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The fallacy of cookie cutter asset allocation: some evidence from "New York's College Savings Program"

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Abstract

In this paper, we establish why "prefabricated" asset allocation schemes mandated by some education savings programs might be suboptimal. Then, using the New York's College Savings Program as an example, we simulate and then compare end of period wealth accumulated in both a tax preferred but regimented asset allocation plan, and in a nontax protected plan.

We find, first, that the longer the child participates in the plan, the greater the benefit. Second, participants in higher tax brackets derive greater benefits; adherence to prespecified asset allocation for low tax bracket investors often results in return loss that overshadows the tax benefit.

JEL classification: G11—Portfolio choice

Keywords: Asset; Allocation; College; Savings; Simulation; Monte Carlo

1. Introduction

In order to encourage savings for college expenses, many states in recent years have offered tax-advantaged plans. At the time of this revision, all 50 states offer or are in the process of offering education savings plans, popularly known as Section 529 plans (visit www.collegesavings.org for a description of the various state plans). Such state sponsored tuition savings programs appear to offer families a highly rewarding vehicle for savings.

Incentives provided include the following preferential tax characteristics: (1) in most cases annual contributions are deductible from state taxable income for state residents, (2)

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assets grow tax-deferred, and (3) withdrawals are either tax exempt or taxed at the child's (presumably) lower tax rate when the savings are ultimately distributed for qualified educational expenses. Eyssell (1997), provides a number of tables for various scenarios to determine the amounts needed to reach the college goal. For a comparative evaluation and description of various state plans see Cropper and Tergesen (2001), Vore (2000) and Wang (2001). For an excellent exposition of other strategies for financing higher education see Marks and Reichenstein (2000).

Most state programs employ professional money managers (e.g., TIAA-CREF), who frequently put saver's funds in portfolios with predefined asset allocations (often called Managed Allocation Plans) that remain fixed for a number of years. As the child ages, the funds are typically shifted into progressively more conservative, predefined asset allocations. Presumably under federal law, participants in such plans cannot exercise discretion over this education savings portfolio. For example, under "New York's College Savings Program" (NYCSP), for a child born in 1998, the contributions are invested 55% in stocks and 45% in bonds for 2 years, after which the contributions and accumulations are readjusted to 50% stocks and 50% bonds. The allocation is changed again every 2 years with increasing proportions being allocated to bonds. The asset allocation structure of the NYCSP for 1999 is presented in Table 1. While this analysis is specific to the NYCSP, at least 20 other states offer similar structured asset allocation plans. Of these, at least two have an asset allocation structure identical to New York's. The findings of our research are therefore also applicable to the plans of these other states. The NYCSP permits a contribution of up to $5,000 per taxpayer per year up to a maximum of $10,000 per household for the "married filing jointly" tax status (TIAA-CREF, 1999).

At first glance, the tax incentives and professional management seem to be a potent combination, offering highly effective savings growth. While the tax incentives are appealing, the effectiveness of the plan is highly dependent on the rate of return which the plan affords. It is possible that the tax benefits of these plans might be overshadowed by the reduced rate of return resulting from mandated asset allocation structures. In other words, it is possible for a taxable plan (where all contributions are post-tax and earnings are taxable)

Table 1
Asset allocation structure of the NYCSP (1999)

Year of birth of child	Base percentages (actual = ±2% of base)		
	Growth stocks	Bonds	Money market
1998 or 99	55	45	0
1996 or 97	50	50	0
1994 or 95	45	55	0
1992 or 93	40	60	0
1990 or 91	35	65	0
1988 or 89	30	70	0
1986 or 87	25	70	5
1984 or 85	15	70	15
Before 1984	10	40	50

Source: TIAA-CREF (1999, March 30), Addendum.

to amass greater end-of-period wealth (or accumulate target wealth with lower contributions), than the state savings plan, based on investments of "equal-pain" but subject to a flexible asset allocation. "Equal-pain" refers to the funds relinquished for investment purposes. If Q dollars are relinquished for investment A, but $Q(1 - t)$ are relinquished for investment B, while tQ goes to taxes, the "pain" is equal because Q dollars are being withdrawn from consumption in both cases.

This paper compares the effective after-tax "accumulation of wealth" in the (tax-deferred/tax sheltered) state savings programs to the effective after-tax "accumulation of wealth" in nontax-preferred alternatives. From these results, it is possible to demonstrate the conditions under which state sponsored plans are optimal and to identify the kind of investor for whom they are appropriate and beneficial. Monte Carlo simulations are performed in order to gain insight into the expected performance of the NYCSP. (For a discussion of Monte Carlo methods see Davidson & MacKinnon, 1993, Chap. 21.) Davidson and MacKinnon (1993), p. 732 describe the Monte Carlo procedure as one "in which quantities of interest are approximated by generating many random realizations of some stochastic process and averaging them in some way." Broadly speaking, we simulate the accumulation of wealth in the NYCSP for various periods, (and consequently under various predetermined and fixed asset allocations as specified in Table 1) and compare it with the accumulation of wealth from nontax preferential investment strategies. We generate thousands of observations of the accumulated wealth based on randomly selected rates of return on stocks, bonds, and money market instruments, for different tax rates and for different holding periods. The location, dispersion, and shape of the resulting frequency distributions of these accumulated earnings are the focus of our study.

