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ARTICLE

Suboptimal household investment and information-processing frictions: Evidence from 529 college savings plans

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Abstract

We use the 529 college savings plan setting to investigate whether and why households make suboptimal choices to invest in local assets. We estimate that 67% of open accounts between 2010 and 2020 were located suboptimally due to the plans' tax inefficiencies and high expenses. Over the accounts' projected lifetimes, such investments yielded expected losses of 8% on average or $15.6 billion in 2020 alone. We then investigate why suboptimal investment is so prevalent. Consistent with households' lack of understanding of state-level tax benefits, we find that a meaningful proportion of households does not account for the potential tax benefits and costs of local versus nonlocal 529 investment. Household financial literacy and plan disclosure complexity appear to explain suboptimal investment patterns, which further supports the role of information-processing frictions. Our study presents novel evidence on individuals' preferences for local assets and how information-processing frictions shape their investment decisions, reducing their financial well-being.

Keywords: information-processing frictions; disclosure complexity; household finance; 529 plans; financial literacy

JEL Codes: G11, G14, G23, G53

1. Introduction

Despite extensive evidence that U.S. households prefer local investments, an open question remains about whether this local preference reduces their financial welfare, and – if it does – why they continue to overinvest locally (e.g., Ivkovic and Weisbenner, 2005; Seasholes and Zhu, 2010; McQueen and Stenkrona, 2012). In this paper, we examine whether and why households invest suboptimally by studying their choice of 529 college savings plans, which are offered by states to facilitate people saving for their beneficiaries' (often children's or grandchildren's) future education costs. In this setting, it can be difficult for households to learn about their options and to acquire and integrate information to compute the payoffs from each (e.g., Blankespoor et al., 2019, 2020). In the case of corporate disclosures, evidence shows that less sophisticated investors prefer clear, easily readable documentation (Miller, 2010; Lawrence, 2013). Similarly, we hypothesize in the 529 setting that the length and complexity of plan disclosures may prevent households from gleaning relevant information about these options. Accordingly, we investigate whether disclosure complexity and a lack of financial sophistication impede households' information processing about 529 plans and reduce their financial well-being.

State-sponsored 529 plans have become increasingly popular, growing from $14 billion to $411 billion in assets between 2001 and 2022 (College Savings Plan Network, CSPN, 2023). Because few 529 plans have residency restrictions, most households can invest in any state's plan. Yet little is known about the distribution of these assets across states' plans and whether households demonstrate a preference for home-state plans. If households prefer local plans, this local preference could reduce their financial welfare. Due to variation in tax benefits and plan costs, many local plans actually appear *ex-ante* financially dominated by nonlocal options.

The 529 college savings plan setting offers several advantages for an analysis of households' decision-making regarding where they choose to invest. First, because 529 account owners can only be households, 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 pecuniary payoffs for households across different states. Third, each plan provides disclosure and participation agreement documents that portray the plan's benefits and costs. Unlike the disclosures of some other consumer financial products or public companies, 529 plan disclosures are neither standardized nor federally regulated. Disclosure complexity therefore may increase household frictions in processing important information that could affect their financial welfare, consistent with prior literature investigating other consumer financial products (deHaan et al., 2021; Kielty et al., 2023; Nicoletti and Zhu, 2023). Such complexity could be especially harmful to less financially literate households, in keeping with prior findings that greater reporting complexity is more deleterious for less financially literate individuals (Lawrence, 2013).

In what follows, we first model expected pecuniary payoffs across all 529 plans available to households in each state, incorporating all information available for such 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 an account opened in one state's plan when the household could earn a higher expected payoff in a different plan. Critically, households are not restricted to investing in 529 plans in their own state of residence. Although low fees and tax savings might make a local (i.e., in-state) plan optimal for some households, the optimal plan for a household living elsewhere could be out of state due to high fees and/or a lack of tax savings for its local plan.

To implement the model, we obtain data on all 529 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 all states*; this definition is free from assumptions about where any given household resides. Our dataset spans 2010 to 2020, and it consists of 803 plan-years comprising 112 unique plans across the 50 U.S. states and the District of Columbia.

Our analysis yields several new insights. First, we document that suboptimal investment across 529 plans is widespread. On average, 67% of open accounts and 71% of assets under management were held in suboptimal plans between 2010 and 2020. In 2020 alone, the aggregate projected dollar loss for households contributing to suboptimal plans was $15.6 billion, representing 6% of projected terminal payoffs. This amount is substantive, especially when considering that it is almost twice the amount of annual aggregate flows into 529 plans.[1] Most notably, significant suboptimal investment occurs across all types of state tax treatment, a key feature affecting 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. 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 preferences in the absence of tax benefits.[2]

Second, we examine *why* suboptimal investment is so prevalent. If households understood the benefits and costs of local versus nonlocal 529 investment, we would expect that in-state investment would be lower in states lacking 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 the District of Columbia and the 49 states sponsoring 529 plans as of second-quarter of 2023. We collected statistics about in-state versus out-of-state account owners and the frequency of account rollovers into and out of plans. We find 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 across states without a tax deduction, states with tax parity, and states 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 having no state income tax. Furthermore, rollovers are uncommon. We also 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.

