A Legislator's Guide to Age-Based Evolving Portfolios: Background, Use, Performance, and Comparison To Other States

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Executive Summary

A growing number of Defined Contribution retirement plans, for Virginia state employees, involve age based evolving portfolios, known as Target Date Funds (TDFs). These funds are designed to be simple investment options for individuals with a specific withdrawal date in mind called the target date. The target date can be any point in the future when withdrawal is expected to occur. TDFs operate by investing in a pre-diversified mix of assets that shift over time from riskier investments (stocks) to more conservative investments (bonds). That shift is referred to as a fund's glide path.

Virginia adopted age-based evolving portfolios as part of State Defined Contribution Plan for retirement in early 2012. The Virginia College Savings Plan (VCSP) has been using age-based evolving portfolios since early 2000s. This report looks at Virginia's use of target date funds by VRS and inVEST, the risks and advantages, historic performance of funds, and a comparison to other states' evolving portfolios.

VRS and inVEST portfolios

A number of key design differences between the structure of the age-based evolving portfolios in VEST and the VRS need to be highlighted:

- **Basic Design:** VRS's age-based evolving portfolios are managed BlackRock Investments, and are tied to their Master Portfolio. The inVEST age-based evolving portfolios are customized funds for VCSP. These funds are geared towards shorter investment horizons, and various investment companies manage the different asset components.

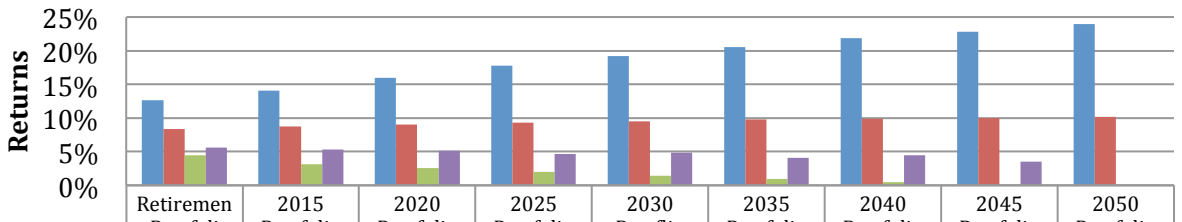
- **Active vs. Passive management:** Components of the inVEST portfolio are actively managed by firms that have a separate investment account for inVEST. Active managers adjust assets to try and beat market returns. VRS is a passively managed fund meaning that the managers mix assets to achieve custom benchmarks set by a mixture of third-party indexes such as the S&P 500 index.

- **Glide paths:** The different investment time horizons result in distinct glidepaths for the VRS and inVEST portfolios. The inVEST glidepath begins with 80% of the portfolio invested in stocks and shifts entirely to bonds as the target date approaches. The VRS portfolio begins with 99% of the portfolio invested in stocks and shifts to about 40% stocks as the target date approaches. The portfolio maintains 40% of its assets in stocks for the lifetime if the investment.

- **Fees**: The annually compounded fees range from 0.78% to 0.30% for the inVEST target date portfolios while the fees for all VRS target date portfolios are fixed at 0.09%. The higher costs reflect that inVEST is actively managed while VRS is passively managed.

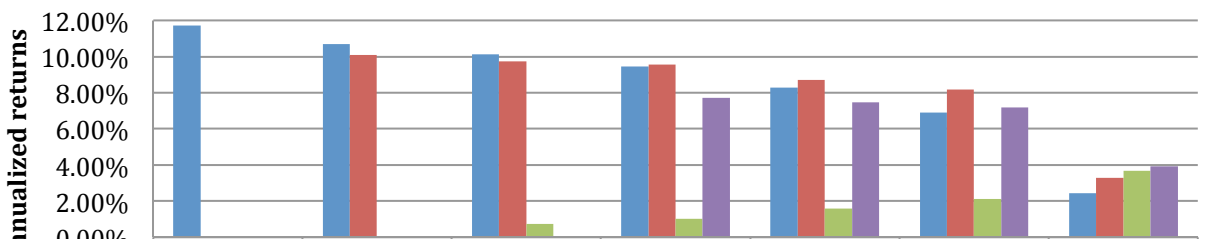
Historical Performance

The average performance of VRS portfolios over the last 3 years was much better than the average performance over the last 5 years. This suggests that these portfolios are making a strong recovery after the financial crisis. The differences between the 1-year, 3-year, 5-year, and 10-year returns reflect the effects of passive management where the assets don't respond to market shocks the way that actively managed portfolios would.



	Retirement Portfolio	2015 Portfolio	2020 Portfolio	2025 Portfolio	2030 Portflio	2035 Portfolio	2040 Portfolio	2045 Portfolio	2050 Portfolio
1 year	13%	14%	16%	18%	19%	21%	22%	23%	24%
3-years	8%	9%	9%	9%	10%	10%	10%	10%	10%
5-years	5%	3%	3%	2%	1%	1%	1%	0%	0%
10-year	6%	5%	5%	5%	5%	4%	4%	4%	0%

The average performance of the inVEST portfolios in the last 1 year and 3 years was not significantly different than the average performance over the last 10 years. The inVEST evolving portfolios bounced back from the recent financial crisis quickly because they are actively managed.



	James River (Ages 0-3)	Eastern Shore (Ages 4-6)	Alleghany (Ages 7-9)	Chesapeake (Ages 10-12)	Potomac (Ages 13-15)	Southside (Ages 16-18)	Piedmont (Over 18)
1 Year	11.71%	10.71%	10.12%	9.47%	8.30%	6.89%	2.43%
3 Year		10.08%	9.74%	9.55%	8.72%	8.19%	3.29%
5 Year			0.72%	1.00%	1.60%	2.12%	3.69%
10 Year				7.71%	7.47%	7.17%	3.94%

Comparison with Other States

The states of North Carolina and Maryland also use Target Date Funds for their retirement and college savings plans. Maryland offers the best comparison data to Virginia because the North Carolina retirement fund is still in its infancy. Thus, the bulk of comparisons are made against the Maryland retirement and college savings plans.

Comparison with Maryland: Retirement Plans

Maryland's retirement funds out-performing Virginia's portfolios, supported by higher percentage of assets in stocks. The 5-year return on the 2015 Fund is the only instance where Virginia is out performing Maryland. Virginia's asset mix may be keeping investors nearing retirement safer from market fluctuations relative to Maryland because Virginia portfolios are less risky.

Maryland's retirement portfolios cost more. One of the reasons for this could be that Maryland's funds are actively managed, and Virginia's are passively managed. This means that when the economic forecast changes, or if the economy changes suddenly, Maryland's TDFs are adjusted in real time, whereas Virginia's funds are left as is.

Comparison with Maryland: College Savings Plan

Maryland's college savings plans are also actively managed. The College savings plans hold a higher number of stocks than Virginia plans and therefore have higher returns.

Conclusion: Risks and Advantages

Target Date Funds used as part of a defined contribution retirement plan shift investment risk from the state of Virginia to the individual investors, the state employees. Used as part of the VCSP, TDFs are risky if the child does not get into a college or if the family is hoping to qualify for need-based financial aid. Also, the shortened timeline for college investment makes it more difficult to weather market fluctuations. Below is a chart listing the risks and advantages investors in any kind of target date fund will encounter.

Advantages	Risks
1. Protection from common investing mistakes. 2. Glidepath allows for appropriate mix of risk over time. 3. Glidepath allows portfolio to evolve based on needs. 4. Potentially improved investment performance over time. 5. Participants choose their "strategy" rather than specific investments. 6. Portfolios are diversified across many assets. 7. Funds are automatically reallocated over lifetime of portfolio. 8. Benefits younger investors who have time to weather market fluctuations.	1. No guarantee of principal investment. 2. Principal balance will fluctuate over time and after retirement. 3. No guarantee of adequate funds at or through retirement. 4. Less advantageous to older investors focused on maintaining assets and who don't have time to weather the ups and downs of the market. 5. If stocks do poorly during first periods of portfolio life and well during the end of portfolio life then losses will be maximized and gains minimized. 6. Target Date Funds should not be considered a complete investment program and may not be designed exclusively for retirement. 7. Target date funds are managed for a group and do not take into consideration an individual's personal threshold for risk. 8. Management of fund may be more costly than other funds.

Background: Age-Based Evolving Investment Portfolios[1]

The Virginia Retirement System has recently adopted the use of age-based evolving investment portfolios in its retirement planning options. Age-based investment portfolios are investments that are managed with the goal of withdrawing funds on a specific date. The date is often referred to as the "target date" and is the reason that age-based investments are commonly called target date funds (TDFs).

TDFs are long-term investment strategies for individuals with specific withdrawal dates. A typical TDF investment portfolio has the withdrawal year in the name of the fund. For example, "Portfolio 2030" might be the name of a fund that is managed for withdrawal in the year 2030. Tolerance for risk and other factors will determine which TDF an investor chooses. Someone planning on retiring in the year 2030 might invest in "Portfolio 2025" which will have a less risky collection of assets when the individual reaches their target date. Conversely, someone investing in "Portfolio 2035" will have a greater collection of risky assets when they retire in 2030. This puts the individual at risk of losing potential portfolio income near retirement, but it could also lead to higher retirement income because the returns might be buoyed by the higher percentage of stock assets in the portfolio.

TDFs are designed so that a risky mix of assets automatically adjusts to a more conservative mix of assets over time. This automatic adjustment of assets makes TDFs different from most other investments, which must be actively managed by the investor. Thus, TDFs provide a real advantage to individuals who are unfamiliar with investment strategies and who don't have time to actively manage their accounts. The mix of assets is determined by what is known as a glidepath. The glidepath is an approach to investing that predetermines what mixture of stocks, bonds, and other investments the fund will have over time. Below are two examples of glidepaths that a TDF might have.