The remainder of this paper is organized as follows: In Section 2, a review of the literature is provided. In Section 3, the methodology and model underlying the simulations is discussed, and in Section 4 the results of the simulation are provided. Section 5 concludes the paper and suggests some investment strategies.

2. Literature review

There are three elements that are relevant to the performance of state savings plans: (1) asset allocation, (2) taxes, and (3) the time over which savings accumulate.

2.1. Asset allocation

The importance of asset allocation decisions has been widely studied in the finance literature (Elton and Gruber, 2000; Jahnke, 2000). Perhaps the most cited and (mis) quoted study on this subject is the Brinson, Hood, and Beebower (1986) study (and later Brinson, Singer, & Beebower, 1991, 1995) of pension plans which show that the asset allocation decision can explain close to 90% of the variability of returns *over time*. Ibbotson and Kaplan (2000) extend the conclusions of Brinson et al. (1991, 1995) by showing that the asset allocation decision explains around 40% of the variation of returns *across* funds and 100% of the variation in the aggregate.

Numerous methods of optimally allocating assets have been suggested. Below are several examples illustrating the varied forms and complexities of suggested strategies:

- The naive methodology of 100–145 minus investor age, which provides the proportion to be allocated to equities (Bengen, 1996).
- Stochastic optimization and scenario analysis (suggested by Koskosidis & Duarte, 1997), which accounts for return expectations and cross correlation of asset classes.
- For individual investors, most financial planners and investment management professionals recommend strict adherence to risk determined asset allocation, usually through a questionnaire and some optimization procedure. Traditionally, these asset classes have been stocks, bonds and cash. Strategic reallocation is often prescribed based upon forecasted market conditions and changes in the risk profile of the individual. At any given point in time, most brokerage houses have a "recommended asset allocation" which purportedly incorporates their forecast of equity and bond returns (Arshanapalli, Coggin, & Nelson, 2001). Arshanapalli et al. (2001) find that an asset allocation model in which the allocation is altered periodically to incorporate asset class return expectations, outperforms the fixed weight allocation where asset class weights remain fixed over the holding period.

It is not difficult to find conflicting advice on asset allocation or to find theoretical opposition to various allocation strategies. For example:

- Canner, Mankiw, and Weil (1997) correctly point out the contradiction of such asset allocation recommendations to the separation theorem. There should be one optimal portfolio and the risk preference of the investor should determine the proportion of assets that are to be allocated between the optimal risky portfolio and the risk free asset. Based on the separation theorem and assumptions of mean variance optimization, multiple asset allocations, such as suggested in Table 1, are suboptimal.
- Canner et al. (1997) express their puzzlement that risk-averse investors and those nearing withdrawal of their wealth should hold a greater proportion of their wealth in fixed income (low risk) securities.

The literature does not suggest an unqualified "best" asset allocation. Many of the strategies conflict with the "cookie cutter" approach suggested by Table 1, while others do not. The effectiveness of the asset allocation scheme implemented by the state saving plan will be investigated in the simulation which follows.

2.2. Taxes

Taxes, one of the most significant costs of investing, are ignored by most investment strategies (Luck, 1999). Bodie and Crane (1997) find that investors do not manage funds across tax preferred and taxable accounts in order to maximize tax savings. In fact, Arnott, Berkin, and Ye (2000) find that taxes are a significant portion of the total costs of investing.

Does a defined asset allocation in a tax-protected plan aggravate the problem? The simulation will provide insight into whether the state plan is optimal or suboptimal as it implements an asset allocation plan in tax protected assets.

2.3. Time horizons

There appears to be no consensus on how an asset allocation should change over time. For example:

- Bierman (1997) and Bodie (1995) support the notion that lengthening the time horizon increases risk.
- Elton and Gruber (2000) point out that it might be impossible to judge the rationality of any asset allocation recommendation, especially in a multiperiod framework.
- In the context of recent strong performance of bonds, Jones and Wilson (1999) caution against increasing the proportions of fixed income assets in the portfolio in expectation of higher returns. They show that over the long run the real return on bonds is not only small but also declines.

These arguments are relevant to college savings plans, whose mandated asset allocations require increasing allocations to fixed income securities as one nears withdrawal. The simulation will provide insight into whether the multiperiod allocations dictated by the state saving plan are effective guidelines for college savers. Note that when rigid asset allocations are *not* mandated, the longer time horizon provides the investor a greater opportunity to alter asset allocations.

2.4. Suboptimality of state savings plans

The NYCSP is a multiperiod framework, since the asset allocation changes over time. Based on the state of knowledge of asset allocation theory, especially in a multiperiod framework, it is not possible to affirm or refute the rationality of the asset allocations being used by the NYCSP. However, three conditions suggest the possible suboptimality of the current NYCSP allocation process:

1. All asset allocations are made independent of the risk aversion (utility function) of the investor.
2. The fixed weights in the managed allocation plans currently being used restrict the ability of the investor to allocate across taxable and tax-deferred investments.
3. The investor is offered no flexibility to increase equity exposure when faced with the possibility of not meeting target end-of-period wealth.