We then examine households' understanding of the benefits and costs of different 529 plans, by explicitly considering variation in their information-processing frictions. In our setting, information-processing frictions could prevent households from selecting plans with the highest payoffs. For example, limited financial knowledge can affect individuals' decision-making and financial well-being (e.g., Lusardi and Mitchell, 2014). Our hypothesis is 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. We show that, in states with higher financial literacy, households open a lower proportion of accounts in suboptimal versus optimal plans.[3] 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 overly complicated and misleading (e.g., Baldwin v. Merrill Lynch, 2019). Plan disclosure documents average more than 65 pages of financial and accounting-related information. Since prior research in other financial settings concludes that less readable disclosures reduce investors' and consumers' reactions to the disclosed information (e.g., Miller, 2010; Rennekamp, 2012;

[1] The aggregate flows into 529 plans were $2.1 billion in Q4 of 2023 (see https://www.529conference.com/4q-2023-529-and-able-market-sizing-highlights/). We annualize this number and find that $15.6 billion is 1.86 times the 2023 aggregate flows into 529 plans (e.g., 15.6/(2.1*4) = 1.857).

[2] In states with tax parity, contributions to any state's plan earn tax deductions.

[3] Private account-level data in each state are not subject to FOIA, which precludes analysis of decision-making at the household level. Therefore, we proxy for the proportion of optimal investment by a state's residents using the proportion of optimal investment in that state's plans. Our use of this proxy requires a few assumptions, which we discuss in Section 3.2.

Lawrence, 2013; Kielty et al., 2023; Nicoletti and Zhu, 2023), we hypothesize here that complex 529 plan disclosures exacerbate suboptimal investment. Indeed, our analysis establishes that households open a lower proportion of accounts in optimal plans when disclosure documents are more linguistically complex. 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 education saving accounts.

Finally, we address alternative explanations and perform robustness tests. Just as investors in other settings prefer local investments due to local informational advantages about companies near them (e.g., Coval and Moskowitz, 1999; Ivkovic and Weisbenner, 2005), here too, households selecting a 529 plan may possess better information regarding the investing skill of their home-state's plan trustee or local asset management company's portfolio manager. We evaluate 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 for home states or local asset management companies and consistent with suboptimal plans having lower realized payoffs. This result also validates that our model's labels of suboptimal and optimal plans are accurate based on realized payoffs. In addition, we assess the robustness of our results to alternative assumptions about the investment time horizon, the amount and timing of contributions, returns, and household income.

We contribute to the literature in three areas. First, we provide a novel explanation for how individuals process information to make local versus nonlocal investment choices. Studies in other settings report that investors favor local investments due to local information advantages;[4] here, we complement that evidence by confirming that information-processing costs are an additional explanation for local preferences. Our results verify 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 about state governments or local asset management companies in our setting (i.e., we find that suboptimal local plans do not outperform optimal plans). Accordingly, our results also relate to prior research showing that other types of investors misjudge the quality of their local information (e.g., Kang et al., 2021). Our findings also add to a broader literature exploring how information-processing costs affect less sophisticated investors in other settings (Cuny, 2018; Blankespoor et al., 2019; Cuny et al., 2021; deHaan et al., 2021; Israeli et al., 2021). By studying households' information-processing frictions and 529 plans, our evidence suggests that less sophisticated individuals may opt for suboptimal, and often local, plans. Accordingly, our results bridge a gap between the literature on the information-processing costs of less sophisticated investors and the literature on local preferences.

Second, we add to the household finance literature by studying how households use financial instruments to save and invest for the future. Prior literature has examined financial decision-making regarding student loans and retirement savings choices.[5] The present study examines household financial decisions that extend beyond the current generation's lifecycle to the next generation, where suboptimal choices affect beneficiaries' financial welfare. Furthermore, prior papers studying 529 plans have

[4] For evidence of U.S. retail investors' local preferences, see Ivkovic and Weisbenner (2005) and Seasholes and Zhu (2010). Studies also find that U.S. institutional investors prefer local investments (e.g., Coval and Moskowitz, 1999, Dyer, 2021).