In Figure 1, the TDF begins with a large ratio of stocks to bonds. This ratio gets smaller over time and as the target date is reached, the portfolio has 60% of its assets in stocks and 40% in bonds. Notice that the ratio continues to change even after the target date is reached. Eventually, the portfolio levels out its allocation with 30% stocks and 70% bonds at a time 25 years after the target date is reached.

[1] Images and information in this section comes from U.S. Securities and Exchange Commission. *Investor Bulletin: Target Date Retirement Funds*. Modified 5/5/2010. Accessed November 2012. http://www.sec.gov/investor/alerts/tdf.htm

Figure 1: Sample Glidepath A

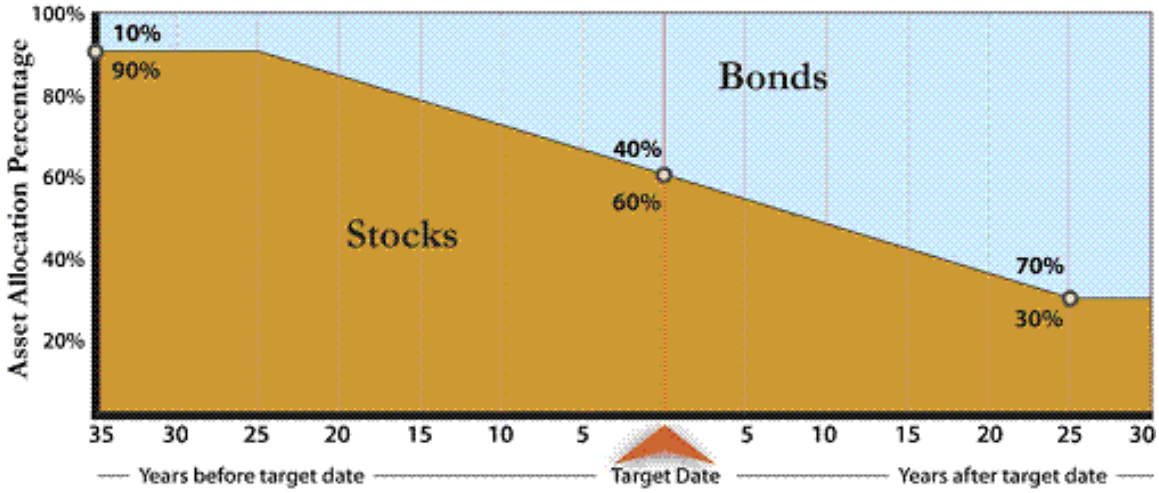
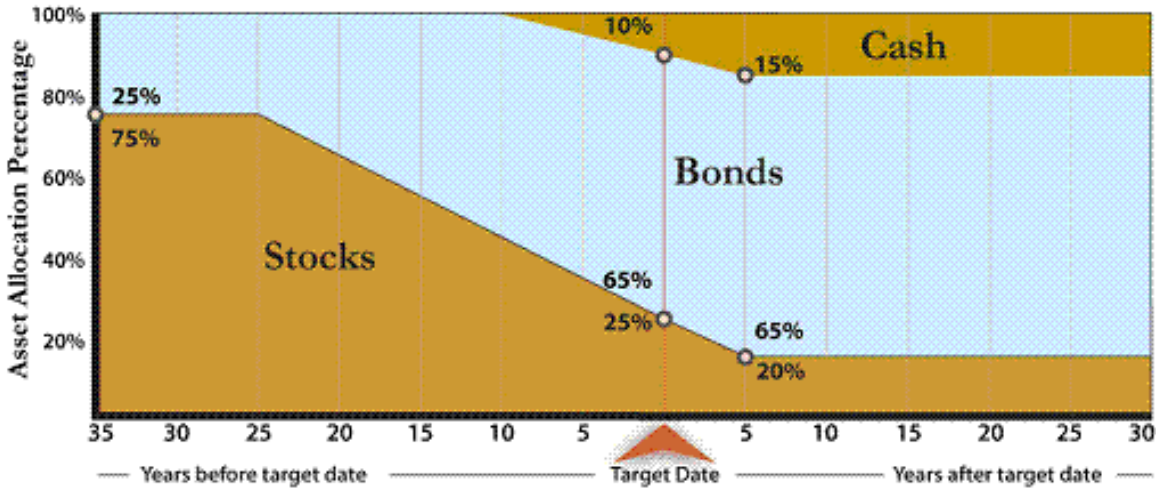


Figure 2 shows an alternative and much less risky glidepath for a TDF. Starting out with 75% stocks and 25% bonds, the assets change over time until at the target date there are 25% stocks and 65% bonds. This investment portfolio also holds cash investments, such as money market accounts. By the time the target date is reached, this fund has 10% of its assets in cash investments. This fund also continues to be managed past the target date, but it settles on the final asset allocation of 20% stocks, 65% bonds, and 15% in cash investments just five years after the target date is reached.

Figure 2: Sample Glidepath B



These two examples illustrate the range of variety in target date funds. Just as TDFs vary in glidepath, so too do they vary in performance. Not all TDFs are created equal. Stocks represent the

greatest risk of investment for TDFs, and also the greatest potential for return an investment portfolio.

There are two types of management styles for TDFs, active and passive. Passive management means the portfolio managers select a benchmark index for each underlying asset the portfolio possesses and use this to calculate a weighted average of returns. The weighted average of the index is reflective of the asset mixture of the portfolio. The portfolio is then managed so that the returns are approximately equivalent to or better than the calculated benchmark index. Active management involves responding to market fluctuations. Active managers will respond to shifts in the market by adjusting stocks and bonds accordingly. The ultimate goal of active management is to outperform the overall market. There is no evidence that one management style is better than the other. However, actively managed funds tend to cost significantly more than index-based portfolios.

Age-based investment portfolios have no guarantees. An age-based portfolio is still an in investment and any investment carries risk. No TDF guarantees that adequate funds will be available on withdrawal. Most private investment firms encourage the use of age-based portfolios as a secondary source of income. These funds should ideally be used in conjunction with another source of income such as social security.

Virginia Retirement System and Target Date Funds

All state employees hired after 2008 are automatically enrolled in Virginia's defined contribution retirement program. Within Virginia's defined contribution program there are optional retirement plans called deferred compensation plans that include the 403(b) and the 457 retirement plans. Both employ age-based evolving investment portfolios as an optional investment strategy.

To be clear, not everyone in the defined contribution plans uses the evolving investment portfolio strategy. This is an optional retirement plan for employees that choose to enroll in a DC plan. Data from the Virginia Retirement System on the specific number of employees who are specifically invested in target date funds were unavailable. However, the number of state employees investing in TDFs is a small, but growing, population. This figure is likely to increase with time. The recent transition from Virginia's defined benefits plan, and the fact that TDFs are the optional, not the default, investment strategy are the main factors that contribute to the size of the TDF-invested population of state employees.

The financial firm BlackRock manages the evolving portfolios in the Virginia Retirement System. These plans are an off-the-shelf financial product, meaning that BlackRock does not have a separate VRS account. Instead, the LifePath Index is what is known as a "feeder fund". The funds within the LifePath Index Portfolio feed into BlackRock's Master Portfolio called LifePath Index Funds. All investments into the LifePath Index Series feed into the Master Portfolio so that investments are actually made at the Master Portfolio level. State employees invest in one of the eight LifePath Index Funds that BlackRock offers. The portfolios are named by their target date year. For instance, the LifePath index 2055 is managed for a withdrawal date for the year of 2055. Employees can choose to invest in any of the eight portfolios offered.

BlackRock uses a passive management technique for its evolving portfolios. The indices BlackRock uses to calculate their custom benchmarks are: the S&P 500 Index, Dow Jones U.S. Completion Total Stock Market index, MSCI ACWI ex-U.S. IMI Index, Barclay's Aggregate Bond Index, Barclay's U.S. Treasury Inflation-Protected Securities Index, FTSE EPRA/NAREIT Developed Index, and Dow Jones-UBS Commodity Total Return Index. This management technique, while less expensive than active management, demands a higher fee for service.

