corresponds to a statistically significant 8.5% increase in the proportion of open accounts held in the state's optimal plan. Using the assets in open 529 accounts in these states, this increase corresponds to a $860 million increase in optimal investment in these states.[18] We also find that suboptimal plans in this set of states are all advisor-sold plans with higher fees, suggesting that less financially literate households are more likely to use costly financial advice (e.g., Foerster et al. 2017). By contrast, the self-assessed financial literacy index is

[17] Our proxies can be sticky across years, in part due to measurement frequency. For instance, the financial literacy survey is conducted every three years. Therefore, we do not include state fixed effects.

[18] The average amount of open assets in these states is $10.1 billion (untabulated). We multiply the coefficient on financial literacy by the variable's standard deviation to obtain the increase in the proportion of optimal accounts of 8.5%, which we multiply by the average amount of open assets in these states' plans to obtain $860 million (=1.892 × 0.045 × $10.1 billion).

negatively related to the proportion of optimal accounts in that state, suggesting that a behavioral component (such as overconfidence) leads to suboptimal investment.[19]

3.3. Information Processing Frictions: Disclosure Complexity

Households also face an information-processing burden related to the complexity of the information presented in plan disclosure documents. Plan disclosure and participation documents describe key features of the plans – who can open an account, how to open an account, available portfolios, fees, tax deductions, legal information, etc. – all of which are fundamental to 529 plan decision-making. The average plan disclosure statement and participation agreement comprises over 65 pages of financial and accounting information, and these plans rarely contain a summary section (mandated by the SEC for mutual funds). Prior literature finds that disclosure complexity in other settings can impede investors' ability to analyze such disclosures and assess investment costs (e.g., deHaan et al. 2021). We hypothesize that increased complexity of the optimal home-plan's disclosure document relative to the suboptimal home-plan's disclosure document is associated with lower investment in the optimal home-plan compared to the suboptimal home-plan.

This analysis continues to focus on states with multiple 529 plan offerings, where one plan is an optimal home-plan and the others are suboptimal. We compute two measures of disclosure complexity: Disclosure Complexity 1 is the Gunning Fog Index, and Disclosure Complexity 2 is the reverse of the Flesch Reading Ease score. Both measures are based on sentence length and word length, and higher scores indicate greater complexity for both measures. The measures differ in that Disclosure Complexity 1 applies a binary classification of word length based on syllable count, while Disclosure Complexity 2 counts the average number of syllables in the entire document (Li 2008; Dougal et al. 2012; Loughran and McDonald 2014; Loughran and McDonald 2020). Disclosure Complexity 1 has a mean score of 10.2 across plan documents, implying that that the average document requires a high school sophomore reading level.

[19] We find similar results if we include both measures of financial literacy in the same regression (untabulated). A source of measurement error in our proxies is that that a fraction of 529 accounts are held by out-of-state investors, as seen in the FOIA dataset. Thus, state-level measures may not reflect those of out-of-state investors. Our interpretation of these tests and their results is subject to this limitation.

Disclosure Complexity 2 has a mean score of 62.1 across documents, implying that the average document requires a college graduate reading level. We further control for asset-based fees as these may be correlated with disclosure complexity and affect investors' choices (deHaan et al. 2021).

Table 5 shows that higher Disclosure Complexity 1 for the optimal home-plan's disclosure document, relative to the suboptimal home-plan's, is associated with lower investment in the optimal home-plan compared to the suboptimal home-plan. A one standard deviation increase in the Disclosure Complexity 1 ratio corresponds to a 5.9% decrease in the proportion of open accounts held in the state's optimal plan, which corresponds to a $595 million decrease in optimal investment in these states. In addition, greater Disclosure Complexity 2 in the optimal home plan's disclosure document relative to the suboptimal home plan's disclosure document is associated with lower investment in the optimal home plan compared to the suboptimal home plan. A one standard deviation increase in the Disclosure Complexity 2 ratio corresponds to a 13.4% decrease in the optimally-located account proportion, which corresponds to a $1.4 billion decrease in optimal investment in these states.[20] These results imply that plan disclosure complexity deters optimal household investment: households prefer plans with simpler disclosures; thus, plan disclosure complexity may impede households' ability to invest optimally.

4. Additional Analyses

4.1. Alternative Explanation: Local Information Advantages

One reason that households may prefer local investments is that they could have local information advantages, in which case their local choice might not be suboptimal. In other investment settings, previous studies report that both individual and institutional investors incorporate local information (e.g., Coval and Moskowitz 1999, Ivkovic and Weisbenner 2005, Hau and Rey 2008, Baik et al. 2010). This is because geographic proximity can offer a local information advantage when investors have easier access to

[20] We multiply the coefficient on Disclosure Complexity 1 (ratio) by the variable's standard deviation to obtain the decrease in the proportion of optimal accounts of 5.9%, which we multiply by the average amount of open assets in these states' plans to obtain $595 million (=0.892 × 0.066 × $10.1 billion). We multiply the coefficient on Disclosure Complexity 2 (ratio) by the variable's standard deviation to obtain the decrease in the proportion of optimal accounts of 13.4%, which we multiply by the average amount of open assets in these states' plans to obtain $1.4 billion (=1.696 × 0.079 × $10.1 billion).

information about companies located near them (Grinblatt and Keloharju 2001). That literature compares the returns of investors' local portfolio holdings (companies headquartered in the same state as the investor) to the returns of investors' non-local holdings. They generally find that local investments earn an additional abnormal return relative to nonlocal holdings (although conflicting evidence does exist, e.g., Seasholes and Zhu 2010).

If local information advantages explain the distribution of 529 accounts, we would expect that model-identified "suboptimal" plans earn higher risk-adjusted returns than do model-identified "optimal" plans. That is, households could have an information advantage regarding their local plan's investment strategies, which could predict outperformance. To test this, we compute plans' realized risk-adjusted returns by aggregating monthly portfolio returns from Morningstar to the plan-level, weighting by portfolio net assets. Table 6A presents the results of *t*-tests comparing the Sharpe ratios of optimal versus suboptimal plans at 3-, 5-, and 10-year time horizons. It shows that *ex-ante* suboptimal plans underperform ex-ante optimal plans throughout our sample period. This result suggests that households choosing suboptimal plans have no local informational advantages that generate greater terminal payoffs for their beneficiaries. Furthermore, this result validates that the *ex-ante* suboptimal plans identified by our model are also ex-post suboptimal based on their realized returns over multiple time periods.