[5] See Campbell (2006); Guiso and Sodini (2013); Beshears et al. (2018); and Gomes et al. (2021) for reviews of the literature on household finance. See Bergstresser and Poterba (2004) for evidence on household retirement savings decisions.

mainly focused on plan participation rates or the determinants of high plan fees. For example, Alexander and Luna (2005) study plan participation rates, arguing that marketing efforts draw investors to high-fee funds, while others contend that higher fees in 529 plans reflect moral hazard by state sponsors (e.g., Bullard 2006; Bogan 2014; Curtis 2020; and Balthrop and Cici 2022). We extend that 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 limited financial knowledge combined with complex plan disclosures.[6]

Finally, our findings have implications for policymakers concerned with household financial well-being, a point to which we turn in Section 6.

2. Institutional background and modeling suboptimal investment

2.1. Institutional background

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 the favorable tax treatment, these 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 that 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 recordkeepers, asset management companies, banks, or in-house government agencies.[7]

Investing in a 529 plan requires several steps. First, the household decides whether to use a 529 plan to save for college expenses instead of or in conjunction with outside options, such as non-529 savings and investment accounts, financial aid, or student loans. Like other assets, 529 plan assets are taken into account when students apply for financial aid. 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 investor 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.[8] Nevertheless, 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 tax.[9] The state-level tax treatment of resident households is a

[6] 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 a 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 are outside the scope of our study.

[7] We do not cluster plans based on the fund family providing the plan because any given fund family does not offer plans in all states. Why any specific fund family offers a particular state's plan and how it sets fees are topics beyond the scope of our paper.

[8] 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. Beginning in 2024, the Secure 2.0 Act of 2022 will permit unused college savings to be transferred (up to a limit) to the beneficiary's retirement savings.

[9] 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.

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 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. In 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, and their value depends 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's output of optimal and suboptimal labels incorporates all characteristics of these plans, including the frequency and amount of contributions, as well as state administrative fees and the fees of every underlying investment option within each plan. The available investment menu differs across plans. 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).

2.2. 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.[10] 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 terminal payoff of a 529 investment, defined using inputs that can vary by time $t \in \{0, \ldots, T\}$, is

$$Terminal\ Payoff_T^{s,p} = (Contribution^{s,p})\left[\prod_{t=1}^{T}\left(Return_t^{s,p} - a_t^p\right) - 1\right](1 - DistribTax^{s,p}) + Contribution^{s,p}$$

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

where s is the household's state of residence, p is the plan where the household opens an account, and a_t^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.

Next, we define $Contribution^{s,p}$, $Return_t^{s,p}$, and $Distribution^{s,p}$.

2.2.1. 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:

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

where τ^s is the effective tax rate for a household in state s.[11] 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 ≤ $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.[12]

2.2.2. 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

$$Return_t^{s,p} = \left(1 + r_t^p\right)\left(1 - f_t^p\right)$$

where $r_t^p = 0.05$ is the common return assumption applied to investment options, and f_t^p is the annual total asset-based percentage fee for plan p, computed as the sum of the underlying fund fee and all state administrative fees.[13]

2.2.3. 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

[11] Using marginal tax rates instead of effective tax rates does not affect the relative ordering of plans' payoffs.

[12] Some plans have share classes with initial sales charges (also known as front-end loads). Our primary analysis does not include sales charges because most plans routinely offer portfolios without loads for households to choose from. In untabulated robustness tests, we incorporate such front-end 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 increase the dollar welfare loss from selecting a suboptimal plan due to higher overall fees.

[13] Each plan has many different investment options, and each may have a different fee. We include all investment options except 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 is the plan that contains the investment option with the highest payoff, and all other plans are labeled as suboptimal.

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, the distribution tax
$DistribTax^{s,p}$ is the effective tax rate for a household in state s if s is Alabama and p is not in Alabama, and $DistribTax^{s,p}$ is set to 0 otherwise.

2.3. Optimal plans and dollar welfare losses

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). Out of 803 plan-years, 81% represent suboptimal plan-years. Appendix A shows an extract from our model of optimal and suboptimal investment for year-end 2020.[14]

3. Main empirical results

3.1. 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) TAXSIM program (Feenberg and Coutts 1993). Plan fees and state tax distribution limits are from plan disclosure documents on state websites and from the Municipal Securities Rulemaking Board (MSRB) database. Data on plans' open accounts and assets under management are available from the College Savings Plan Network. 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 112 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.