The expense ratio, which is deducted from the fund's average gross assets, is accrued on a yearly basis. The annual expense ratio for all funds within the LifePath Series is 0.09% or 0.90$ per $1000 invested. The compounding nature of the fees means that a 0.09% fee on a principal invested over 30 years would result in a 2.6% reduction in market value at target date.[2]

Table 1 shows the current percentage of bonds and equities for all of the LifePath Index portfolios used by the Virginia Retirement System. This table shows how the mixture of bonds and

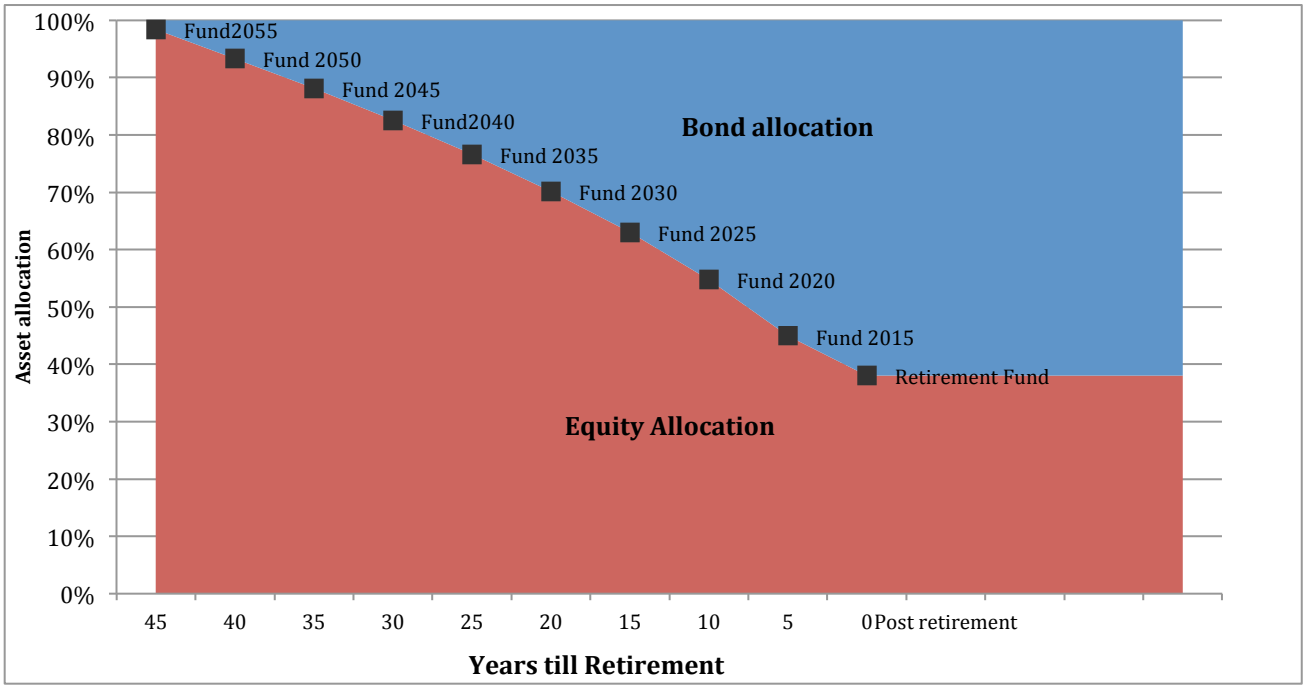
[2] Based on the formula (1-(1-fee)^30)

equities changes over time for state employees invested in the Virginia Retirement System. Portfolios for older investors (i.e. where target dates is approaching in the near future) hold a significantly higher fraction in bonds than portfolios designed for younger investors. Figure 3 illustrates the VRS TDF glidepath.

Table 1: Percentage of Stocks and Bonds in the VRS Evolving Portfolios

Retirement Portfolio	Equity asset	Bond asset
LifePath retirement index	38%	62%
LifePath index 2020	56%	44%
LifePath index 2025	63%	36%
LifePath index 2030	71%	29%
LifePath index 2035	77%	22%
LifePath index 2040	84%	16%
LifePath index 2045	89%	11%
LifePath index 2050	95%	5%
LifePath index 2055	99%	1%

Figure 3: Blackrock's Glidepath



While the percentage of equities and bonds will no longer change after the target date, BlackRock will continue to evaluate the assets available to ensure that gains are still made throughout retirement. A more detailed display of the bond and equity mixture that BlackRock uses is shown in Figure 4. This figure shows in greater detail the way that Blackrock will allocate funds across the different portfolios. Notice that the portfolio contains a mixture of International equities, US small, large, and mid cap equities, US bonds, US inflation linked bonds, and a very small amount of money market accounts.

Figure 4: Detailed Asset of BlackRock's LifePath Index Portfolios

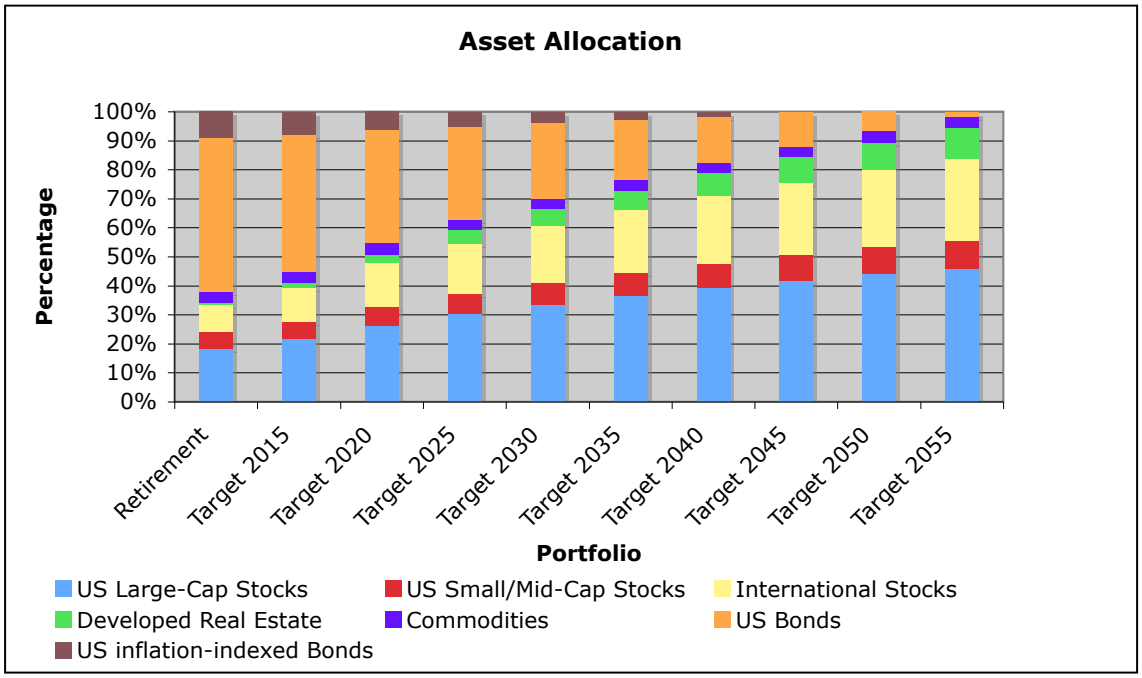


Figure 4 shows the asset mixture changes over time to incorporate a larger percentage of bonds into the portfolio of Virginia employees. For a more specific description of asset allocation for each investment index, the Virginia Retirement website keeps a detailed table of assets by portfolio which it continuously updates for members of the retirement system.

Virginia 529 inVEST and Target Date Funds

In 1994 the Virginia General Assembly established the Virginia College Savings Plan (VCSP) as an independent state agency. Five years later, the General Assembly authorized VCSP to create one or more investment savings options in accordance with the provisions of Section 529. As part of the investment savings options, the VCSP offers several age-based evolving portfolios for the college savings. Although VCSP TDFs, the structures of the target date funds are somewhat different the ones offered by VRS. This section covers the use of TDFs in the Virginia Education Savings Trust, and will highlight the structural differences between the use of TDFs by inVEST and VRS where appropriate.

The Virginia College Savings Plan has four different options in saving for a child's education expenses: the Virginia 529 prePAID, Virginia 529 inVEST, College America, and College Wealth. Each savings option has different risks and advantages and caters to different types of investors. Some are savings plans, others are prepaid tuition programs. Some are backed by FDIC insurance and others are risk with no safety net. Only one program makes use of TDFs, the Virginia 529 inVEST program, and it will be the focus of this section.

The Virginia 529 inVEST program is an investment-based savings account. In the program, customers choose between age-based evolving portfolios and non-evolving portfolios. The non-evolving portfolios use an asset mix much like the evolving portfolios where there is investment in both equities and bonds. Unlike evolving portfolios, their asset mix does not change over time. Investors choose a non-evolving mix based on their level of risk, investment timeline, and overall investment goal. The age-based evolving portfolios are chosen based more on investment strategy and age of the child than a personal tolerance for risk. Investors are free to choose which plan they would like to enroll in, however, and they have the option of changing their investment to a different portfolio once every year.

The inVEST program offers eight age-based evolving investment portfolios for college savings. Listed in order of most recently created to oldest, the portfolio names are: James River, Eastern Shore, Alleghany, Chesapeake, Potomac, Southside, Blue Ridge, and Piedmont. All of these portfolios share the same investment glidepath, and they are located at different stages along the glidepath. Table 2 below shows the equity and fixed income percentage of each portfolio. As the target date approaches each portfolio will shift progressively into larger holdings of fixed income until each fund resembles the Piedmont portfolio at 100% fixed income with a stable value.

Table 2: Initial Asset Mix of inVEST Evolving Portfolios

Portfolio name	Equity Assets	Fixed Income Assets
James River	80%	20%
Eastern Shore	70%	30%
Alleghany	60%	40%
Chesapeake	50%	50%
Potomac	40%	60%
Southside	25%	75%
Blue Ridge	0%	100%
Piedmont	0%	100%/stable value

The asset allocations for each investment change about every three years. This is different from the retirement system due in part to the short time horizon of a college savings plan. Retirement plans are managed on 30 year or longer timeline whereas a college savings plan is roughly an 18-year timeline. Table 3 below shows how the assets will change over time

Table 3: Asset Allocations inVEST Portfolios Over Time

	Current Allocation	Anticipated Asset Allocation					
Portfolio	January 2012-January 2015	January 2015-January 2018	January 2018-January 2021	January 2021-January 2024	January 2024-January 2027	January 2027-January 2030	January 2030
James river	80% Equity 20% Fixed Income	70% Equity 30% Fixed Income	60% Equity 40% Fixed Income	50% Equity 50% Fixed Income	40% Equity 60% Fixed Income	25% Equity 75% Fixed Income	0% Equity 100% Fixed Income
Eastern Shore	70% Equity 30% Fixed Income	60% Equity 40% Fixed Income	50% Equity 50% Fixed Income	40% Equity 60% Fixed Income	25% Equity 75% Fixed Income	0% Equity 100% Fixed Income	
Alleghany	60% Equity 40% Fixed Income	50% Equity 50% Fixed Income	40% Equity 60% Fixed Income	25% Equity 75% Fixed Income	0% Equity 100% Fixed Income		
Chesapeake	50% Equity 50% Fixed Income	40% Equity 60% Fixed Income	25% Equity 75% Fixed Income	0% Equity 100% Fixed Income			
Potomac	40% Equity 60% Fixed Income	25% Equity 75% Fixed Income	0% Equity 100% Fixed Income				
Southside	25% Equity 75% Fixed Income	0% Equity 100% Fixed Income					
Piedmont/Blueridge*	0% Equity 100% Fixed Income/ Stable Value						

* The Blue Ridge portfolio has evolved into the same asset allocation as the Piedmont portfolio.