We further investigate the information advantage explanation by analyzing the subset of plans for which households are most likely to possess local information. A stricter formulation of information advantages is that a household maintains an informational advantage only for plans managed by a local asset management company, as opposed to plans managed by out-of-state asset management companies. A local information advantage might occur through access to the local company managing the assets, as opposed to the state office offering the plan. Table 6B presents a *t*-test of the difference between the realized Sharpe ratios of optimal plans with out-of-state managers versus those of suboptimal home-state plans with in-state managers. Again, suboptimal plans underperform: suboptimal home-state plans with in-state managers underperform optimal plans with out-of-state managers. This result is consistent with households

choosing suboptimal plans and having no local information advantage that provides greater terminal payoffs.

4.2. Robustness Tests: Variation in the Investment Time Horizon

Our model assumes that a representative household makes a $10,000 one-time contribution to a 529 plan of choice, consistent with most disclosure documents. Furthermore, our model assumes that a household opens an account for a beneficiary when the child is born, resulting in an assumed 18-year investment horizon (Leung and Wendell 2020). Of course, a household can contribute in several different ways: $1,000 annually over ten years; $5,000 or even $75,000 in one lump sum; or over shorter time horizons.[21] They can also face different state effective tax rates.[22] While we cannot model all possible combinations, we do conduct robustness tests with key variations in assumptions for the representative household. We consider (1) a shorter account life, (2) spreading contributions over time, and (3) a return assumption inferred from past performance.

Different investment horizons may be of interest since households can open accounts for their beneficiaries several years after a child's birth, as uncertainty about the beneficiary's propensity to attend college is resolved. Different investment time horizons change the relative impact of the model's parameters on the expected terminal payoff: as the investment time horizon shortens, the asset-based percentage fee has a smaller impact on the terminal payoff, compared to account maintenance fees and the state tax-deduction on contributions. To this end, we use a 10-year period as an alternative investment horizon (T = 10), assuming that an account is opened when the beneficiary is eight years old. Comparing our main results to this alternative assumption, we document results consistent with our main inferences. We find that 66%

[21] 529 plans do not have annual contribution limits. Nevertheless, 529 plan contributions are considered completed gifts for federal tax purposes: up to $15,000 per donor per beneficiary qualified for the annual gift tax exclusion (in 2020). Alternatively, a donor can 'superfund' the account by making the equivalent of 5 years' worth of contributions ($75,000) at once, as allowed by the tax code.

[22] We find the labeling of optimal plans slightly differs below the $50,000 gross household income mark, as matching grants (state tax deductions) play a larger (smaller) role below that threshold. Different modeling outcomes for low-income households should not materially affect our results, however, as Hannon et al. (2016) find that the 529 participation rate is very small (0.3%) for households with $50,000 or less in income, compared to 16% in the highest income percentiles. Our empirical findings can be interpreted to reflect the actions of household incomes above $50,000 (national median ≈ $59,000 throughout our sample period).

of assets under management and 62% of open accounts are held in suboptimal plans on average over our sample period, slightly lower than the 71% of assets and 67% of open accounts reported in Section 2.2.

Using a T = 10 investment horizon, we also reach similar conclusions regarding households' information-processing frictions. Table 7A shows that states with higher objective, but not subjective, levels of financial literacy have more open accounts in the optimal home plan than in the suboptimal home plan. States with more complex optimal home plan disclosure documents, measured relative to the complexity of suboptimal home plan disclosure documents, have fewer accounts in the optimal home plan compared to the suboptimal home plan. Once again, information-processing frictions appear to drive household suboptimal 529 financial decisions. Table 7B shows that the set of optimal plans continues to outperform suboptimal plans on a realized risk-adjusted basis, reaffirming that households do not maintain a local informational advantage in their 529 savings choices. Lastly, Table 7C shows that the set of optimal plans managed by out-of-state asset management companies continues to outperform suboptimal plans with in-state asset management companies, on a realized risk-adjusted basis.

4.3. Robustness Tests: Variation in the Amount and Timing of Contributions

The next robustness test uses alternative assumptions about the amount and timing of contributions. Instead of making a one-time $10,000 contribution, a household could contribute to a plan on a repeated basis over many years, especially if it contributes a portion of their annual income. To illustrate this case, we assume that the household equally distributes a $10,000 total contribution over 18 calendar year-ends, for a contribution of $555 per year. The timing of contributions is unlikely to significantly change inferences: an optimal plan that is optimal in the first contribution year will continue to be an optimal plan in subsequent years. Yet, the reduction in the contribution amount can spur differences, since a smaller contribution increases the relative value of the state tax-deduction. That is, a greater proportion of the contribution qualifies for a tax deduction in states with limits on the amount of a contribution eligible for tax deductions.

Using this alternative assumption, we find that 65% of assets under management and 61% of open accounts were held in suboptimal plans, on average, over our sample period. Both figures are slightly lower

than the 71% of assets and 67% of open accounts described in our base case. Table 8 repeats the analyses of Sections 3 and 4.1 using this alternative contribution assumption. Overall, our inferences are qualitatively unchanged. Table 8A shows that states with higher objective, but not subjective, levels of financial literacy have more open accounts in the optimal home plan versus the suboptimal home plan. States with more complex optimal home plan disclosure documents, relative to those of suboptimal home plan documents, have lower investments in the optimal home compared to the suboptimal home plan. Table 8B shows that the choice set of optimal plans continues to outperform suboptimal plans on a realized risk-adjusted basis, reaffirming that households maintain no local informational advantage in their 529 savings choices under this alternate assumption. Lastly, Table 8C shows that shows that the set of optimal plans managed by out-of-state asset management companies continues to outperform suboptimal plans with in-state asset management companies on a realized risk-adjusted basis. Collectively, the finding that information processing frictions contribute to household suboptimal financial decisions remains robust to alternative modeling assumptions for the representative household.