3.2. Empirical findings on suboptimal vs. optimal plan choices

Using the model's predictions, we assign optimal and suboptimal labels to the cross-product of states s and plans p, which allows us to study the observed distribution of 529 plan assets. Due to the sensitive nature of household-level data on residency, data on household residency by 529 plan are only available in aggregate (see Section 3.1). Therefore, in our empirical analysis, we label a plan as suboptimal only if it is suboptimal for households across all states s. This has the advantage of being free from assumptions about where each household resides.[15]

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[14] 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. Over the sample period, our model's classifications are quite stable, in that there are only a few instances in which plans change their optimal status across years. These changes mainly occur due to changes in fees over time, but hypothetically they could also occur if a state changes its tax treatment. In our sample, nine states sponsored plans with higher historical costs of investment relative to other states' plans: while residents of these states' plans invested optimally by investing in-state in 2020, they would have invested suboptimally if they had chosen home-state plans in previous years. In addition, eight states sponsored plans with historically lower costs of investment relative to other states' plans: while these states' plans represented suboptimal home investment in 2020, they represented optimal home investment in previous years.

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

Table 1. Variable Definitions and Summary Statistics

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)	Average risk-adjusted return of the plan, calculated over the next *X* years, divided by the standard deviation of the return of the plan over the next *X* years. We risk-adjust the return by subtracting the Treasury bill rate from the return.	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
Effective State Income Tax (%)	3.404	3.843	2.822	4.537	1.643	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

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, for the full sample of 517 state-years and the subsample of 112 state-years with both optimal and suboptimal plans. 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, defined only for the subsample of 112 state-years with both optimal and suboptimal plans. 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), defined only for the subsample of 112 state-years with both optimal and suboptimal plans.

Using data on 529 plan assets under management and open accounts in 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, and Table 2A reports the proportion of assets and accounts held in suboptimal plans by year.[16] Over the period, the average proportion of assets under management and open accounts held in suboptimal plans were 71% and 67%, respectively. These 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

[16] 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.