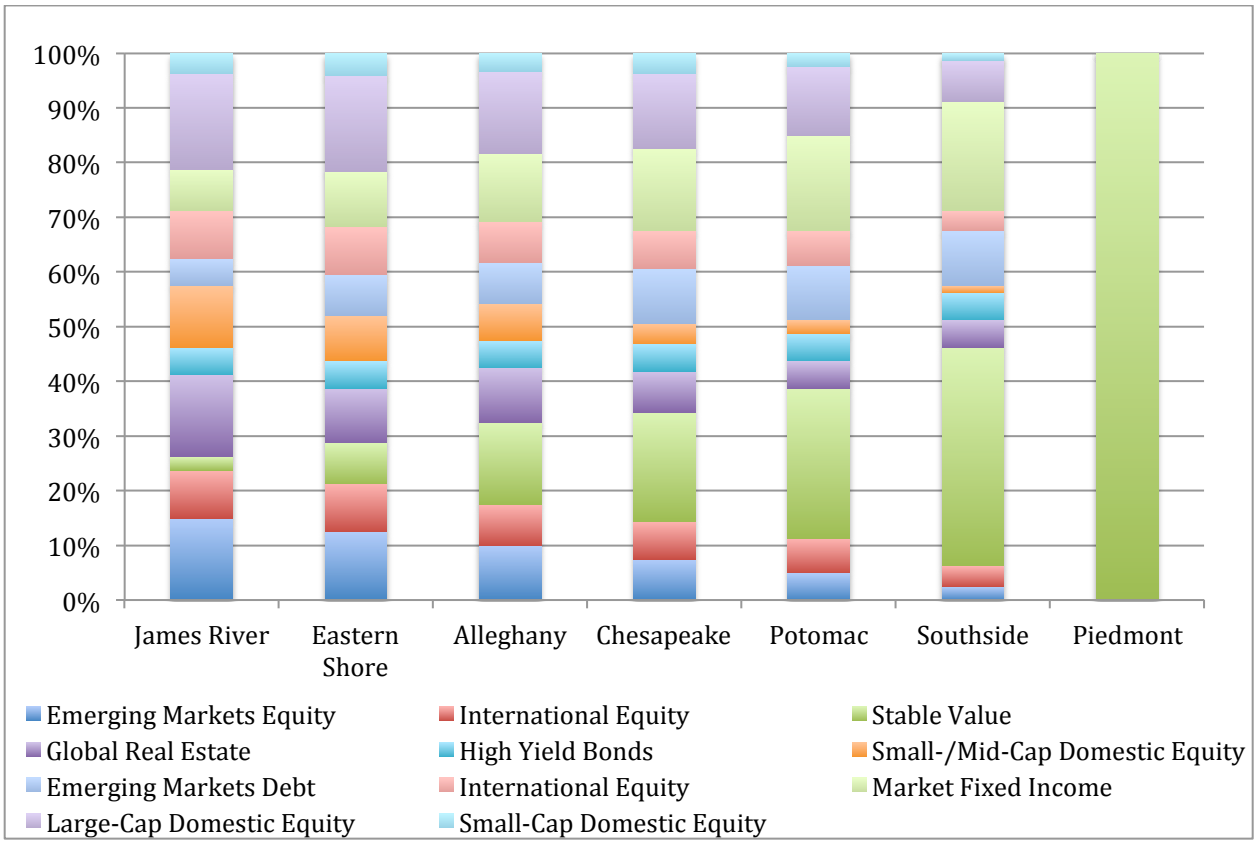
One of the contrasts between the inVEST program and the VRS retirement program lies in the asset allocations. In the VRS program, all money is transferred to one large mutual fund that is managed by one independent investment company, BlackRock. The inVEST program takes funds from investors and spreads the money across many different funds run by many different managers. For example, Prudential Investment Management is in charge of managing high yield bonds, while the

Vanguard Group manages all large-cap domestic equity investments for the inVEST program. In the VRS program these assets are entirely managed by BlackRock management. Some funds are placed in a separate investment account specifically designed for inVEST. Other times the money is allocated to a mutual fund. The following charts distill this information. Table 4 shows the different managers that inVEST uses, the type of assets they are in charge of managing and whether they use an existing fund or have a separate account custom designed for Virginia inVEST. The separate accounts are actively managed for inVEST. Figure 5 displays graphically the different asset mixtures of each portfolio. This graph also displays how asset mixtures will change as the portfolios evolve.

Table 4: Underlying Investments of inVEST Portfolios

Investment Manager	Asset Class	Fund or Separate Account
Aberdeen Asset Management Inc.	Emerging Markets Equity	Aberdeen Emerging Market Fund
Capital Research & Management Co.	International Equity	American Funds EuroPacific Growth Fund
Invesco Advisers, Inc.	Stable Value	Separate investment account for VEST
Morgan Stanley	Global Real Estate	Morgan Stanley Institutional Global Real Estate Fund
Prudential Investment Management, Inc.	High Yield Bonds	Separate investment account for VEST
Rothschild Asset Management Inc.	Small-/Mid-Cap Domestic Equity	Separate investment account for VEST
Stone Harbor Investment Partners	Emerging Markets Debt	Stone Harbor Emerging Market Debt Fund
Templeton Institutional Funds, Inc.	International Equity	Templeton Foreign Equity Series
The Vanguard Group, Inc.	Market Fixed Income	Total Bond Market Index Fund
The Vanguard Group, Inc.	Large-Cap Domestic Equity	Small-Cap Index Fund
The Vanguard Group, Inc.	Small-Cap Domestic Equity	Institutional Index Fund

Figure 5: Asset allocation of inVEST Portfolios



Risks and Advantages: Retirement TDFs

Any investment for retirement carries risk. Target date funds are no exception to this rule. Putting money in a defined contribution plan of any sort constitutes a gamble. However, TDFs present a unique set of risks and advantages. This section explains the risks and advantages that are specific to the use of TDFs as an investment strategy.

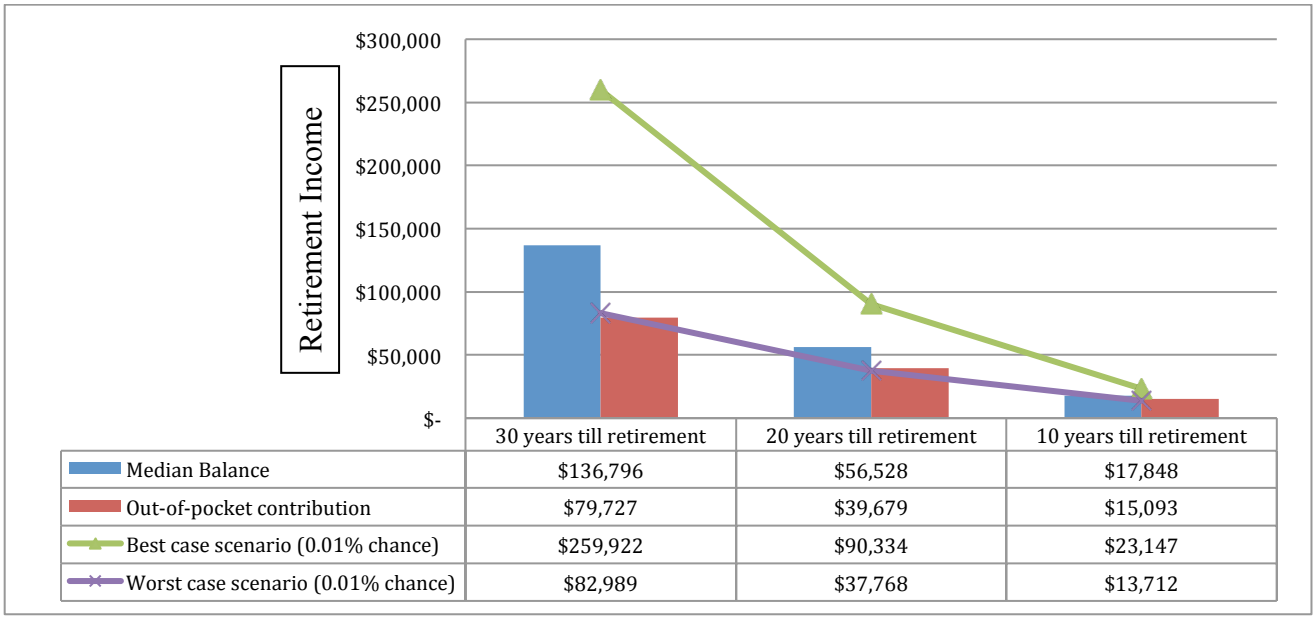
Risks

The largest risks that TDFs encounter stem from their high level of investment in equities. Although the percentage of equities owned by the TDF decreases over time, there can still be as much as 40% of a VRS portfolio invested in equities at retirement age. This leaves retirement funds vulnerable to market losses and gains. As no one can effectively predict the health of equities in 30 years, the investment in equities represent a significant risk to retirees. It is because of this sensitivity to market fluctuation that a TDF does not guarantee the amount of money invested will be available to retirees as they approach and pass the target retirement date. There is also no guarantee of the principal investment in TDFs. This risk is common among all defined contribution plans, including Virginia's other options for retirement.