4.4. Robustness Tests: Variation in the Return Assumption

A final robustness test uses an alternative assumption for returns on investment, where a household assesses investment options using their past investment performance, rather than using the 5% return assumption provided in plan disclosure documents. That is, if the household uses past returns to form expectations about future returns, this may explain why households favor our *ex-ante* "suboptimal" plans. that households estimate the year their beneficiary will attend college and compare the past performance of target-date/age-based investment options matching that horizon. Plan disclosure documents commonly project the cost of fees to a 10-year horizon, so we focus on investment options that match the 10-year investment horizon. For example, in 2014, we isolate target-date portfolios covering 2024 as the enrollment year and age-based portfolios covering age eight.[23] We calculate each plan-year's annualized trailing five-year return and use it as r^p (defined in Section 1.2). This analysis shows that 97% of assets under

[23] The 10-year investment horizon also allows us to calculate trailing returns, as 18-year-out investment options tend to be newer offerings with shorter return histories.

management and 96% of open accounts were held in suboptimal plans, on average, over our sample period. Therefore, suboptimal investment is even higher than our base case using this alternative return assumption.[24] In other words, the widespread suboptimal 529 investment we observe in our base case is not the result of households choosing plans with the best past performance.

5. Conclusions

This paper evaluates the geographic distribution of household investment in 529 college savings plans, using a model for household decision-making composed from the features and considerations presented in plan disclosures. Combined with data on the distribution of 529 plan assets, we show that a substantial proportion of 529 plan accounts is invested in *ex-ante* suboptimal plans. The aggregate projected dollar loss for households contributing to suboptimal plans was $13.4 billion in 2020, representing 6% of projected terminal payoffs. We propose that this outcome often results from household information-processing frictions, since many in-state plans charge high costs without offsetting residency-dependent tax benefits or matching grants. Using data collected via FOIA requests to state sponsors, we confirm that in-state investment in states with tax deductions is not meaningfully higher than in states without tax deductions or with tax parity. Thus, household decisions to invest in home-state 529 plans do not appear to take into account the potential benefits of out-of-state plans, which are more likely to provide higher payoffs when the home state lacks a state tax deduction or has tax parity. Our results also suggest that suboptimal investment is positively associated with lower resident financial literacy and more complex plan disclosures. Thus, disclosure complexity and behavioral explanations, including perceived versus objective financial competency, are factors shaping household decisions regarding where to invest.

Our findings contribute to the literature by providing novel evidence of households' local preferences and suboptimal investment in the context of their savings decisions for the next generation. Critically, these investment choices reduce individuals' financial well-being, making our findings

[24] Choosing plans based on past performance produces poor forward-looking outcomes: plans with high past-performance exhibit lower forward-looking realized Sharpe ratios (untabulated). Our primary model assumes an expected 5% gross return, because (a) plan documents explicitly project fees using the 5% assumption and not past performance, and (b) plan documents explicitly state that past performance may not be indicative of future performance.

informative for policymakers. Although many individuals make suboptimal choices in the education savings market, no federal agency is currently charged with ensuring the safety, quality, and cost-effectiveness of college savings plans across the nation (Curtis 2020). This is in sharp contrast to qualified retirement plans, where plan sponsors must act as fiduciaries under federal law and manage savers' assets prudently. In view of the size of 529 plan assets and the institutional complexity facing savers in these plans, our results will be informative for those designing policies to improve household financial well-being – not only over the life cycle, but across generations.

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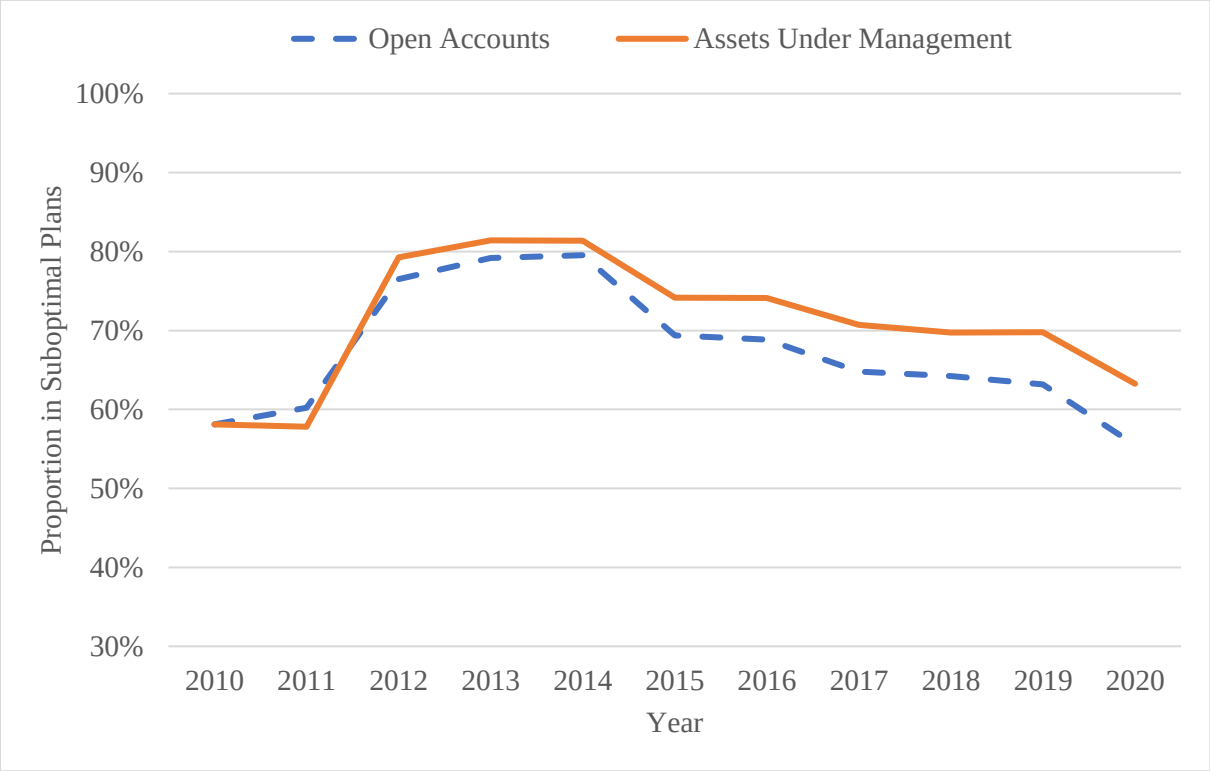
Figure 1: Suboptimal Investment and Welfare Loss by Year

Panel A plots suboptimal 529 plan assets under management and open accounts by year over the sample period. Suboptimal investment is calculated as a proportion of total assets under management and total open accounts across optimal and suboptimal plans. In Panel A, the discontinuity in 2012 is attributed to six states charging the same lowest fee in 2010 and 2011, followed by a plan breaking the tie in 2012. Panel B presents the aggregate dollar welfare loss from households' choosing suboptimal instead of optimal 529 plans, by year over the sample period.