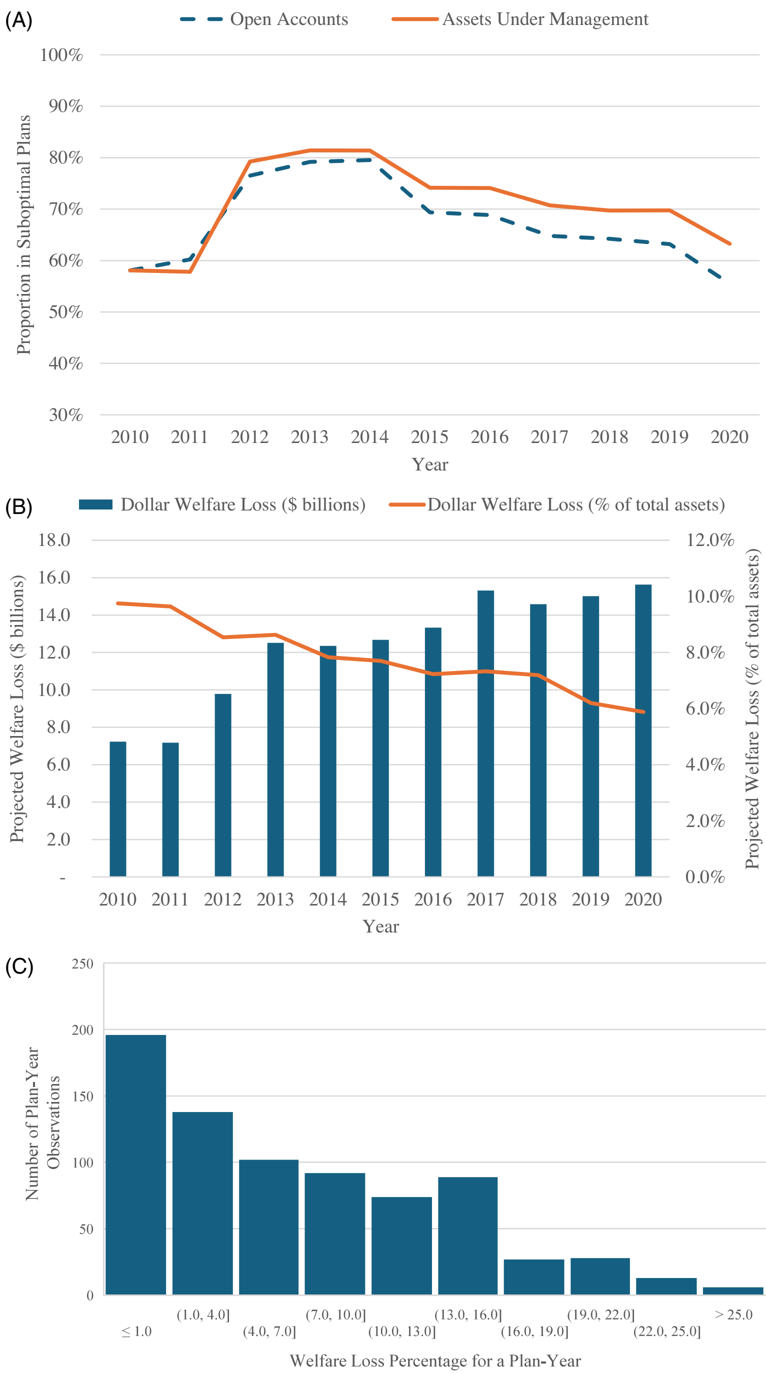

Figure 1. Suboptimal Investment and Welfare Loss by Year. Panel A plots suboptimal 529 plan assets under management and open accounts by year over the sample period. Suboptimal investment is calculated as a proportion of total assets under management and total open accounts across optimal and suboptimal 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 C presents a histogram of the distribution of welfare losses across plan-years, grouping welfare losses $\leq 1\%$ into one bin. Panel A: Suboptimal Investment Over Time. Panel B: Welfare Loss Over Time. Panel C: Distribution of Welfare Losses Across Plan-Years.

Table 2. Suboptimal Investment and Welfare Loss 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	Total Welfare Loss Amount ($ millions)	Welfare Loss (%)	Welfare Loss Per Account ($)	Welfare Loss Range (%)
2010	7,229	9.8	2,950	[1.5, 25.4]
2011	7,179	9.6	2,538	[0.7, 25.4]
2012	9,786	8.5	2,302	[0.6, 27.0]
2013	12,514	8.6	2,574	[0.5, 28.1]
2014	12,355	7.8	2,347	[0.3, 23.1]
2015	12,676	7.7	2,419	[0.1, 23.3]
2016	13,328	7.2	2,451	[0.0, 33.0]
2017	15,310	7.3	2,738	[0.0, 23.7]
2018	14,584	7.2	2,459	[0.0, 23.7]
2019	15,014	6.2	2,433	[0.1, 23.7]
2020	15,632	5.9	2,622	[0.5, 24.2]

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.

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.[17] This welfare loss peaked at 9.8% in 2010 and trended down to 5.9% in 2020,

[17] Suboptimal plans are labeled suboptimal only if they are suboptimal for all states' 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 households' optimal plan.

suggesting that the difference in returns between suboptimal and optimal plans has declined over time. This decline is mostly due to the average fees decreasing over time, and only minimally attributed to a small decrease in fee spread between cheaper and more expensive plans over time. Although the percent welfare loss has dropped, the dollar amount of the loss has grown from $7.2 billion in 2010 to $15.6 billion in 2020, consistent with the growth in the number of households investing in 529 plans. The welfare loss per account, also reported in Table 2B, ranges from $2,302 in 2012 to $2,950 in 2010. 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%. To show this, Figure 1C plots the distribution of percentage welfare losses across plan-years. More than half of plan-years indicate a welfare loss greater than 5%; over 30% have a welfare loss greater than 10%; and more than 10% have a welfare loss greater than 15%. Furthermore, we find qualitatively similar results to those reported throughout the paper if we raised the threshold for suboptimality to $\geq$1% welfare loss.[18] Lastly, several states only have suboptimal plans, which means investing locally yields a welfare loss relative to the optimal out-of-state plan (see Appendix A).[19]

Key factors affecting 529 investment payoffs include state tax deductions and credits, which provide 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 nationally for the best 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 raise household welfare and also spur in-state investment. Nevertheless, many accounts and assets in states offering 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 income taxes and with tax parity. Table 3B shows dollar and percent welfare losses by state tax status. The percent welfare loss is highest among states without tax deductions and lowest among states with tax parity.

4. Explanations for suboptimal 529 investment

To evaluate potential explanations for these 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

[18] Specifically, the average percentage of total AUM and accounts labeled suboptimal falls, from 71% to 65% and from 67% to 61%, respectively. The dollar welfare loss decreases just slightly, from $15.6 to $15.4 billion in 2020. We find qualitatively similar results for Sharpe ratio tests and regression analyses using this alternative threshold to assign suboptimality.

[19] For example, in 2020, the optimal plan and portfolio for Texas residents is the California ScholarShare College Savings Plan's U.S. Stock index portfolio. Texas residents investing in Texas's LoneStar 529 plan would suffer an annual welfare loss of up to 30% (most expensive portfolio) and at least 5% (Texas College Saving Plan's U.S. Stock index portfolio). Appendix A illustrates the frequency with which each optimal out-of-state plans is optimal for the states that only have suboptimal plans.

Table 3. Suboptimal Investment and Welfare Loss by 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]

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.

optimal plan can be a nonlocal plan. Second, we control for local investment and focus on households' information-processing frictions. Both prove to be informative.

4.1. Empirical findings on local vs. nonlocal investment

One explanation for patterns of local and nonlocal 529 investments is that households may fail to 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 the District of Columbia and the 49 states sponsoring plans as of second-quarter 2023.[20] 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 enquired 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,

[20] 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, and Right to Know Law). We use FOIA as a general term to refer to these statutes.