In circumstances such as these, where theory is not complete or easily tested, Monte Carlo computer simulations can provide meaningful insights. In the next section, we begin discussion of the Monte Carlo simulation and the investigation into how well these plans perform.

3. Methodology

3.1. Concepts

Each year, "*A*" dollars are withdrawn from consumption and put into one of two types of savings options: a State Savings Plan (SSP) which has distinct tax advantages, and a

Non-State Savings Plan (NSSP) which does not. In the SSP, all A dollars are put into the plan, while in the NSSP only $A(1 - t_{ps})$ are put in.

The SSP earns returns which are tax-deferred, while the NSSP must pay both state and federal taxes on earnings. Since the SSP has strict (and conservative) asset allocation rules, it is quite possible that despite the SSP's tax preference, it may yield less than the NSSP. Since the SSP becomes progressively more conservative as the child nears college age, (refer to Table 1), it is quite reasonable to expect that the later the entry into these plans, (the older the child is upon entry), the less effective the tax savings will be.

Since A dollars are withdrawn from consumption in order to buy into either the SSP or the NSSP, it should be relatively easy to calculate the accumulated wealth of the SSP and the NSSP for various scenarios. For example, by simulating expected returns based on historical realized rates of returns, it should be possible to calculate the amassed wealth net of tax in the SSP and in the NSSP for "children" of various ages.

3.2. Assumptions

We determine end of period wealth accumulations based on the following assumptions:

- New York state is the case study example (TIAA-CREF, 1999). Results may or may not generalize to other state savings plans depending upon the asset allocation flexibility afforded, asset class weights, and state tax rates.
- The child's birth date is September 1. By specifying the September 1 birth date, there will be full years of compounding, thus simplifying calculation. For example, funds added on the child's 17th birthday will compound for a full year before being withdrawn for college expenses on the child's 18th birthday.
- The SSP invests in three asset types: stocks, bonds, and money market at designated times and in designated proportions as shown in Table 1.
- Investments in the NSSP are part of the total wealth of the investor and are invested solely in equities. While the major thrust of the investigation for the NSSPs assumes 100% stocks, we later include results from simulations for more conservative allocation schemes.
- A constant amount of funds ($500) is added to the plan each year on the child's birth date ("A" = $500).
- We sample from a distribution of annual rates of return, but compound quarterly.

3.3. Variables

The following variables are used in defining the model and describing the estimation process.

A The funds withdrawn from consumption for investment purposes each year.

t_{pf} The marginal federal tax rate of the parent during the accumulation period and during the distribution period.

t_{ps} The marginal state tax rate of the parent during the accumulation period and during the distribution period.

t_{pe} The combined federal and state tax marginal tax rate of the parent, which is equal to $t_{pf} + t_{ps}(1 - t_{pf})$.
t_{sf} The marginal federal tax rate for the student during distribution.
t_{ss} The marginal state tax rate for the student during distribution.
t_{se} The combined federal and state tax marginal tax rate of the student, which is equal to $t_{sf} + t_{ss}(1 - t_{sf})$.
r(s) Annual rate of return on stocks.
r(b) Annual rate of return on bonds.
r(m) Annual rate of return on money market accounts.

λ_i(s), λ_i(b), λ_i(m) are the proportion of the portfolio designated for stocks, bonds, and money market assets in the ith year, respectively. Each $\lambda > 0$, and $\lambda_i(\mathrm{s}) + \lambda_i(\mathrm{b}) + \lambda_i(\mathrm{m}) = 1$.

3.4. The model

Assume that rates of return change quarterly. Further, let $r_{is} = 1 + r_i(\mathrm{s})/4$, the compounding factor for stocks in the ith quarter. In a parallel fashion, let r_{ib} and r_{im} represent the quarterly compounding factors for bonds and money markets. The total accumulated amount after the first year in the state savings plan can be represented as:

$$S_1 = A[\lambda_1(\mathrm{s})\{(r_{1s})(r_{2s})(r_{3s})(r_{4s})\} + \lambda_1(\mathrm{b})\{(r_{1b})(r_{2b})(r_{3b})(r_{4b})\} + \lambda_1(\mathrm{m})\{(r_{1m})(r_{2m})(r_{3m})(r_{4m})\}] \quad (1)$$

The amount at the end of year 1 clearly depends on (1) A, the effective contribution, (2) the quarterly rates of return for each asset type, and (3) the λs, which represent the asset allocations.