Panel A: Suboptimal Investment Over Time



Panel B: Welfare Loss Over Time

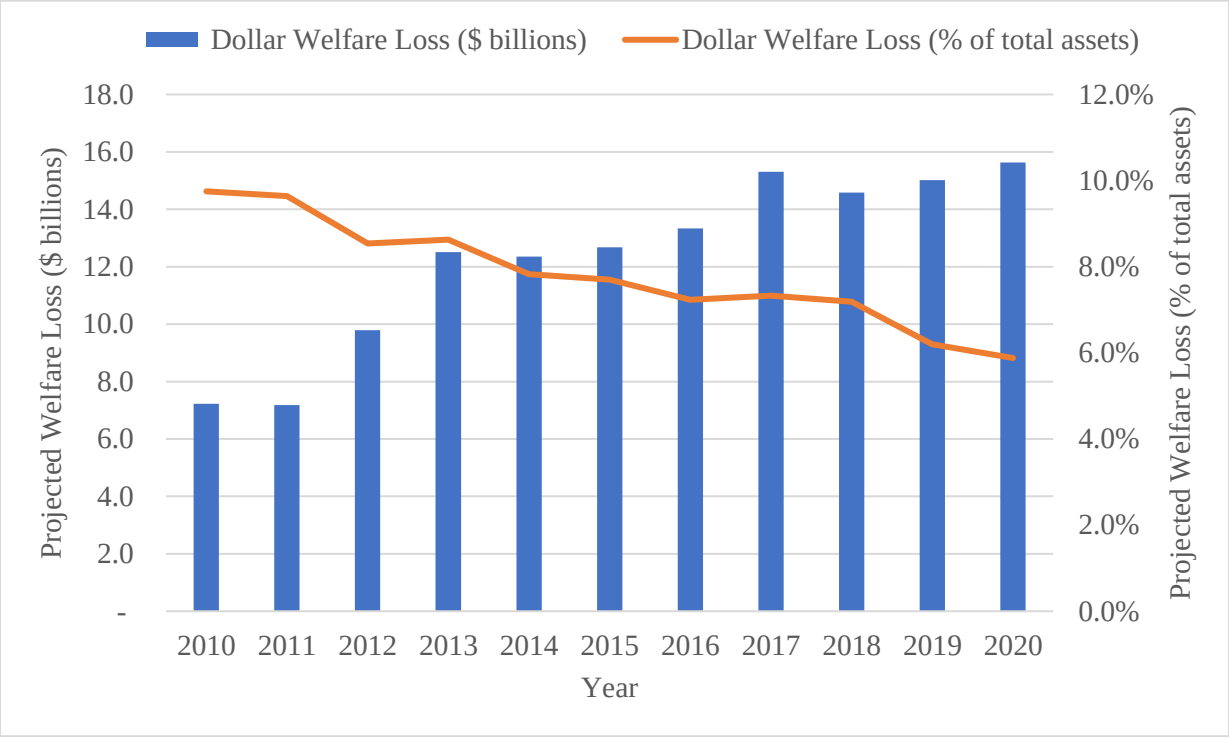


Table 1: Variable Definitions and Summary Statistics

Panel A defines our variables. Panel B presents summary statistics for variables measured at the plan-year level. Panel C presents summary statistics for variables measured at the state-year level. Variable names ending with "(proportion)" refer to the value for the state's optimal 529 plan as a proportion of the total value across all plans in the state. Variable names ending with "(ratio)" refer to the ratio of the state's optimal plan value to the suboptimal home-state plan value (or average across multiple suboptimal plans in the state).

Panel A: Variable Definitions

Variable	Definition	Source
Assets Under Management	Total market value of investments in plan or portfolio, measured in $ millions.	CSPN
Assets Under Management (proportion)	Proportion of total assets under management in the state held in the optimal in-state plan, based on our model calculation.	CSPN
Disclosure Complexity 1	Disclosure complexity measured using the Gunning Fog Index, based on sentence length and word length. The index applies a binary classification of word length based on syllable counts. Calculated at the state-year level as the average for all plans in a state-year.	MSRB
Disclosure Complexity 1 (ratio)	Ratio of Disclosure Complexity 1 (Gunning Fog Index) of the optimal in-state plan disclosure to that of the suboptimal in-state plan disclosure.	CSPN
Disclosure Complexity 2	Disclosure complexity using the Reverse Flesch Reading Ease score, calculated as 101 less Flesch Reading Ease, where Flesch Reading Ease is a readability index based on sentence length and word length. The index counts the average number of syllables across the entire document to determine word length. Calculated at the state-year level as the average for all plans in a state-year.	MSRB
Disclosure Complexity 2 (ratio)	Ratio of Disclosure Complexity 2 (Reverse Flesch Reading Ease) of the optimal in-state plan disclosure to that of the suboptimal in-state plan disclosure.	CSPN
Expected 529 Participation	Proportion of a state's age 25-65 population with at least some college education.	ACS
Home-State Investment Manager	Indicator variable equal to one if the plan has a portfolio managed by an in-state investment manager.	Morningstar
Literacy: Self-Assessed High	Proportion of households in a state assessing their financial literacy to be high. Surveys conducted in 2009, 2012, 2015, and 2018; linear interpolation applied for years in between.	NFCS
Literacy: Test Questions Correct	Proportion of financial literacy assessment questions answered correctly by households in a state. Surveys conducted in 2009, 2012, 2015, and 2018; we linearly interpolate values for years between the survey years.	NFCS
Married Household Income	Average married-couple household income for a state, measured in $ thousands	ACS
Open Accounts	Total number of accounts open in plan, measured in thousands.	CSPN
Optimal Accounts (proportion)	Proportion of total open accounts in the state held in the optimal in-state plan, based on our model calculation.	CSPN