Table 4. Analysis of Local and Nonlocal Investment

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

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 of 2022 and second-quarter of 2023.

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 does not differ significantly from and is 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 fraction of households in the states with a tax deduction demonstrates a preference for a local plan, even in the absence of state tax benefits. Only households in states without state income taxes hold 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, under 1% of accounts per year. In view of the suboptimal holdings documented in Section 2.2, this indicates that households do not often relocate their 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 decisions.[21]

[21] 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.

4.2. 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.[22] Such frictions could result in households choosing a local plan 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. Focusing on states offering both an optimal and suboptimal plan, we proxy for the proportion of optimal investment by a state's residents using the proportion of optimal investment in that state's plans. Our identification makes two assumptions. First, we assume that residents of a state with both an optimal and suboptimal plan generally choose between these in-state plans.[23] Second, we assume that having out-of-state investors in a given state's plans does not introduce measurement error in the proportion of optimal investment in that state's plans.[24] These assumptions may seem strong, and we lack detailed household-level data to validate them. Nevertheless, our assumptions are weaker than those applied in prior 529 studies (e.g., Alexander and Luna, 2005), which assumed that households only held in-state plans. In addition, measurement error in this proxy would affect our inferences only if it systematically varied with financial literacy or disclosure complexity.

The first factor we use to account for differences in information-processing frictions is differences in state residents' financial literacy. That is, given a menu of investment options, savvier households may better understand how state tax deductions, residency restrictions, asset-based management fees, and other components affect terminal payoffs. In the retirement plan context, for instance, Hastings and Tejeda-Ashton (2008) and Hastings and Mitchell (2020) document positive correlations between financial literacy and investment in lower-cost retirement funds. Moreover, previous financial literacy research has also documented 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 levels of household financial literacy by state, and the relative proportion of within-state 529 accounts invested in optimal plans. To test this, we use household financial literacy scores collected in FINRA's National Financial Capability Study (NFCS).[25] 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 objective measure will assess 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

[22] 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 disclosure processing costs literature.

[23] Specifically, our proxy for $x_o/(x_s + z_s)$ is $(x_o + y_o)/(x_s + y_s)$, where x_o (x_s) is investment by residents in the state's optimal (suboptimal) plan, z_s is investment by the state's residents in out-of-state suboptimal plans, and y_o (y_s) is investment by out-of-state investors in the state's optimal (suboptimal) plan. The first assumption states that z_s is very small in states with both an optimal and suboptimal plan.

[24] The second assumption is that $y_o$and y_s have relative magnitudes that preserve $(x_o + y_o)/(x_s + y_s)$ as an appropriate proxy for $x_o/(x_s + z_s)$.

[25] For details, see https://gflec.org/initiatives/national-financial-capability-study/.

Table 5. Analysis of Information-Processing Frictions

	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 Participation	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

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 is the subsample of 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.

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. This 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.[26]

Table 5 confirms that states with more financially literate residents also 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 objective 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.[27] We also document that the suboptimal

[26] 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.

[27] The average amount of open assets in these states is $10.1 billion (untabulated results). We multiply the coefficient on financial literacy by the variable's standard deviation to obtain the 8.5% increase in the proportion of optimal accounts, which we then multiply by the average amount of open assets in these states' plans to obtain $860 million (=1.892 × 0.045 × $10.1 billion). We also verify that our estimates correspond to 100% optimal

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 proves to be negatively related to the proportion of optimal accounts in that state, suggesting that a behavioral component (such as overconfidence) can lead households to make suboptimal investments.[28]

4.3. 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 (in contrast to the summary required for mutual funds by the Securities Exchange Commission (SEC)). Prior literature documents substantial heterogeneity in the length and complexity of corporate financial reports (Bonsall et al., 2017; Dyer et al., 2017; Bushee et al., 2018). Prior literature also finds that disclosure complexity in other settings can impede individuals' processing of such disclosures (e.g., Miller, 2010; Rennekamp, 2012; Lawrence, 2013; deHaan et al., 2021; Kielty et al., 2023; Nicoletti and Zhu, 2023). We hypothesize that increased complexity of the optimal home-plan's 529 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.

To test the disclosure complexity hypothesis, we continue 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: 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; De Franco et al., 2015; Loughran and McDonald, 2014; Loughran and McDonald, 2016). 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. 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, which may be correlated with disclosure complexity and affect investors' choices (deHaan et al., 2021).

investment at the maximum financial literacy level. To quantify the optimal investment for maximum financial literacy, we use the estimates from Table 5 column 1 and replace the objective financial literacy measure with 65% (the sample maximum). Similarly, we find that replacing Disclosure Complexity 1 (ratio) with 0.81 (the sample minimum) results in 100% optimal investment. These results indicate that financial literacy and disclosure complexity are very important in explaining the variation in optimal investment.