The end of year 2 amount repeats the pattern of Eq. (1). At the end of year 2, the following total will be available for the state plan:

$$S_2 = (S_1 + A)[\lambda_2(\mathrm{s})\{(r_{1s})(r_{2s})(r_{3s})(r_{4s})\} + \lambda_2(\mathrm{b})\{(r_{1b})(r_{2b})(r_{3b})(r_{4b})\} + \lambda_2(\mathrm{m})\{(r_{1m})(r_{2m})(r_{3m})(r_{4m})\}] \quad (2)$$

For the NSSP, let $r^*_{1s} = [1 + (r_1(\mathrm{s})/4)(1 - t_{pe})]$, which is the effective quarterly after-tax compounding factor on stocks. The total accumulated amount after the first year in the NSSP can be represented as:

$$N_1 = A(1 - t_{ps})\{(r^*_{1s})(r^*_{2s})(r^*_{3s})(r^*_{4s})\} \quad (3)$$

where (1) the effective contribution is reduced by state taxes, (2) the effective rate of return is reduced by federal and state taxes, and (3) all assets are in stocks.

The accumulation pattern continues for the NSSP as well. At the end of year 2, the following will have been accumulated.

$$N_2 = [N_1 + A(1 - t_{ps})]\{(r^*_{1s})(r^*_{2s})(r^*_{3s})(r^*_{4s})\} \quad (4)$$

where the r^*_{is} are after-tax quarterly compounding factors in year 2.

The central question which this paper addresses is: *After all taxes are paid on these two savings strategies, will the tax advantages of the SSP outweigh the disadvantages of the rigid asset allocation*s? That is, will S_T (after appropriate taxes have been paid) exceed N_T?

3.5. Determining rates of return

First, it is assumed that future rates of return for stocks, bonds, and money market instruments would resemble their historical record. The generation of random rates of return in the simulation begins with attempting to define the populations from which the random rates of return are chosen.

Using monthly rates of return from 1980 to 1999 for stocks, bonds, and 3-month U.S. Treasury bills (T-bills) derived from the Ibbotson SBBI database (Ibbotson Associates, 2000), the effective quarterly rates of return are calculated for each of the series, for each of the 20 years. The return on the 90-day T-bills is used as a proxy for money market instruments. In the case of bonds, two outliers at more than 3.7 S.D.s from the mean have been excluded from the descriptive analysis. One outlier, at more than 5 S.D.s from the mean, has been excluded from the 3-month T-bills data.

Descriptive statistics are obtained for the three series and Kolmogorov–Smirnov tests of normality are performed for each series. In each case, the assumption of normality cannot be rejected ($p > 0.15$, which is as large as the test is calibrated for). Since the three series are also intercorrelated, values of the rates of return for all three series are assumed to be joint-normally distributed with means of 18.36%, 6.92% and 2.91%, respectively for stocks, bonds, and T-bills. The S.D.s of the returns distributions are 33.84, 21.97, and 2.53 for stocks, bonds, and T-bills, respectively. The correlation between stocks and bonds is 0.358, between stocks and T-bills is 0.153, and, between bonds and T-bills is 0.512.

Random rates of return are selected from this multinormal distribution. Thus the historical interdependencies of the three series are preserved in the simulation. Random variates are generated using a Cholesky decomposition (see Naylor, Balintfy, Burdick, & Chu, 1968) of the variance–covariance matrix, using standard normal deviates generated by the method of Box and Mueller (Kennedy & Gentle, 1980, p. 202). For a discussion of generating variables from a p-variate normal distribution see Kennedy and Gentle (1980), pp. 228–231.

It might be possible that the high rate of return on stocks over the last 10 years favor the NSSPs over the SSP. In order to test this assertion, the study has been replicated using historical returns from 1970 through 1989. The average quarterly returns during this 20 year period is 11.57%, 3.95%, and 1.49% for stocks, bonds, and T-bills, respectively. While the dollar amounts of accumulated wealth for both the SSP and NSSPs are clearly smaller at these lower rates of return, the general results of this paper are substantially similar to the results based on the 1980–1999 time period. Thus, the high rates of return on stocks in the last decade do not appear to bias the results in favor of the NSSPs.

3.6. How the simulation was performed

End-of-savings-period, post-tax wealth in a college savings plan and in a self-directed plan with no tax benefits are calculated repeatedly for plans with 9 distinct holding periods. For the SSP, an annual rate of return is randomly selected from the joint probability distribution of rates of return. Each rate of return is made into an effective quarterly rate of return and the amounts $S_1, S_2, \ldots S_T$ are calculated corresponding to Eq. (2), where T represents the length of time that the child participated in the plan: 2, 4, 6, . . . or 18 years.

The total amount amassed at the end of T years is one observation in the Monte Carlo simulation. This process is repeated 1,000 times, so that there are 1,000 different wealth amounts accumulated over each of the 9 periods, each observation subject to different patterns of randomly chosen rates of return, but each observation built on the mandated asset allocations in Table 1.

The NSSP worked similarly to the above, with amounts N_1, N_2, $\ldots N_T$ calculated corresponding to Eq. (4). Again, the process is repeated 1,000 times, for each of the 9 periods, and for each of the four tax brackets.

For each quarter, the same rates of return on stocks (r(s)) and bonds (r(b)) are used for the SSP and the NSSPs.