Sharpe Ratio (*X*-Year)	Risk-adjusted return of the plan, calculated over the next *X* years.	Morningstar
Total Asset-Based Fee	Annual cost of portfolio investment including all fees, as a percentage of assets under management.	MSRB
Total Asset-Based Fee (ratio)	Ratio of the total-asset based fee of the optimal in-state plan to that of the suboptimal in-state plan.	MSRB

Panel B: Plan-Year Variable Summary Statistics

Variable	**Mean**	**Median**	**P25**	**P75**	**Std. Dev.**	**Obs.**
Assets Under Management	3,019.217	1,235.525	388.687	3,254.438	6,809.580	803
Open Accounts	137.977	73.413	22.419	171.856	262.560	803
Total Asset-Based Fee	0.740%	0.710%	0.440%	1.030%	0.370%	803
Sharpe Ratio (36-month)	0.277	0.280	0.196	0.334	0.102	602
Sharpe Ratio (60-month)	0.259	0.257	0.210	0.309	0.072	442
Sharpe Ratio (120-month)	0.274	0.275	0.251	0.306	0.038	109
Disclosure Complexity 1	10.152	10.170	9.575	10.785	0.933	803
Disclosure Complexity 2	62.113	61.630	59.710	63.460	4.773	803
Disclosure Page Count	67.169	64.000	47.500	80.000	26.618	803

Panel C: State-Year Variable Summary Statistics

Variable	**Mean**	**Median**	**P25**	**P75**	**Std. Dev.**	**Obs.**
Literacy: Correct Answers	0.545	0.545	0.508	0.579	0.045	517
Literacy: Self-Assessed High	0.726	0.727	0.705	0.747	0.029	517
Expected 529 Participation	0.688	0.693	0.655	0.726	0.054	517
Married Household Income	102.825	99.173	89.243	112.473	18.287	517
Assets Under Management (proportion)	0.482	0.479	0.141	0.826	0.317	112
Optimal Accounts (proportion)	0.471	0.401	0.213	0.802	0.283	112
Disclosure Complexity 1 (ratio)	1.008	1.011	0.961	1.049	0.066	112
Disclosure Complexity 2 (ratio)	1.010	1.006	0.986	1.027	0.079	112
Total Asset-Based Fee (ratio)	0.314	0.301	0.162	0.442	0.156	112

Table 2: Suboptimal Investment and Welfare Loss by Year

Panel A presents the suboptimal 529 plan assets under management and open accounts by year over the sample period. Suboptimal investment is presented as a proportion of total assets under management and total open accounts across optimal and suboptimal plans. Panel B presents the aggregate dollar welfare loss from households' choosing suboptimal plans instead of optimal plans by year over the sample period. The last column of Panel B presents the range of percent welfare losses across all suboptimal plans by year.

Panel A: Suboptimal Investment by Year

Year	Total Accounts (thousands)	Total AUM ($ millions)	Suboptimal Accounts (thousands)	Suboptimal AUM ($ millions)	Suboptimal Accounts (%)	Suboptimal AUM (%)
2010	4,218	77,911	2,450	45,254	58.1	58.1
2011	4,698	83,118	2,829	48,051	60.2	57.8
2012	5,558	108,967	4,252	86,357	76.5	79.3
2013	6,138	145,093	4,861	118,125	79.2	81.4
2014	6,619	162,850	5,265	132,533	79.5	81.4
2015	7,552	176,022	5,240	130,518	69.4	74.1
2016	7,899	196,238	5,437	145,419	68.8	74.1
2017	8,628	241,895	5,591	171,087	64.8	70.7
2018	9,232	235,842	5,930	164,427	64.2	69.7
2019	9,768	291,947	6,172	203,673	63.2	69.8
2020	10,747	359,477	5,963	227,385	55.5	63.3

Panel B: Welfare Loss by Year

Year	Welfare Loss Amount ($ millions)	Welfare Loss (%)	Welfare Loss Range (%)
2010	4,412	9.8	[1.5, 25.4]
2011	4,632	9.6	[0.7, 25.4]
2012	7,375	8.5	[0.6, 27.0]
2013	10,194	8.6	[0.5, 28.1]
2014	10,377	7.8	[0.3, 23.1]
2015	10,050	7.7	[0.1, 23.3]
2016	10,514	7.2	[0.0, 33.0]
2017	12,541	7.3	[0.0, 23.7]
2018	11,822	7.2	[0.0, 23.7]
2019	12,628	6.2	[0.1, 23.7]
2020	13,370	5.9	[0.5, 24.2]

Table 3: Suboptimal Investment and Welfare Loss by Tax Status

Panel A presents suboptimal 529 plan assets under management and open accounts by state tax status. Suboptimal investment is calculated as a proportion of total assets under management and total open accounts across optimal and suboptimal plans. Panel B presents the aggregate dollar welfare loss from households' choosing suboptimal plans instead of optimal plans by state tax status. The last column of Panel B presents the range of percent welfare losses across all suboptimal plans in each set of states with that tax status. In both panels, we sum accounts and AUM across all years (2010 through 2020) and divide by 11 to display the annual average for each set of states with that tax status.

Panel A: Suboptimal Investment by Tax Status

Tax Status	Total Accounts (thousands)	Total AUM ($ millions)	Suboptimal Accounts (thousands)	Suboptimal AUM ($ millions)	Suboptimal Accounts (%)	Suboptimal AUM (%)
No Deduction	928	21,171	661	14,902	71.2	70.4
No State Tax	1,744	41,594	1,641	39,288	94.1	94.5
Tax Deduction	4,292	116,449	2,217	70,166	51.7	60.3
Tax Parity	405	9,818	389	9,537	96.1	97.1

Panel B: Welfare Loss by Tax Status

Tax Status	Welfare Loss Amount ($ millions)	Welfare Loss (%)	Welfare Loss Range (%)
No Deduction	1,615	10.8	[0.5, 20.0]
No State Tax	2,774	7.1	[0.5, 28.1]
Tax Deduction	5,150	7.3	[0.0, 33.0]
Tax Parity	420	4.4	[0.5, 18.1]

Table 4: Analysis of Local and Nonlocal Investment

Panel A presents the average proportion of accounts held by in-state residents by state tax status. Statistics are as of a month-end between December 2022 and June 2023. Panel B presents the percentage of accounts rolled into or out of a state's plan into another plan. Percentages are calculated with the total number of open accounts in the state as the denominator. Rollover statistics reflect calendar year 2022 or an annualized quarter, where the quarter is between fourth-quarter 2022 and second-quarter 2023.