[28] Some authors have explored the gap between peoples' objectively measured and subjective views of their own financial literacy. For instance, Balasubramnian and Sargent (2020) examine the 2015 NFCS and find that those who were overconfident about their own financial literacy made numerous financial errors, including using alternative financing mechanisms, missing mortgage payments, and having poor banking behavior. In a study of Belgian holders of online brokerage accounts, Ingelbrecht and Tedde (2024) report that overconfident traders engaged in more frequent trading, thus incurring higher transaction costs. We find similar results when we include both measures of financial literacy in the same regression (untabulated results).

Table 5 reports 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 implies 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, implying a $1.4 billion decrease in optimal investment in these states.[29] These results mean that plan disclosure complexity deters optimal household investment: households prefer plans with simpler disclosures; thus, plan disclosure complexity appears to impede households' ability to invest optimally.

5. Additional analyses

5.1. 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, both individual and institutional investors tend to incorporate local information (e.g., Coval and Moskowitz, 1999; Ivkovic and Weisbenner, 2005; Dyer, 2021), since geographic proximity can offer a local information advantage when investors have easier access to information about companies located near them (Grinblatt and Keloharju, 2001; Kang et al., 2021). That literature compares the returns of investors' local portfolio holdings (companies headquartered in the same state as the investor) to the returns of investors' nonlocal holdings. They generally report that local investments earn an additional abnormal return relative to nonlocal holdings (although conflicting evidence does exist, e.g., Seasholes and Zhu, 2010).

In our setting, it is possible that households could have more information regarding their home state's investment strategies, including information about the investing skill of their home-state's plan trustee or local asset management company's portfolio manager. If this form of local information advantage explains the distribution of 529 accounts, we would expect that model-identified "suboptimal" plans earn higher risk-adjusted returns than do model-identified "optimal" plans. 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 all suboptimal versus their optimal plans at 3-, 5-, and 10-year time horizons for the full sample of suboptimal plan-years. Here we see 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 confirms that the *ex-ante* suboptimal plans identified by our model are also ex-post suboptimal based on their realized returns over multiple time periods.

[29] 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).

Table 6. Analysis of Local Information Advantage Alternative Explanation

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

Panel A presents *t*-tests of the differences between the realized Sharpe ratios of optimal 529 plans and those of suboptimal plans, using the full sample of suboptimal plan-years compared to their optimal plan-years. 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.

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, we conclude that 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.

5.2. Robustness tests: variation in the investment time horizon

Our model assumes that a representative household with an annual income of $100,000 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 (as in Leung and Wendell, 2020). Yet, a household could contribute in several different ways: $1,000 annually over 10 years; $5,000 or even $75,000 in one lump sum; or over shorter time horizons.[30] Households with different incomes can also face different state effective tax rates. Although we cannot model all possible combinations, we do conduct robustness tests by varying the assumptions for representative households. In particular, we consider (1) a shorter account life, (2) spreading contributions over time,

[30] 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.

(3) a return assumption inferred from past performance, and (4) a different household income level.

Alternative 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 declines. 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, results remain consistent with our main inferences. We find that 66% 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.[31] 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.

5.3. 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, for instance, as a portion of its annual income. To illustrate this case, we assume that the household equally distributes its $10,000 total contribution over 18 calendar year-ends, for an annual contribution of $555. 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 could spur differences, since a smaller contribution increases the relative value of the state tax deduction. That is, a greater proportion of the contribution will qualify 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 an average of 65% of assets under management and 61% of open accounts were held in suboptimal plans 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

[31] Using alternative assumptions, the optimal and suboptimal plan labels change slightly. Tables 7 and 8 include slightly more observations because, under alternative assumptions, more states can have both optimal and suboptimal plans.

Table 7. Robustness Test: Variation in Investment Horizon

Panel A. Analysis of Information-Processing Frictions

Variable	Dependent Variable: Optimal Accounts (proportion) (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 Participation	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

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. The sample for this analysis is the subsample of state-years with both an optimal and suboptimal plan. 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.

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

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 Participation	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

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. The sample for this analysis is the subsample of state-years with both an optimal and suboptimal plan. 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 is indicated by *, **, and ***, respectively.

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 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.

5.4. Robustness tests: variation in the return assumption

In an additional robustness test, we use an alternative assumption for returns on the 529 plan investment, rather than using the 5% return assumption provided in plan disclosure documents. In particular, we assume that the household uses past returns to form expectations about future returns, which could explain why households favor the *ex-ante* "suboptimal" plans. In particular, we posit that the household estimates the year the beneficiary will attend college and compares 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 used only target-date portfolios ending in 2024 for the college enrollment year and age-based portfolios starting at age 8.[32] 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 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.[33] In other words, the widespread suboptimal 529 investment observed in our base case is not the result of households choosing plans with the best past performance.