The high percentage of equities that target date funds carry means that the principal balance will fluctuate over time. This includes the period of time after retirement, as some TDFs will continuously adjust their funds beyond the target date. The fluctuations of principal balance leave retirees with no guarantee of a steady income upon retirement. Retirees may find their income is inadequate and might have to supplement their income, delay retirement, or take on the burden of debt to meet their financial needs. This fluctuation makes investing in TDFs more risky for older employees who do not have time to weather the ups and downs of the market. Employees approaching retirement age should avoid investing in evolving portfolios late in their career since market downturns close to retirement erode their savings. Figure 6 displays this information graphically. It shows the results of simulated outcomes for VRS investors who are 30, 20, and 10 years away from their withdrawal date.[3] Assuming that employees invest continuously until retirement, the earnings potential as measured by median retirement balance outcome at the target date of someone 30 years away from the retirement date is significantly higher than the earnings potential of someone only 10 years away from their retirement date.

[3] The graph shows the results of a Monte Carlo simulation technique. More information on how this was calculated can be found in Appendix C.

Figure 6: Potential VRS Earnings at Varying Investment Horizons*



	30 years till retirement	20 years till retirement	10 years till retirement
Median Balance	$136,796	$56,528	$17,848
Out-of-pocket contribution	$79,727	$39,679	$15,093
Best case scenario (0.01% chance)	$259,922	$90,334	$23,147
Worst case scenario (0.01% chance)	$82,989	$37,768	$13,712

*Monthly $100 contribution plus 5% annual escalation

The success of target date funds relies on maintaining an age appropriate mix of equities and bonds. Younger workers have very little financial capital to invest in their retirement, but they have decades of future earning power ahead of them. Subsequently, the bulk of equities are held in these years allowing investors to maximize their gains when stocks do well during this period. As portfolios shift to higher levels of bonds later in the investment cycle, investors can minimize their losses if stocks do poorly during this period. However, if the opposite occurs- if stocks do poorly during the early stages of a portfolio's life and well at the end, then investors have maximized their losses and minimized their gains.

Target date funds for large groups do not account for an individual investor's tolerance for risks. Some TDFs do not account for individual risk tolerance; so individual investors may find themselves displeased with their outcome. TDFs can provide more and less aggressive investment options for their clients, but in large group portfolios, such as the VRS, it is much harder to match an individual's personal risk threshold with that of the group. In order to account for this, a risk-adverse investor may choose to participate in an evolving portfolio with a closer target date. Likewise an investor with a high tolerance for risk may choose a portfolio with a target date after their planned retirement. These are the only ways state employees can manage their risk using the age-based evolving portfolios.

Many investment firms advise against relying on TDFs as a complete investment strategy. TDFs should be viewed as a single component of an overall investment strategy. The importance and reliability of social security cannot be understated as a major component of a retirement plan, and TDFs exist to provide income retirement beyond what social security can provide.

The performance of a TDF portfolio is determined by the decisions of the fund manager. Each manager must make a choice of how to allocate funds in the portfolio. Although the glidepath determines the mix of stocks and bonds, it is the decision of the fund manager to determine which stocks and bonds are ultimately chosen as part of the portfolio. This is a significant gamble on the part of the investor, as they have to fully rely on a third party to make investment decisions. If the fund managers makes poor investment decisions employee retirement income ultimately suffers.

Finally, because TDFs are constantly managed to maintain an optimal percentage of equities and bonds, they tend to be more expensive. Firms will charge 1%-3% more as an annual fee to manage a TDF than they will for other defined contribution plans. This higher fee, while seemingly small, can have a significant impact on the funds available for retirement. The higher costs are present to account for the extra service provided by TDF managers. Ideally this money ensures an optimal level of management. As it has already been explained, there is no guarantee that the extra attention provided by managers result in more funds available for retirement.

Advantages

Just as TDFs have a unique set of risks, they also have a particular set of advantages for investors. The glidepath of an evolving portfolio creates a unique set of advantages for retirement funds. The shifting of assets over time represents the greatest advantages of target date funds. There is no need for individual investors to constantly monitor and reallocate the funds themselves because funds are automatically adjusted over time. This is advantageous for people who do not understand or have time to consider how market fluctuations impact their retirement. Putting the onus of management on the portfolio manager saves these employees from making costly mistakes that affect their retirement savings. The manager acts as a guardian over the retirement fund and prevents investors from making common investment mistakes by insuring that funds are shifted over time, stocks are not too heavily invested in, and that default investment options are not adopted, as these tend to be a poor long term strategy.

Similarly, the glidepath allows for the appropriate mix of risk as investors age. Risk exposure is kept at an optimal level throughout the life of the fund. This avoids investors falling into all-or-nothing investment traps where the portfolio is all bonds or all stocks.[4] This simultaneously allows a portfolio to evolve based on needs of the investor. The portfolio can conceivably be adjusted to anticipate consumption levels desired upon and after retirement. Lastly, the glidepath spreads risk around by diversifying assets over time. This can protect expected return values without exposing the investor to excessive risk associated with one type of asset.

Management and adjustment of portfolios means that TDFs have a higher earning potential than standard defined contribution plans. Some managers do better than others and no retirement fund will guarantee better performance than another retirement fund.

[4] See Figure Appendix C Figure C2 for a demonstration of how evolving portfolios can yield better results than a non-evolving 50% equity portfolio and a non-evolving 100% equity portfolio.

Investors choose a strategy, and not assets for retirement. This saves retirees from making the often-difficult decision of appropriating their funds across many investment options. Since the focus is on total consumption, rather than choosing the right mix, investors are saved from making poor investment decisions regarding their retirement funds.

The benefits of target date funds are especially prominent for younger investors. This population has a much greater earning potential. Youth allows new investors to weather the ups and downs of the market. The current state of the market represents a chance for young investors to buy equities at low prices, increasing their potential returns. While the same is true for those approaching retirement, the gains they make from their investments are realized over a shorter time horizon. Table 5 summarizes the risks and advantages of using evolving portfolios in a retirement fund.

Table 5: Risks and Advantages of VRS TDFs

Advantages	Risks
1. Protection from the following common investing mistakes. • Adopting basic default investment options • Investing too heavily in company stocks • Failing to rebalance the proportion of different asset classes over time. **2. Glidepath allows for appropriate mix of risk over time.** • Investors maintain constant level of variability (risk exposure) over the life cycle. • Empirical evidence suggests adoption of TDFs has the effect of eliminating extreme zero-or all-equity positions. **3. Glidepath allows portfolio to evolve based on needs.** • Investors can calibrate the trade-off between risk of loss and potential for gain according to their expected future consumption profile. **4. Potentially improved investment performance over time.** • Managers optimize fund allocation so that risk is reduced to the lowest level possible for a given expected rate of return. **5. Participants choose their "strategy" rather than specific investments.** • Focus is not on the financial plan itself but rather on the lifetime consumption profile that it implies. **6. Portfolios are diversified across many assets.** • A basic tenet of financial economics is that having diverse assets whose returns do not move in unison allows investors to minimize his/her risk for a given level of return. **7. Funds are automatically reallocated over lifetime of portfolio.** • The need for investors to constantly monitor market movements and realign their personal investment allocations can be avoided. **8. Benefits younger investors who have time to weather market fluctuations.** • Market losses will tend to be concentrated at relatively younger ages when labor supply flexibility can act as a buffer against market losses. • For young investors, stock market drop represents a chance to buy low, accumulating long-term equity in bonds at reduced prices.	**1. No guarantee of Principal.** • The broadly diversified investment risk that TDF's provide is a compensated risk, but it is still a risk. • For all 2010 TDFs, diversification across asset classes or across geographies provided only weak defense against recent market losses. **2. Principal balance will fluctuate over time and after retirement.** **3. No guarantee of adequate funds at or through retirement.** • TDFs are no silver bullet. Providing a guaranteed amount of retirement income is still the crucial role of social security as well as defined benefit pensions, not TDF. **4. Less advantageous to older investors focused on maintaining assets and who don't have time to weather the ups and downs of the market.** • Many 2010 Lifecycle funds fell by 25 to 30 percent or even more in 2010. **5. If stocks do poorly during first periods of portfolio life and well during the end of portfolio life then losses will be maximized and gains minimized.** **6. Target Date Funds should not be considered a complete investment program and may not be designed exclusively for retirement.** • TDFs should be seen as just one component of other retirement investments, particularly social security. **7. Target date funds are managed for a group and do not take into consideration an individual's personal threshold for risk.** • In most cases, investors are offered a series of TDFs just from one sponsor/one investment company complex, and this doesn't take into account differences across investors (or fund managers). • There are no "conservative" "moderate" and "aggressive" versions of the Target Date Series. These are available in other funds (Vanguard Life Strategy Funds) but not in TDFs. **8. Management of fund may be more costly than other funds.** • For example, a 1% annual fee over thirty years amounts to a 26% reduction in market value at the target date, whereas 2% amounts to a 45% reduction.