Panel A: In-State Investment by Tax Status

Tax Status	In-State Resident Accounts (%)	Number of Plans
No Deduction	60	8
No State Tax	35	13
Tax Deduction	68	34
Tax Parity	57	6

Panel B: Rollovers by Tax Status

Tax Status	Rollovers Out (%)	Rollovers In (%)	Number of Plans
No Deduction	0.59	0.40	6
No State Tax	0.63	0.35	11
Tax Deduction	0.55	0.64	15
Tax Parity	0.70	1.34	3

Table 5: Analysis of Information Processing Frictions

This table presents the results of regressing the within-state proportion of optimal 529 accounts on proxies for household information-processing frictions, financial literacy, and plan document disclosure complexity. The sample for this analysis includes state-years with both an optimal and suboptimal plan. All variables are defined in Table 1A. *t*-statistics appear in parentheses and are based on standard errors clustered by year. Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

	Dependent Variable: Optimal Accounts (proportion)			
Variable	(1)	(2)	(3)	(4)
Literacy: Test Questions Correct	1.892***	2.294***		
	(3.535)	(6.171)		
Literacy: Self-Assessed High			-1.022*	-1.881***
			(-1.858)	(-4.709)
Disclosure Complexity 1 (ratio)	-0.892***		-0.786***	
	(-4.196)		(-4.208)	
Disclosure Complexity 2 (ratio)		-1.696***		-1.672***
		(-5.648)		(-5.342)
Total Asset-Based Fee (ratio)	-0.762***	-0.521***	-0.751***	-0.491***
	(-6.084)	(-3.248)	(-6.467)	(-2.963)
Married Household Income	0.003***	0.004***	0.001**	0.002**
	(3.385)	(4.468)	(2.088)	(2.336)
Expected 529 Partipication	1.356***	1.118***	2.316***	2.399***
	(5.529)	(4.684)	(11.118)	(12.130)
Observations	112	112	112	112
Year Fixed Effects	Y	Y	Y	Y
Adjusted R^2	0.412	0.548	0.398	0.538

Table 6: Analysis of Local Information Advantage Alternative Explanation

Panel A presents *t*-tests of the differences between the realized Sharpe ratios of optimal 529 plans and those of suboptimal plans. Panel B presents *t*-tests of the differences between the realized Sharpe ratios of optimal plans with out-of-state program managers and those of suboptimal home-state plans with in-state program managers. Sharpe ratios are calculated using monthly plan returns. All variables are defined in Table 1A. *t*-statistics appear in parentheses and are based on standard errors clustered by year. Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

Panel A: Sharpe Ratios of Optimal Plans vs. Suboptimal Plans

***t*-test**	**Sharpe Ratio (3-Year)**	**Sharpe Ratio (5-Year)**	**Sharpe Ratio (10-Year)**
Difference (Optimal – Suboptimal)	0.047***	0.048***	0.046***
	(7.521)	(8.816)	(9.057)
Observations	517	380	77

Panel B: Sharpe Ratios of Optimal Plans with Out-of-State Program Managers vs. Suboptimal Plans with In-State Program Managers

***t*-test**	**Sharpe Ratio (3-Year)**	**Sharpe Ratio (5-Year)**	**Sharpe Ratio (10-Year)**
Difference (Optimal – Suboptimal)	0.047***	0.047***	0.048***
	(2.828)	(3.649)	(4.466)
Observations	81	60	10

Table 7: Robustness Test: Variation in Investment Horizon

Panels A, B, and C repeat the tests presented in Tables 5, 6A, and 6B, respectively, using a one-time $10,000 contribution for a 10-year account life as an alternate formulation of a representative household's 529 contribution schedule. Panel A presents the results of a regression of the within-state proportion of optimal accounts on measures of financial literacy, disclosure complexity, and controls. Panel B presents a *t*-test of the difference between the forward-looking realized Sharpe ratios of optimal and suboptimal plans. Panel C presents a *t*-test of the difference between forward-looking realized Sharpe ratios of optimal plans with out-of-state program managers and those of suboptimal plans with in-state program managers. All variables are defined in Table 1A. *t*-statistics appear in parentheses and are based on standard errors clustered by year. Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

Panel A: Analysis of Information Processing Frictions

	Dependent Variable: Optimal Accounts (proportion)			
Variable	(1)	(2)	(3)	(4)
Literacy: Test Questions Correct	1.336**	1.890***		
	(2.477)	(6.059)		
Literacy: Self-Assessed High			-0.017	-1.049*
			(-0.027)	(-1.728)
Disclosure Complexity 1 (ratio)	-1.060***		-0.992***	
	(-3.041)		(-3.309)	
Disclosure Complexity 2 (ratio)		-1.876***		-1.829***
		(-6.703)		(-6.652)
Total Asset-Based Fee (ratio)	-0.460***	-0.349***	-0.453***	-0.332***
	(-3.622)	(-3.007)	(-3.550)	(-3.112)
Married Household Income	0.001***	0.005***	0.002**	0.003***
	(2.786)	(3.906)	(2.421)	(2.863)
Expected 529 Partipication	0.238	0.021	0.803***	0.926***
	(0.673)	(0.070)	(4.428)	(3.584)
Observations	139	139	139	139
Year Fixed Effects	Y	Y	Y	Y
Adjusted R^2	0.239	0.447	0.229	0.432

Panel B: Sharpe Ratios of Optimal Plans vs. Suboptimal Plans

***t*-test**	**Sharpe Ratio (3-Year)**	**Sharpe Ratio (5-Year)**	**Sharpe Ratio (10-Year)**
Difference (Optimal – Suboptimal)	0.049***	0.049***	0.047***
	(7.393)	(8.683)	(9.010)
Observations	477	357	74