3.7. Factors which influence the outcomes

The purpose of this study is to obtain a sense of how effectively the SSP accumulates wealth. There are several factors, previously addressed in the Section 2, which affect the total accumulation of wealth by the SSP compared with a NSSP. These factors to be discussed below, include (1) the variability of returns on stocks, bonds, and money market, (2) the asset allocations rules, (3) the tax preference or lack thereof, and (4) the holding period.

3.7.1. The variability of returns on stocks, bonds, and money market

As noted in the preceding section, the study attempts to mimic rates of return on stocks, bonds, and money markets which occurred during the period 1980–1999. The interdependencies among the three asset classes are also preserved. The same rates of return are used for stocks in the SSP and in the NSSPs for any given year; different outcomes between SSP and NSSPs are thus minimally attributable to variability in rates of return or to rates of return on stocks being unusually large.

3.7.2. Asset allocation

The asset allocation of the SSP is predetermined. The younger the child, the larger the proportion of funds in stocks and the smaller in bonds and money market instruments. The exact proportions are noted in Table 1. The asset allocation for the NSSPs is (initially) solely stocks.

3.7.3. Taxes and tax preference

The SSP has three tax preferences that are unavailable to the NSSP. These include (1) contributions to the plan are exempt from state tax, (2) accumulation takes place on a tax-deferred basis, and (3) distributions are taxed at the child's tax rate. The NSSP has none of these benefits and the effect of the preferential tax treatment is an item of interest. It can be easily imagined that a child is "gifted" this amount under the Uniform Gift to Minors Act (UGMA) and the money is compounded at the child's after-tax rate. That strategy, however, creates ownership differences and we have assumed a less favorable scenario for NSSPs in order to illustrate the differences.

Four distinct tax brackets, all based on the Federal Internal Revenue Service tax tables for 2000, are used in calculating the after-tax amounts for the NSSPs. "Low Tax," "Medium

Tax," "High Tax," and "Very High Tax," correspond to the federal marginal tax rates for married parents filing jointly. "Low Tax" corresponds to the lowest Federal tax bracket, for taxable income in (2000) up to $43,850, "Medium Tax" corresponds to taxable federal income up to $105,950, "High Tax" corresponds to taxable federal income up to $161,450 and "Very High Tax" corresponds to taxable federal income up to $288,350.

3.7.4. The holding period of the investment

Comparisons are made assuming that a parent began accumulating college savings on the day the child was born (18-year holding period in a savings plan), or, alternately, began accumulating on the child's 2nd birthday (16 years in a savings plan), . . ., and lastly, began accumulating on the child's 16th birthday (2 years in a savings plan). Thus, there are nine different holding periods: 18, 16, 14, 12, 10, 8, 6, 4, and 2 years.

In the next section, the results of the Monte Carlo simulation reveal the effects of asset allocation, tax preference, and the length of the holding period on wealth amassed in the SSP and the NSSPs.

4. Results

Before valid comparisons can be made, one adjustment is required. We wish to compare the first year after-tax distribution from these various plans. Assuming that 1/4 of the amount will be distributed in the first year (September 1, on the child's 18th birthday), the amount distributed under the SSP must be adjusted for taxes due on the distribution, but paid by the child. Since only gains are taxable, the amount distributed under the SSP in the first year, net of taxes, is calculated as follows:

S_T The accumulated amount under the state plan after T years before adjusting for taxes.
G Gains from the savings plan $= S_T - (T)(A)$, where T is the number of payments made into the plan, and A is the amount contributed each year.

Thus the tax paid by state contributors will be Tax $= Gt_{se}$, where t_{se} is the student's marginal tax rate, corresponding to the lowest federal and state marginal tax rate. The net amount of funds available for college expense in the first year is thus $1/4(S_T - \text{Tax})$. The NSSP amount was simply 1/4 of the total accumulation, since all taxes have already been paid.

Based on the simulation experiment, we obtain 1,000 observations for each of the 9 age groups (and corresponding holding periods) for the SSP and for each of the 9 age groups (and corresponding holding periods), in four distinct tax categories, for the NSSP. The location and shape of the resulting distributions of earnings can now be analyzed and compared.

Descriptive statistics for all 9 holding periods, four tax rates and tax-deferred versus taxable investment are calculated. In the interest of brevity, three holding periods, namely 18, 10, and 4 years are presented (Table 2).

There is a shifting pattern, by years-of-participation and by tax rate, in the superiority or inferiority of the SSP relative to the NSSPs. The NSSP (Low Tax) allows for higher average and median annual withdrawals for college expenses than does the SSP for all participation periods. Furthermore, the minimum annual withdrawal generated in the NSSP (Low Tax) is

Table 2
Descriptive statistics for annual amounts available for college costs—various holding periods