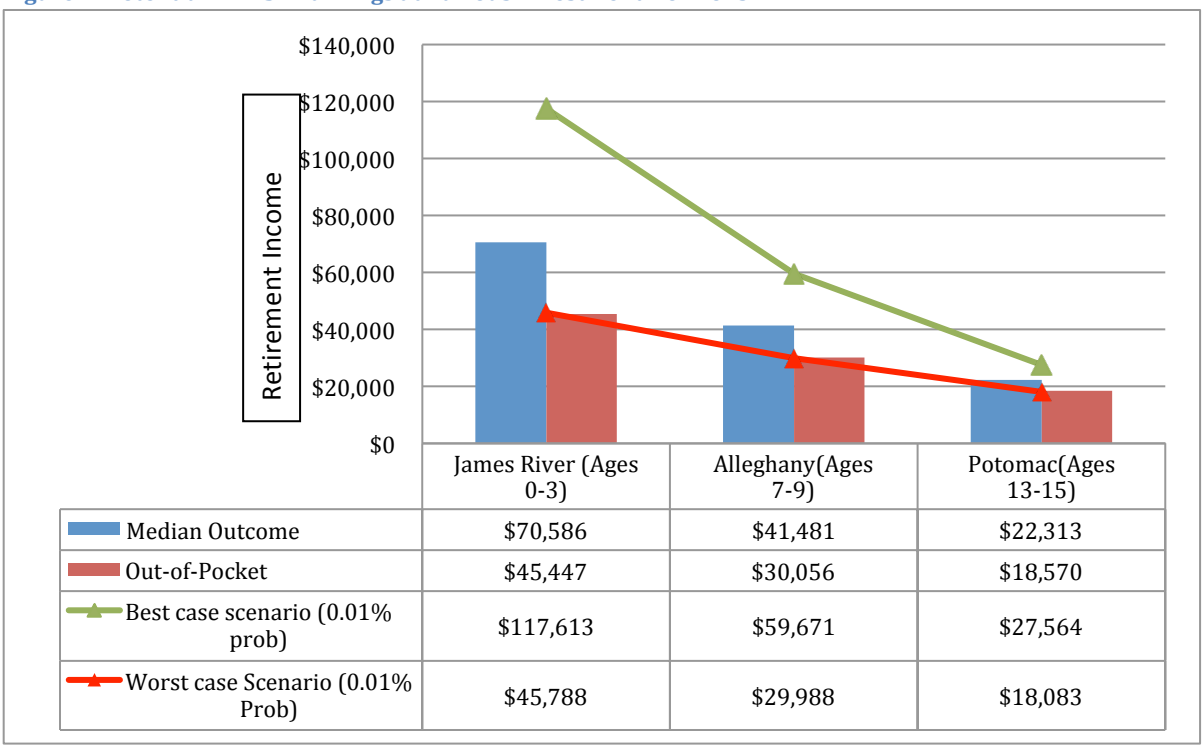
Risks and Advantages: College Savings TDFs

The risks and advantages mentioned in the previous section are not unique to the Virginia Retirement System. Many of the risks and advantages mentioned are common across all target date funds regardless of their purpose. The TDFs used by the Virginia 529 inVEST College Savings Plan are no exception. This section will outline shared risks and advantages and then highlight risks and advantages that are specific to education savings investment.

Education and retirement funds share the risks and advantages associated with glidepaths, management, and market conditions. The nature of the risks and advantages does not change across investment types. The portfolios in both categories are subject to market conditions and timing. No TDF is guaranteed to earn money, and no TDF is guaranteed to maintain the principal investment. Each TDF must weather market fluctuations on its own. It is because of this that neither investment guarantees sufficient funds as the target date approaches.

While a majority of risks and advantages are shared across both types of investment, there are some risks and advantages that are unique to college saving funds that the retirement program does not share. First, the college fund operates on a significantly shortened timeline than the retirement fund (18 years or less as opposed to 30 years or more). This shortened timeline has several effects. Namely, it does not allow the fund to weather ups and downs as well as long-term retirement investments. The shortened timeline may in turn cause investors and managers to choose more aggressive glidepaths that expose funds to higher levels of loss (and gain) during the lifetime of the portfolio. Such aggressive portfolios call for active management and leads to higher fees compared to passively managed portfolios. Some possible outcomes in terms of account balance at target date for 3 VEST portfolios are shown in Figure 7. Investing early in college savings target date funds (when a child is aged 0-3) gives much higher median returns but also has a wider range of possible outcomes at the target date.

Figure 7: Potential inVEST Earnings at Various Investment Horizons*



	James River (Ages 0-3)	Alleghany(Ages 7-9)	Potomac(Ages 13-15)
Median Outcome	$70,586	$41,481	$22,313
Out-of-Pocket	$45,447	$30,056	$18,570
Best case scenario (0.01% prob)	$117,613	$59,671	$27,564
Worst case Scenario (0.01% Prob)	$45,788	$29,988	$18,083

***Simulation assumes that investors have an initial asset of $10,000 at the start of investment horizon, on top of which they contribute $100 per month with 5% annual escalation until the child goes to college.**

Another risk unique to inVEST is that it does not guarantee a student will be able to obtain admittance to college. As this money can only be used for specific education expenses, this represents a significant gamble on the future for some participants. Having a college savings account can also impact the ability to qualify for need-based financial aid. This should be considered before investors decide to start saving for college. Lastly, the college education savings portfolios are protected from bankruptcy proceedings, guaranteeing that the account will remain with the investor despite individual financial downturns. Table 6 highlights the unique risks and advantages encountered by Virginia's 529 inVEST College Savings Plan.

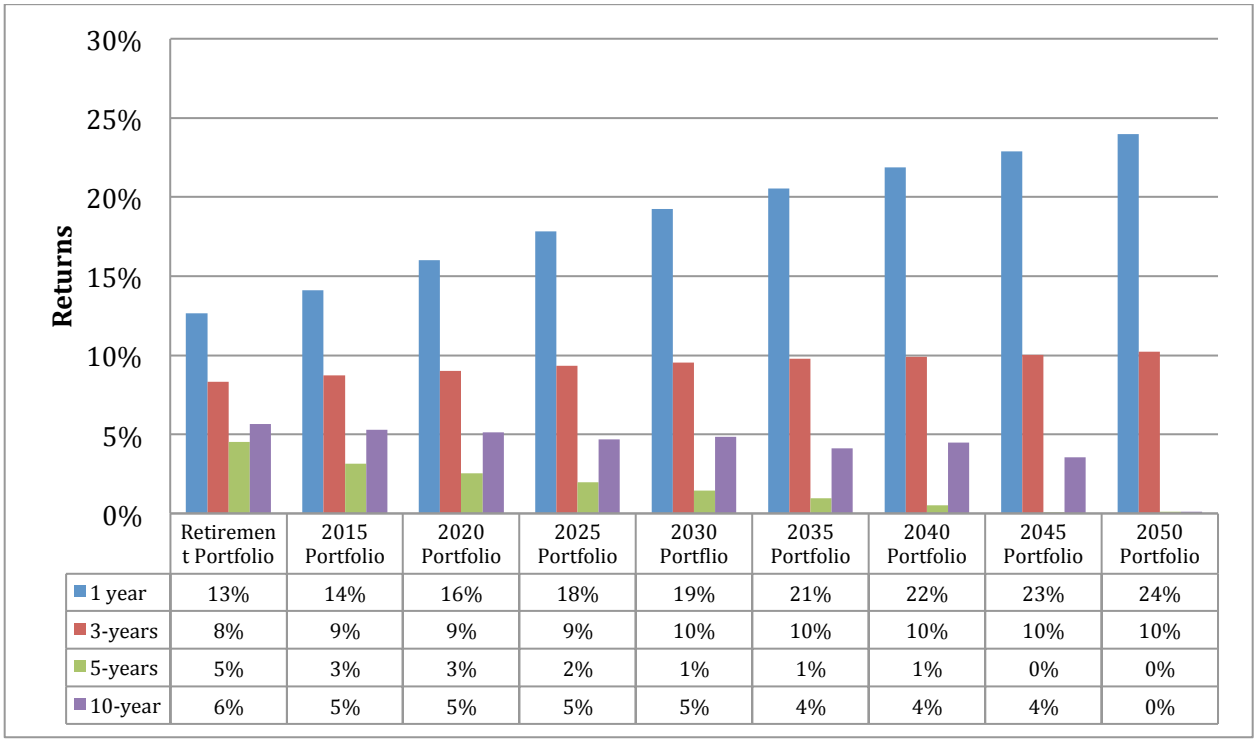
Table 6: inVEST Risks and Advantages

Risks	Advantages
1) Shortened timeline of investment 2) No guarantee of meeting college expenses 3) No guarantee of admission to college 4) Possibility of lowered Student Financial aid	1) Protection from bankruptcy

TDFs in VRS: Historical Performance

Analyses of returns involves looking at 1-year and annualized 3-year, 5-year, and 10-year returns on a given investment. Annualized returns give the average of funds' yearly performances over a given time period. Therefore, these returns mask a fund's year-to-year volatility. Data from the Virginia Retirement System's website is used to compare the 1-year, 3-year, 5-year and 10-year returns.[5] It is important to keep in mind the condition of the market environment that prevailed during the different periods used. Figure 8 shows the one, three, five, and ten-year returns of the VRS portfolio.