5.5. Robustness tests: variation in the representative household's annual income

Households face different state effective tax rates, based on their household income. To study how our results vary with 529 plan participants' household income, our final robustness test uses $250,000 for the representative household's annual income, as opposed to the lower $100,000 used in our main tests. We use this higher household income because Hannon et al. (2016) show that the 529 participation rate is very small (0.3%) for households with $50,000 or less in income, compared to 16% for the highest income percentiles. Once again, we find that the labeling of optimal plans for a household with a gross income of $250,000 is identical to the labeling for a household with an income of $100,000. This is because tax benefits are capped. Furthermore, this result generalizes to other assumed household incomes above $100,000, where our results remain unchanged.[34]

[32] 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.

[33] 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.

[34] If we use a much lower household income (below the $50,000 gross household income mark), the labeling of optimal plans differs slightly due to matching grants playing a larger and state tax deductions playing a smaller

6. Conclusions

This paper evaluates the geographic distribution of household investment in 529 college savings plans. We use a household decision-making model that incorporates the features and considerations available from plan disclosures. Implementing the model with data on the distribution of 529 plan assets, we find 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 $15.6 billion in 2020, representing 6% of projected terminal payoffs. Many in-state plans charge high costs without offsetting residency-dependent tax benefits or matching grants. Using data we 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, despite being more likely to provide higher payoffs when the home state lacks a state tax deduction or has tax parity. Our results also document that suboptimal investment can be explained by household information-processing frictions, since 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 household local investment preferences and suboptimal investment behavior in the context of their savings decisions for the next generation. Critically, these investment choices reduce household financial well-being, making our findings informative for policymakers. 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. Federal agencies such as the SEC and the Consumer Financial Protection Bureau have made efforts in other settings to improve the ease with which investors and consumers extract relevant information from disclosures (Blankespoor et al., 2014; Bhattacharya et al., 2018; Kielty et al., 2023; Nicoletti and Zhu, 2023). Accordingly, our results can inform future research and policy, as well as suggest new tools – for example, educational guides and disclosure principles – that could enhance household decision-making for college savings and, as a result, improve the next generation's financial well-being (e.g., Alexander et al., 2015). For example, it is difficult for households to compare fees across 529 plans, especially in light of their disclosure complexity. While households might employ third-party tools to compare plans, these charge subscription fees.

Our study is subject to a few caveats. First, household-level data on 529 plan investments are not publicly available nor subject to FOIA requests. Consequently, we are unable to collect direct measures of household-level information-processing frictions and 529 plan choice. Nevertheless, our computation of the extent of suboptimal investment is intentionally conservative, in that we assume that a 529 plan is suboptimal if it is suboptimal for all households. Our state-level analysis also makes several assumptions about the information-processing frictions faced by and the investment decisions made by households in each state (see Section 3.2), which could introduce measurement error to our proxies. Second, household optimal investment decision-making is complex and subject to several considerations, many of which we do not observe. To test the robustness

role below that threshold. Based on the findings in Hannon et al. (2016), however, we do not use these labels for this group, as it is not reflective of optimal plan labels for the majority of households participating in 529 plans.

of our results, we vary the assumptions made for representative households, and we confirm that our results are robust to alternative time horizons, contribution frequencies, return assumptions, and income levels. Our results should be interpreted with these limitations and assumptions in mind.

Although 529 plans are sold nationally, no organization is currently charged with ensuring the safety, quality, and cost-effectiveness of college savings plans across the nation. Therefore, conflicts of interest in plan sponsorship and management can emerge and persist at the state level (Curtis, 2020; Balthrop and Cici, 2022). This is in sharp contrast to qualified retirement plans, where plan sponsors must act as fiduciaries under federal law to manage savers' assets prudently. In the extreme, if all households invested optimally, the distribution of households' assets across states would look very different. For example, our conversations with plan sponsors suggest that some states could better serve their residents by not sponsoring a plan (as it is expensive to sponsor a plan). Furthermore, adoption of the College Savings Plan Network's disclosure principles is currently voluntary. Standardization and simplification of disclosure could facilitate household information processing and decision-making, as has occurred with other entities charged with financial oversight in different contexts (e.g., the SEC for corporate and mutual fund disclosures, or FINRA for brokers transacting securities). In addition, providing free and easy-to-use tools to compare fees across plans, similar to those currently offered by third-party data providers for a fee, could be useful in reducing the substantial losses from suboptimal investment. 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 also across generations.

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

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