	SSP	NSSP (Low Tax)	NSSP (Medium Tax)	NSSP (High Tax)	NSSP (Very High Tax)
18 years					
Mean	8243.18	11141.20	8322.03	7718.55	6889.52
S.D.	3022.21	5139.31	3092.74	2695.84	2177.44
C.V.	0.3666	0.4612	0.3715	0.3493	0.3160
Q1	6036.96	7444.30	6065.35	5735.43	5273.61
Median	7696.24	10217.60	7829.87	7309.53	6578.46
Q3	9812.99	13647.80	9945.36	9165.74	8116.28
Minimum	2840.39	3134.78	2959.83	2914.16	2844.86
Maximum	28481.30	53338.60	30631.20	26504.80	21280.80
Skewness	1.40	1.92	1.50	1.40	1.25
Kurtosis	4.04	8.29	5.14	4.50	3.66
10 years					
Mean	2168.35	2867.00	2465.16	2370.341	2233.55
S.D.	450.38	892.56	631.83	574.18	493.78
C.V.	0.2077	0.3113	0.2563	0.2423	0.1317
Q1	1838.06	2222.81	2006.91	1953.24	1875.61
Median	2124.35	2752.19	2396.60	2312.03	2188.58
Q3	2434.71	3341.48	2817.83	2698.49	2523.54
Minimum	1087.25	1173.86	1179.96	1181.10	1182.45
Maximum	4373.10	7363.25	5468.26	5056.99	4488.81
Skewness	0.72	1.06	0.88	0.84	0.77
Kurtosis	1.01	2.00	1.41	1.28	1.09
4 years					
Mean	591.85	683.65	642.93	632.66	617.32
S.D.	64.52	134.73	106.12	99.14	88.90
C.V.	0.1090	0.1971	0.1650	0.1567	0.1440
Q1	546.70	591.59	570.51	564.94	556.63
Median	586.20	670.35	634.30	624.93	610.86
Q3	630.93	765.54	709.73	695.42	674.17
Minimum	413.86	393.09	405.14	408.29	413.08
Maximum	831.12	1252.23	1074.35	1032.73	971.97
Skewness	0.42	0.67	0.57	0.54	0.50
Kurtosis	0.25	0.91	0.68	0.62	0.55

C.V. = Coefficient of variation.

lower than the SSP only for participation periods of 6 or fewer years. This evidence strongly suggests that for families in the "low" income category, which have a long term college savings goal, the SSP is likely to be an inferior alternative to a plan which aggressively contributes to a 100% equity plan. Note that for the 18-year holding period, the NSSP (Low Tax) has an average annual amount available for college expenses that is 35% higher than the average amount available under the SSP. Since the child's rate of combined marginal rate of taxation is assumed to be much less than 35%, our results hold even if distributions from the SSP are tax exempt upon withdrawal.

The NSSPs produce higher average annual withdrawal amounts and higher median annual withdrawal amounts compared with the SSP for all participation periods in the Low Tax, Medium Tax, and High Tax brackets. The NSSPs have higher average and median withdrawals than the SSP in the Very High Tax bracket for holding periods of less than 14 years. For holding periods of 18, 16, 14, 12, 10, and 8 years, the SSP always has the lowest return. Clearly the NSSPs perform better on average, and when they perform poorly, not as poorly, as the SSP.

As might be expected, the NSSPs are considerably more volatile than the SSP, as measured by the S.D. (S.D.s for the NSSPs are larger than the SSP with four exceptions: for 18-year holding periods in the High Tax bracket and 18-, 16-, and 14-year durations in the Very High Tax brackets.) Given the larger standard deviations (risk) in the NSSPs, it is reasonable to expect that these riskier plans would result in lower end of period wealth accumulations at the left end of district. This does not happen for the following reasons.

The average return is often substantially higher for the NSSPs. So that even though the dispersion is greater, the location of the distribution is considerably higher than the SSP.

A positive skewness coefficient number tends to indicate right-skewness, and the higher the number, the greater the skewness. While the distributions of all the plans are right skewed, the NSSPs are more right skewed than the SSP. One can observe that with a single exception (18-year holding period, NSSP (Very High Tax)), the NSSPs are at least as skewed as the SSP. The variances for the NSSPs tend to be larger than for the SSP and are likely related to the high skewness. Extremely large positive returns in the right hand tail of the distributions of the NSSPs raise both the average annual amounts available for college expenses and the variance.

The distributions of all the plans have some degree of positive kurtosis (leptokurtic), indicating more peakedness than the normal and more area in the tails (fatter tails) than the normal. The NSSPs (again with one exception, NSSP (Very High Tax), 18-year holding period), show a greater degree of kurtosis than the SSP in each condition. For the NSSPs, it appears that a larger proportion of the outcomes fall into the upper tail. The positive kurtosis and positive skewness may be related.

Table 3 gives an additional indication of how the NSSPs fare against the SSP. In 1,000 trials at each of the 9 different holding periods in the plan, a simple tally of the number of

Table 3
The frequency (out of 1,000) that each of the NSSPs obtained annual payout amounts larger than the SSP, by holding period in the plan

Years in plan	Low Tax	Medium Tax	High Tax	Very High Tax
18	956	514	333	104
16	957	653	491	259
14	957	731	602	393
12	947	771	667	496
10	927	781	720	569
8	901	770	719	606
6	859	750	698	612
4	812	722	700	632
2	712	641	612	559

Table 4
Descriptive statistics for "annual amounts available for college costs" after an 18-year holding period—(NSSPs hold stocks and bonds)