Figure 8: VRS Historical Returns[6]



	Retirement Portfolio	2015 Portfolio	2020 Portfolio	2025 Portfolio	2030 Portflio	2035 Portfolio	2040 Portfolio	2045 Portfolio	2050 Portfolio
1 year	13%	14%	16%	18%	19%	21%	22%	23%	24%
3-years	8%	9%	9%	9%	10%	10%	10%	10%	10%
5-years	5%	3%	3%	2%	1%	1%	1%	0%	0%
10-year	6%	5%	5%	5%	5%	4%	4%	4%	0%

During the past year, these funds had exceptionally high returns, ranging from 13% in the stable Retirement Portfolio to 24% in the more equity based 2050 Portfolio. The average performance over the last three years was more modest: over the past three years

[5] Since the LifePath Index that VRS invests into is barely two-years old, the information below uses longer-term returns based on the returns of the BlackRock LifePath *Master* Portfolio F into which the LifePath Index funds invest. As discussed earlier, the Master Portfolio F is BlackRock's in-house proprietary portfolio mix to which all of its flagship target Date series invest into. The returns are expressed net of deductions taken for investment management fees negotiated by VRS and fund administrative expenses.

[6] Virginia Retirement System. "Commonwealth of Virginia Defined Contribution Plans: Investment Option performance as of September 30, 2012." http://www.varetire.org. September 30, 2012. http://www.varetire.org/Pdf/RFP/DCP/Attach/B-Unbundled-DC-Plans-Investment-Option-Performance-as-of-September-30-2012.pdf (accessed November 5, 2012).

the Retirement Portfolio experienced 8.3% annualized returns, while the 2050 Portfolio saw 10.3% returns. The five-year average return was even lower due to the financial market crash. The Retirement portfolio returns are 4.5% over the time period, but the stock-heavy 2050 Portfolio only saw .13% returns. The ten-year returns for bond-heavy funds, like the Retirement Fund, are between 5% and 6%. The 2045 returns are 3.56%.[7] Overall, the 3-year returns are better than the 5-year returns. These returns show how the VRS portfolios are recovering from the financial crisis.

Table 7 shows investment returns in monetary values using 1, 3, and 5-years returns from Figure 7. It displays the net earnings on initial investments of $1000, $5,000 and $10,000 over three different time horizons, and for three specific investment portfolios, each at different stages of the glidepath.

Table 7: VRS Monetary Returns on Investment

VRS TDF 1 Year Returns			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2015	$141	$706	$1,412
2030	$192	$962	$1,923
2050	$240	$1,200	$2,399

VRS TDF 3 Year Returns			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investments
2015	$87	$436	$871
2030	$95	$477	$953
2050	$102	$511	$1,021

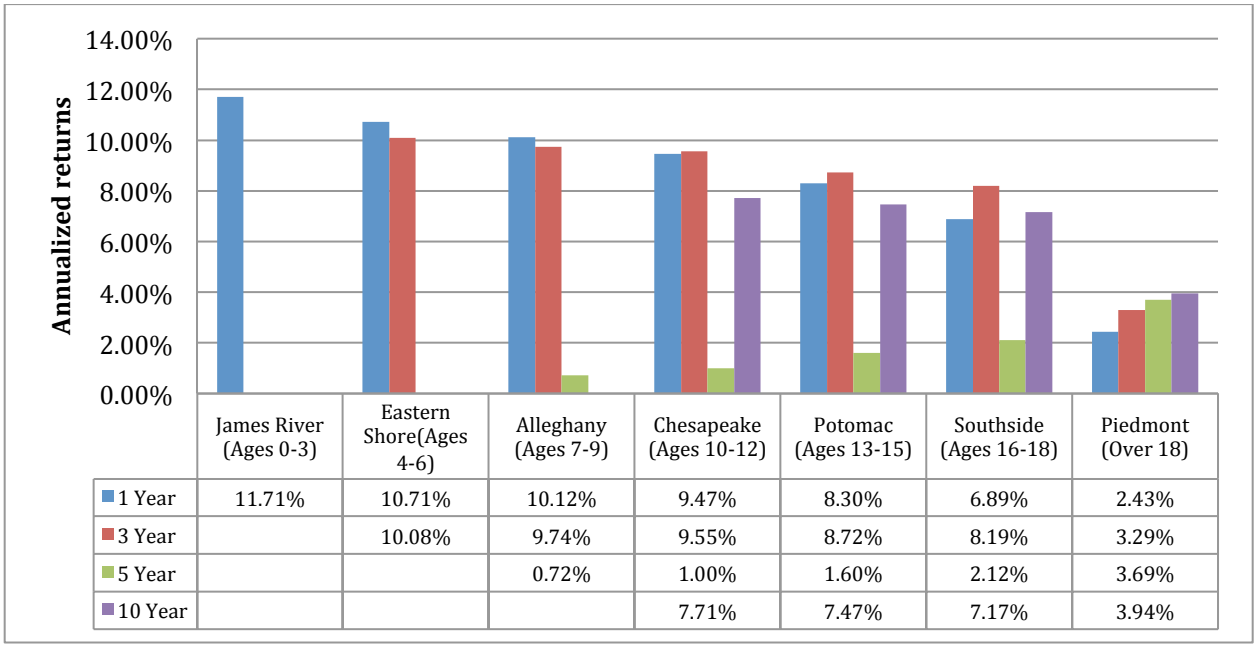
VRS TDF 5 Year Returns			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investments
2015	$32	$158	$315
2030	$14	$72	$144
2050	$1	$7	$13

[7] The retirement 2050 portfolio was created in 2007. Therefore, 10-year returns are unavailable for this fund. Thus, the retirement 2045 fund was used as the closest substitute for ten-year returns.

TDFs in 529 inVEST: Historical Performance

Unlike the historical performance of the VRS portfolios described above, the inVEST portfolios do not have as much of a sharply contrasting 1- 3- 5- and 10-year average returns records. This is partly due to the fact that in these funds the fraction held in stocks drops much more quickly, giving way to a bond-heavy portfolio. While the range of outcomes is narrower than its VRS counterpart, the returns themselves are also smaller in absolute terms. Figure 9 displays the returns for inVEST.

Figure 9: inVEST Historical Returns[8]



	James River (Ages 0-3)	Eastern Shore(Ages 4-6)	Alleghany (Ages 7-9)	Chesapeake (Ages 10-12)	Potomac (Ages 13-15)	Southside (Ages 16-18)	Piedmont (Over 18)
1 Year	11.71%	10.71%	10.12%	9.47%	8.30%	6.89%	2.43%
3 Year		10.08%	9.74%	9.55%	8.72%	8.19%	3.29%
5 Year			0.72%	1.00%	1.60%	2.12%	3.69%
10 Year				7.71%	7.47%	7.17%	3.94%

Three funds, James River, Eastern Shore, and Alleghany do not have returns data for all of the time horizons. This is because these portfolios have recent inception dates. However, these funds are preforming similarly over the past year, with each portfolio experiencing above 10% returns. Older funds have more data available for calculating returns. The Piedmont fund, which is 100% bonds, did worse over the past year than it did over the past 3, 5, and 10 years. Its performance over 5 years indicates that bond returns weather the recession relatively well. The Chesapeake Portfolio had returns of 1% over the last five years, and has been preforming better over the last 3 years illustrating a rebound from the recession. The ten-year returns are the most reliable metrics. As depicted in the figure above, the inVEST portfolios that carry equities get returns around 7%. In general, the funds have rebounded from the recession much more quickly

[8] Virginia 529 College Savings Plan. inVEST Performance. October 31, 2012. http://www.virginia529.com/invest/performance/index.php (accessed November 5, 2012).

than the VRS evolving portfolios did. However, funds may lose out on the possibility of higher stock returns as a result of shifting to hold more bonds within a shorter time period.

Table 8 shows investment returns in monetary values. It displays the net earnings on initial investments in the inVEST savings plan of $1000, $5,000 and $10,000 over three different time horizons, and for three specific investment portfolios, each at different stages of the glidepath.

Table 8: inVEST Monetary Returns on Investment

Virginia VEST Target Date Fund 1 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
Eastern Shore (Ages 4-6)	$107	$536	$1,071
Chesapeake (Ages 10-12)	$95	$474	$947
Southside (Ages 16-18)	$69	$345	$689
Virginia VEST Target Date Fund 3 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investments
Eastern Shore (Ages 4-6)	$101	$504	$1,008
Chesapeake (Ages 10-12)	$96	$478	$955
Southside (Ages 16-18)	$82	$410	$819
Virginia VEST Target Date Fund 5 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investments
Eastern Shore (Ages 4-6)	-	-	-
Chesapeake (Ages 10-12)	$10	$50	$100
Southside (Ages 16-18)	$21	$106	$212

Comparison Between Virginia and Other States

This section compares Virginia TDFs to TDFs from Maryland and North Carolina. All three states have similar economic, demographic and geographic attributes. Virginia, Maryland, and North Carolina all rank in the top 15 states for statewide gross domestic product.[9] According to the United States Census Bureau, Maryland and Virginia have similar per-capita incomes.[10] North Carolina's per-capita income is within $10,000 of Virginia's. The states have similar minority populations.[11] However, for the specific comparison of target date funds, there are other reasons why Maryland and North Carolina are good comparisons. When comparing retirement systems, it helps to have similar labor forces. The next section delves into the comparison between the labor forces in the three states.