Panel C: Sharpe Ratios of Optimal Plans with Out-of-State Program Managers vs. Suboptimal Plans with In-State Program Managers

***t*-test**	**Sharpe Ratio (3-Year)**	**Sharpe Ratio (5-Year)**	**Sharpe Ratio (10-Year)**
Difference (Optimal – Suboptimal)	0.060***	0.058***	0.048***
	(2.759)	(3.753)	(4.466)
Observations	57	46	10

Table 8: Robustness Test: Variation in the Amount and Timing of 529 Contributions

Panels A, B, and C repeat the tests presented in Tables 5, 6A, and 6B, respectively, using a $10,000 contribution divided equally over 18 years ($555 per year) as an alternate formulation of a representative household's 529 contribution schedule. Panel A presents the results of a regression of the within-state proportion of optimal accounts on measures of financial literacy, disclosure complexity, and controls. Panel B presents a *t*-test of the difference between forward-looking realized Sharpe ratios of optimal plans and those of suboptimal plans. Panel C presents a *t*-test of the difference between forward-looking realized Sharpe ratios of optimal plans with out-of-state program managers and those of suboptimal plans with in-state program managers. All variables are defined in Table 1A. *t*-statistics appear in parentheses and are based on standard errors clustered by year. Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

Panel A: Analysis of Information Processing Frictions

	Dependent Variable: Optimal Accounts (proportion)			
Variable	(1)	(2)	(3)	(4)
Literacy: Test Questions Correct	1.352**	1.863***		
	(2.318)	(6.334)		
Literacy: Self-Assessed High			-0.078	-1.084*
			(-0.118)	(-1.812)
Disclosure Complexity 1 (ratio)	-1.024***		-0.958***	
	(-3.164)		(-3.431)	
Disclosure Complexity 2 (ratio)		-1.851***		-1.811***
		(-6.793)		(-6.726)
Total Asset-Based Fee (ratio)	-0.463***	-0.351***	-0.454***	-0.334***
	(-3.670)	(-3.089)	(-3.591)	(-3.195)
Married Household Income	0.003**	0.005***	0.002**	0.003***
	(2.471)	(3.756)	(2.169)	(2.775)
Expected 529 Partipication	0.275	0.082	0.860***	0.994***
	(0.713)	(0.272)	(4.475)	(3.676)
Observations	138	138	138	138
Year Fixed Effects	Y	Y	Y	Y
Adjusted R^2	0.244	0.446	0.234	0.433

Panel B: Sharpe Ratios of Optimal Plans vs. Suboptimal Plans

***t*-test**	**Sharpe Ratio (3-Year)**	**Sharpe Ratio (5-Year)**	**Sharpe Ratio (10-Year)**
Difference (Optimal – Suboptimal)	0.049***	0.049***	0.047***
	(7.391)	(8.687)	(8.890)
Observations	479	356	73

Panel C: Sharpe Ratios of Optimal Plans with Out-of-State Program Managers vs. Suboptimal Plans with In-State Program Managers

***t*-test**	**Sharpe Ratio (3-Year)**	**Sharpe Ratio (5-Year)**	**Sharpe Ratio (10-Year)**
Difference (Optimal – Suboptimal)	0.061***	0.060***	0.047***
	(2.719)	(3.613)	(3.849)
Observations	53	42	8

Appendix A: Optimal and Suboptimal 529 Plans

This table shows a one-year extract of optimal and suboptimal home-state 529 plans, as identified by our model for year-end 2020. The first column presents the state tax status for a resident household's 529 plan contribution. The second column shows states where in-state investment is optimal, along with the name of the in-state optimal plan. The third column shows states where in-state investment is suboptimal.

Resident State Tax Status	States with Optimal Home-State Plans		States with Only Suboptimal Home-State Plans
Tax Deduction	AL	CollegeCounts 529 Fund Direct-Sold Plan	CO
	CT	CHET Direct College Savings Plan	DC
	GA	Path2College 529 Plan	ID
	IA	College Savings Iowa 529 Plan	MS
	IL	Bright Start Direct-Sold College Savings	ND
	IN	CollegeChoice 529 Direct Savings Plan	NE
	LA	Louisiana START Saving For College	OH
	MA	U.Fund College Investing Plan	OK
	MD	MD Sen Edward J. Kasemeyer Plan	VT
	MI	Michigan Education Savings Program	
	NM	The Education Plan	
	NY	New York's 529 Program (Direct)	
	OR	Oregon College Savings Plan	
	RI	Collegebound Saver	
	SC	Future Scholar 529 (Direct)	
	UT	My529	
	VA	Invest529	
	WI	Edvest 529 Plan	
	WV	Smart529 WV Direct College Savings Plan	
Tax Parity	CA	ScholarShare College Savings Plan	AR
	ME	NextGen College Investing Plan Direct	AZ
			KS
			MN
			MO
			MT
			PA
No State Tax	FL	Florida 529 Savings Plan	AK
			NH
			NV
			SD
			TN
			TX
			WA
No Deduction			DE
			HI
			KY
			NC
			NJ

Internet Appendix for
Suboptimal Investment and Local Preferences: Evidence from 529 College Savings Plans

This Internet Appendix contains accompanying analysis for the paper, "Suboptimal Investment and Local Preferences: Evidence from 529 College Savings Plans." The appendix is organized as follows: Section IA-1 shows the assumptions used by states to compare investment options for investors; Section IA-II shows the impact of state and plan characteristics on the expected terminal payoff (ETP) of a 529 investment; Section IA-III describes our data sources in additional detail; and Section IA-IV presents correlations of variables used in the hypothesis tests.

IA-1: Representative Household Assumptions

The following exhibits show the assumptions used in 529 plan documents. Exhibit 1 presents an excerpt from the Nevada Vanguard 529 College Savings Plan's 2011 disclosure document. Exhibit 2 presents an excerpt from the California ScholarShare College Savings Plan's 2014 disclosure document. Plans' assumptions remain consistent across states and throughout time.