	SSP	NSSP (Low Tax)	NSSP (Medium Tax)	NSSP (High Tax)	NSSP (Very High Tax)
Mean	8243.18	8835.82	6884.64	6455.09	5856.67
S.D.	3022.21	3359.05	2123.95	1874.95	1543.47
C.V.	0.3666	0.3802	.3083	0.2903	0.2634
Q1	6036.96	6440.60	5341.44	5090.92	4730.32
Median	7696.24	8338.18	6623.27	6219.07	5680.53
Q3	9812.99	10603.40	8057.04	7502.41	6728.18
Minimum	2840.39	3138.28	2943.58	2894.15	2820.21
Maximum	28481.30	333311.50	20707.80	19298.50	15171.00
Skewness	1.40	1.92	1.49	1.40	1.25
Kurtosis	4.04	8.29	5.14	4.50	3.66

While the SSP follows the asset allocation as shown in Table 1, these NSSPs have a more conservative allocation of 80% stocks and 20% bonds, compared to the NSSPs in Table 2 which have 100% in stocks. A SSP has distinct tax advantages, and a NSSP does not.

times that the NSSP (at each tax level) obtained larger annual withdrawal amounts at the end of the plan is kept. It is quite clear that for plans of longer holding periods (starting early and contributing regularly) the NSSPs with low to moderate rates of taxation did much better than the SSP. The Low Tax NSSP obtains larger annual withdrawals over 90% of the time for plans of 8 or more years. These results again strongly suggest that the SSP is an inferior savings plan for savers in the "low" tax range, compared with the NSSPs (or would have been over the past 20 years).

We also simulate end of period wealth for NSSPs with an 80–20 stock-bond allocation for all holding periods. The descriptive statistics for this allocation and for an 18-year holding period are presented in Table 4.

It can be observed that even with this comparatively conservative asset allocation, the NSSP is a superior alternative for the Low Tax bracket. In the Low Tax bracket, the average return, the median return, the first quartile return, and the minimum return are all higher than comparable measurements for the SSP. The NSSP returns for the Medium Tax and High Tax brackets are lower, on average, than for the SSP. These occurrences once again fortify the argument that the SSP tends to benefit those in higher tax brackets rather than the least wealthy savers.

Is there a stock-bond allocation ratio for each of the NSSP tax brackets and age levels which performs equally to the SSP? We calculate the proportion of stocks to bonds that would be needed for the various holding periods to match the end-of-period wealth of the SSP, that is, the constant asset allocation ratio which would provide equal wealth accumulation to the SSP. Table 5 presents calculations made for all 9 holding periods for the Low, Medium, High, and Very High tax brackets.

For the Low Tax bracket, a 74%/26% stock-bond asset allocation results in the same average return for the 18-year period as does the SSP. For the Medium Tax bracket, a 99%/1% stock-bond ratio performs with equal effectiveness to the SSP for the 18-year holding

Table 5
Percentage of stock in NSSP required to equal SSP wealth accumulation

Length of investment (years)	Percent in stocks			
	Low Tax	Medium Tax	High Tax	Very High Tax
18	74	99	–	–
16	69	93	100	–
14	64	84	94	–
12	58	79	87	100
10	53	74	82	98
8	50	68	75	91
6	45	65	71	85
4	39	58	65	76
2	40	60	67	76

The remainder percentage is invested in bonds. No investment in money market instruments is assumed.

period. The Very High and High Tax brackets for the 18-year holding period cannot match the SSP even with 100% stocks.

The results affirm our earlier finding of a pattern favoring NSSPs for those in lower tax brackets. The saver using the NSSP can obtain returns which are equivalent to those in the SSP by using an asset allocation strategy which is more aggressive than the SSP, yet conservative by some standards. For all SSP savers, the longer you participate the better. Buying into the SSP when the child is near college age is shown to be a poor strategy.

The results presented in Tables 4 and 5 can also be used to temper a potential criticism of this study, that the results appear to rely on 100% equity versus the SSP's more conservative allocation. What Table 5 highlights is that in the Low Tax group, a 75%/25% equity/bond ratio still outperforms the SSP over an 18-year holding period (74%/26% equals it). For the Low Tax bracket, a 70%/30% ratio outperforms the SSP over 16 years (69%/31% equals it), and a 60%/40% ratio outperforms it over 12 years. Clearly the outcomes which this study has found are not contingent on the 100% equity allocation. The SSP are overly conservative based on the historical rates of return over the past 20 years.

Based on the method described in Section 3.5, the study is replicated using rates of return from 1970 to 1989, when rates of return were historically lower. The same general conclusions can be stated about SSP and NSSPs during that period; NSSPs generally provide larger after-tax accumulations for the lower tax groups than do the SSP. It would seem that as long as there is a considerable spread between rates of return on stocks and rates of return on bonds, the NSSPs will outperform the SSP. For the SSP, the benefit of favorable tax treatment might be insufficient in overcoming the conservative and inflexible asset allocation.

5. Conclusion

We have illustrated that restricting asset allocation in education savings plans might be suboptimal. The restrictive asset allocations imposed by the SSP is often not offset sufficiently by the tax postponement. In fact, the tax "advantage" is a relative disadvantage for families in lower tax brackets. As is already known, tax advantaged investment benefit taxpayers in higher tax brackets more than those in lower tax brackets.

Participants in higher tax brackets, who may already have substantial exposure to risky asset classes like equities, and who start contributions earlier in the child's life, stand to derive the greatest benefit from these managed allocation plans. First, the longer the child participates in the state savings plan, the greater the benefit. The increasingly conservative asset allocation as the child ages provides decreasing rates of return, thus late entrants in the plan can expect relatively smaller growth. Second, the higher their tax bracket, the greater the benefit to participants. Strikingly, participants in the "low" tax brackets (who save over the long term), are likely to amass more after-tax savings by foregoing the state savings plans. We believe both of these results are due to increasingly conservative asset allocation over time required by the SSP.

Many plan sponsors have recently started offering a wider variety of investment plans to participants. This will definitely make the plans more equitable across income groups. Investors in lower income groups who are considering these plans would be well advised to consider

- starting contributions earlier in the life of the child,
- exercising investment options that are equity aggressive, and,
- making the savings plans a part of a comprehensive asset allocation plan that takes into consideration all assets, rather than a piece-meal approach.

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References

Arnott, R. D., Berkin, A. L., & Ye, J. (2000). How well have taxable investors been served in the 1980s and 1990s? *Journal of Portfolio Management*, *26*(4), 84–93.

Arshanapalli, B., Coggin, D. T., & Nelson, W. (2001). Is fixed weight asset allocation really better? *Journal of Portfolio Management*, *27*(4), 27–38.

Bengen, W. P. (1996). Asset allocation for a lifetime. *Journal of Financial Planning*, *9*(4), 58–63.

Bierman, H. (1997). Portfolio allocation and the investment horizon. *Journal of Portfolio Management*, *23*(4), 51–55.

Bodie, Z. (1995). On the risk of stocks in the long run. *Financial Analysts Journal*, *51*(3), 8–13.

Bodie, Z., & Crane, D. B. (1997). Personal investing: Advice, theory and evidence. *Financial Analysts Journal*, *53*(6), 13–23.

Brinson, G. P., Hood, R. L., & Beebower, G. L. (1986). Determinants of portfolio performance. *Financial Analysts Journal*, *42*(4), 39–45.

Brinson, G. P., Singer, B. D., & Beebower, G. L. (1991). Determinants of portfolio performance. *Financial Analysts Journal*, *47*(3), 40–48.

Brinson, G. P., Singer, B. D., & Beebower, G. L. (1995). Determinants of portfolio performance II: An update. *Financial Analysts Journal*, *51*(1), 133–138.

Canner, N., Mankiw, G. N., & Weil, D. N. (1997). An asset allocation puzzle. *The American Economic Review*, *87*(1), 181–191.

Cropper, C. M., & Tergesen, A. (2001, March 12). College savings plans come of age. *Business Week*, 102–106.

Davidson, R., & MacKinnon, J. G. (1993). *Estimation and inference in econometric*s. New York: Oxford University Press.

Elton, E. J., & Gruber, M. J. (2000). The rationality of asset allocation recommendations. *Journal of Financial and Quantitative Analysis*, *35*(1), 27–42.

Eyssell, T. H. (1997). Financial planning and college savings recommendations: Let's set things straight. *Financial Services Review*, *6*(1), 17–28.

Http://www.collegesavings.org

Ibbotson Associates. *Stocks, bonds, bills and inflation 2000 yearbook. Valuation edition*. Chicago, IL: Roger Ibbotson and Associates.

Ibbotson, R. G., & Kaplan, P. D. (2000). Does asset allocation policy explain 40, 90, or 100 percent of performance? *Financial Analysts Journal*, *56*(1), 26–33.

Jahnke, W. W. (2000, Spring). The importance of asset allocation. *Journal of Investing*, 61–64.

Jones, C. P., & Wilson, J. W. (1999). Asset allocation decisions—making the choice between stocks and bonds. *Journal of Investing*, *8*(1), 51–56.

Kennedy W. J., & Gentle, J. E. (1980). *Statistical computin*g. New York: Marcel Dekker Inc.

Koskosidis, Y. A., & Duarte, A. M. (1997). A scenario-based approach to active asset allocation. *Journal of Portfolio Management*, *23*(2), 74–85.

Luck, C. G. (1999). Tax-advantaged investing. *Journal of Wealth Management*, *2*(1), 1–6.

Marks, B., & Reichenstein, W. (2000). Tax strategies for financing higher education. *Journal of Financial Planning*, *13*(5), 104–113.

Naylor, T. H., Balintfy, J. L., Burdick, D. S., & Chu, K. (1968). *Computer simulation techniques* (pp. 97–99). New York: Wiley.

TIAA-CREF. (1999, March 30). Program brochure: New York's college savings program: Imagine the returns.

Vore, J. (2000, February). College savings plans: A guide to how they work? *AAII Journal*, 11–14.

Wang, P. (2001). The 529 solution. *Money*, *30*(5), 96–103.