Exhibit 1: 2011 Nevada Vanguard 529 College Savings Plan[25]

Investment Cost Example

The following example is intended to help you compare the cost of investing in the Portfolios over different time periods. It illustrates the hypothetical expenses that you would incur over various periods if you invest $10,000 in a Portfolio. This example assumes that a Portfolio provides a return of 5% a year, and that the Portfolio's expense ratio remains the same as shown in the table on page 17. The results apply whether or not the investment is redeemed at the end of the period, but they do not take into account any redemptions that are Nonqualified Withdrawals (defined in **Part 7. Other Information About Your Account—Withdrawals**) or withdrawals otherwise subject to state or federal income taxes or any penalties.

Exhibit 2: 2014 California ScholarShare College Savings Plan[26]

Investment Cost Example. The example in the following table is intended to help you compare the cost of investing in the different Investment Portfolios over various periods of time. This example assumes that:

- You invest $10,000 in an Investment Portfolio for the time periods shown below.
- Your investment has a 5% compounded return each year.
- You withdraw your entire investment from the Investment Portfolio at the end of the specified periods for Qualified Higher Education Expenses.
- Total Annual Asset-Based Fees remain the same as those shown in the Fee Table above.

[25] Vanguard 529 College Savings Plan, 2011, Program Description, *State of Nevada*.
[26] ScholarShare College Savings Plan, 2014, Plan Disclosure Booklet and Participation Agreement, *ScholarShare Investment Board*.

IA-2: Impact of State and Plan Characteristics on a 529 Plan's Terminal Payoff

Several state and plan characteristics impact the expected terminal payoff (ETP) of a pre-state tax contribution to a 529 plan. Key state characteristics affecting a plan's ETP include the state's income tax rate, its tax deduction benefits for 529 plan contributions, and its matching grants for contributions. Key plan characteristics shaping a plan's ETP include the plan's underlying portfolios, management fee, and account maintenance fee. As described in Section 1.2, these characteristics impact the $Contribution^{s,p}$, $Return^{s,p}$, and $Distribution^{s,p}$ components of a plan's terminal payoff.

By presenting the intermediate values of the model's calculations, this table reports the extent to which each of the characteristics affects the ETP. We assess the impact of a single state or plan characteristic by comparing the average ETP with and without that characteristic. Assumptions follow those in Section 1.2. The average expected terminal payoff (ETP) is $20,655, representing an 107% cumulative growth over the account lifetime from the pre-tax contribution of $10,000. The average ETP for minimum fees, defined as charging the minimum total asset-based fees across all plans in a year and no account maintenance fees, is $23,707, or 14.77% higher than the average ETP with fees. The average ETP without state tax deduction benefits is $20,498, or 0.76% lower. The average ETP without state income taxes (and thus had no need for tax deduction benefits), then the average ETP is $21,169, or 2.49% higher. Lastly, the average ETP without matching grants for 529 plan contributions is $20,595, or 0.29% lower. Therefore, among all state and plan characteristics, fees have the largest impact on the expected growth of a 529 plan contribution.

	Amount ($)	**ETP Difference (%)**
Expected Terminal Payoff (ETP) of $10,000 pre-tax contribution	20,655	
ETP with:		
Minimum Fees	23,707	14.77
No State Tax Benefits	20,498	-0.76
No State Taxes	21,169	2.49
No State Matching Grants	20,595	-0.29

IA-3: Data Sources

Plan Data Sources

We obtain information about plan characteristics from several data sources. The College Savings Plan Network (CSPN) reports data on assets under management and number of accounts by plan. We gather assets and accounts for each year-end between 2009 and 2021. The Municipal Securities Review Board (MSRB) reports plan disclosure documents for nearly all plans. We download all plan disclosure documents since 2009. For plans without disclosures in the MSRB database, we manually gather their historical disclosures from plan websites and internet searches. From each disclosure, we extract information on each plan portfolio's underlying management fees, program fees, and total asset-based fees as well as plan-level account maintenance fees. Morningstar Direct collects data on plan characteristics (direct- vs. advisor-sold, residency restrictions, matching grants, program manager, inception and obsolete dates) and portfolio characteristics (monthly returns, assets under management, and asset management company). We search asset management company websites to verify their headquarters to determine in-state vs. out-of-state status relative to each plan. Lastly, we use Saving For College data and plan websites as independent checks to verify the accuracy of our data. After cleaning the plan names, we merge the CSPN, MSRB, and Morningstar data sets by plan name.

State Data Sources

We obtain state characteristics from multiple data sources. The National Bureau of Economic Research (NBER) provides annual historical tax rates for representative taxpayers for each state. The Census Bureau's American Community Survey (ACS) provides annual historical data on the size, age, college attainment, and income distribution of each state's population. The Census Bureau's Annual Survey of State and Local Government Finances (ASSLGF) provides historical data on states' total revenue and expenditures as well as education-specific revenue and expenditures each year. Lastly, the Financial Industry Regulatory Authority's (FINRA) National Financial Capability Survey (NFCS) reports both objective and subjective indices of households' financial literacy in each state every three years. We merge the NBER, ACS, ASSLGF, and NFCS data sets by state and year.

IA-4: Correlation Table

This table presents the Pearson correlations between variables measured at the state-year level. Variable names appended with "(proportion)" refer to the value of the state's optimal 529 plan relative to the state total. Variable names appended with "(ratio)" refer to the ratio of the value for the optimal home-state plan to the value for the state's suboptimal plan(s). All variables are defined in Table 1A. Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	Assets Under Management (proportion)	1.000								
(2)	Optimal Accounts (proportion)	0.973***	1.000							
(3)	Disclosure Complexity 1 (ratio)	-0.316***	-0.244**	1.000						
(4)	Disclosure Complexity 2 (ratio)	-0.514***	-0.469***	0.525***	1.000					
(5)	Literacy: Test Questions Correct	0.127	0.036	-0.004	0.035	1.000				
(6)	Literacy: Self Assessed High	0.059	0.056	-0.010	-0.168	0.065	1.000			
(7)	Total Asset-Based Fee (ratio)	-0.342***	-0.374***	0.138	0.293**	0.413***	0.063	1.000		
(8)	Expected 529 Participation	0.371***	0.395***	0.087	0.134	0.174***	0.099*	-0.029	1.000	
(9)	Married Household Income	0.298**	0.352***	0.018	0.127	-0.216***	0.011	-0.184*	0.623***	1.000