Labor force between Virginia, Maryland, and North Carolina

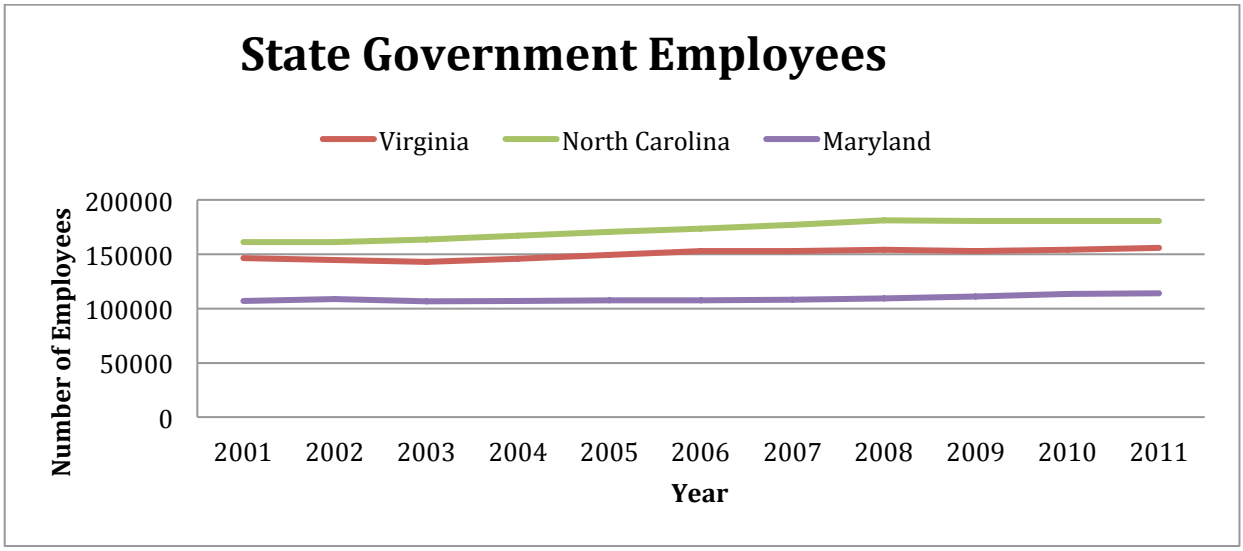
The most salient aspect, when comparing retirement systems between these two states and Virginia is the labor force. Maryland and North Carolina have a similar number of state and local government employees. Figure 10 shows state and local government employment for all three states.

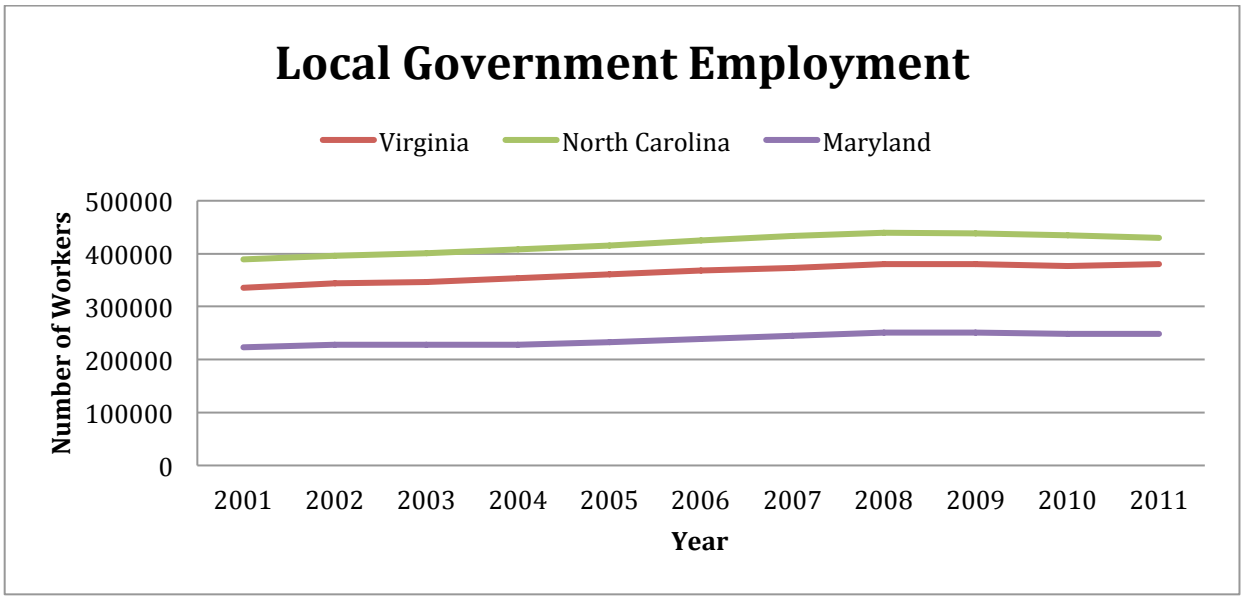
[9] United States Census Bureau, "Gross Domestic Product by State in Current Dollars, 2008." Last modified 2008. Accessed October 2012. http://www.census.gov/compendia/statab/2012/ranks/rank28.html.

[10] United States Census Bureau, "Personal Income per Capita in Current Dollars, 2007." Last modified 2007. Accessed October 2012. http://www.census.gov/statab/ranks/rank29.html.

[11] United States Census Bureau, "2012 Statistical Abstract: State Rankings, 2012." Last Modified 2012. Accessed October 2012. http://www.census.gov/compendia/statab/rankings.htm.

Figure 10: State and Local Government Employment[12][13]





Virginia trails North Carolina in state and local government employment population, but their numbers are generally similar. The data in these graphs for Maryland does not include their separate category for state and local government education employees. If those numbers were included, the three states would be bunched very tightly. These basic employment measures

[12] Virginia Workforce Connection, "Historical Data Analysis: Occupation Employment by Industry." Last modified 2012. Accessed November 2012. http://www.vawc.virginia.gov/analyzer/searchAnalyzer2.asp?cat=HST_EMP_WAGE_OCC&session=OCCINDS&subsession=99&time=&geo=&currsubsessavail=&incsource=&blnStart=True.

[13] North Carolina Department of Commerce Division of Employment Security, "Labor Market Information." Last modified 2012. Accessed November 2012. http://www.ncesc1.com/LMI/industry/industryMain-NEW.asp.

reinforce the use of Maryland and North Carolina as retirement system comparison points for Virginia. Their state and local government s are about the same. With similar numbers of individuals employed by state and local government in Virginia, Maryland, and North Carolina, the focus shifts to a comparison between the target date funds used in the three states.

Maryland Retirement System[14]

Maryland, like Virginia, is transitioning away from a defined benefit program to a defined contribution program. To ensure that individuals are saving enough for retirement, the state also offers 401(a), 403(b), and 457 plans. These plans are part of Maryland's supplemental retirement options, and it is within these plans, that Maryland uses target date funds. These optional plans provide additional retirement savings to state employees. The individual is allowed to decide which plan they wish to enroll in, and how their investments will be made. The plans are funded via a payroll deduction, and like all other optional retirement plans, taxes are paid when benefits are withdrawn. The 401(a) and 457 plans allow individuals to begin collecting benefits from their retirement funds when they leave state employment regardless of age, but the 403(b) plan requires that an individual be at least 55 when they stop working for the state to begin collecting their funds. This information highlights the basics of Maryland's supplemental retirement plans, but there are some key differences between Maryland and Virginia.

Unlike Virginia, enrollment in Maryland's plans is not automatic. Enrollment in both states is optional, but the Maryland plans require that employees opt into one of the optional retirement plans. If individuals choose to be part of the optional plans in Maryland, they must pick their investment option, which includes the opportunity to invest in a target date fund.

Maryland offers T. Rowe Price target date funds. Their target date funds for individuals retiring in 2010, 2020, 2030, and 2040 started in 2002. TDFs for employees with target retirement dates of 2005, 2015, 2025, and 2035 emerged in 2004. The last three evolving retirement portfolios for Maryland's supplement plans went online in 2005 for the 2045 plan and 2006 for the 2050 and 2055 plans. The inception date for the BlackRock LifePath Indexed Fund O was 2011, but underlying master funds used for the O Fund were created between 2005 and 2010. This means that Maryland's TDFs are older and have a longer history of return data for comparison.

Aside from having used target date funds for a longer period of time, Maryland's TDFs have a different asset breakdown. As mentioned before, these funds are comprised of different funds, the

[14] All information on the Maryland Retirement System came from these two reports:
Maryland State Retirement and Pension System, "Benefits Handbook." Last modified 2012. Accessed October, 2012. http://sra.maryland.gov/Participants/Members/Downloads/Handbooks/BenefitHandbook-Emp-Ret.pdf.
Maryland State Retirement and Pension System, "Comprehensive Annual Financial Report." Last modified 2011. Accessed October, 2012. http://msrp.maryland.gov/2011financialreportcafr.pdf.

percentage of which depends on how far in the future the fund is expected to be collected. The breakdown of Maryland's 2015 TDF investment portfolio is shown in table 9.

Table 9: Maryland's TDF Asset Allocation[15]

T. Rowe Price 2015 Target Date Fund	
Asset Type	Percentage Held
Domestic Stocks	42.10%
Foreign Stocks	18.70%
Cash	3.10%
Preferreds	0.30%
Convertibles	0.20%
Domestic Bonds	27.20%
Foreign Bonds	8.50%

Maryland's fund has a distinctly different breakdown than Virginia's fund. It invests in a different mix of assets and uses different investment tools such as Preferreds and Convertibles. Preferreds are assets that function like a hybrid between a stock and a bond. They are usually issued by companies that have not gone public. Convertibles are assets that can be changed into cash almost immediately. Understanding precisely what these investments are is not germane to the topic of this report. It is, however, necessary to understand that the underlying investments in evolving portfolios are different between Maryland and Virginia.

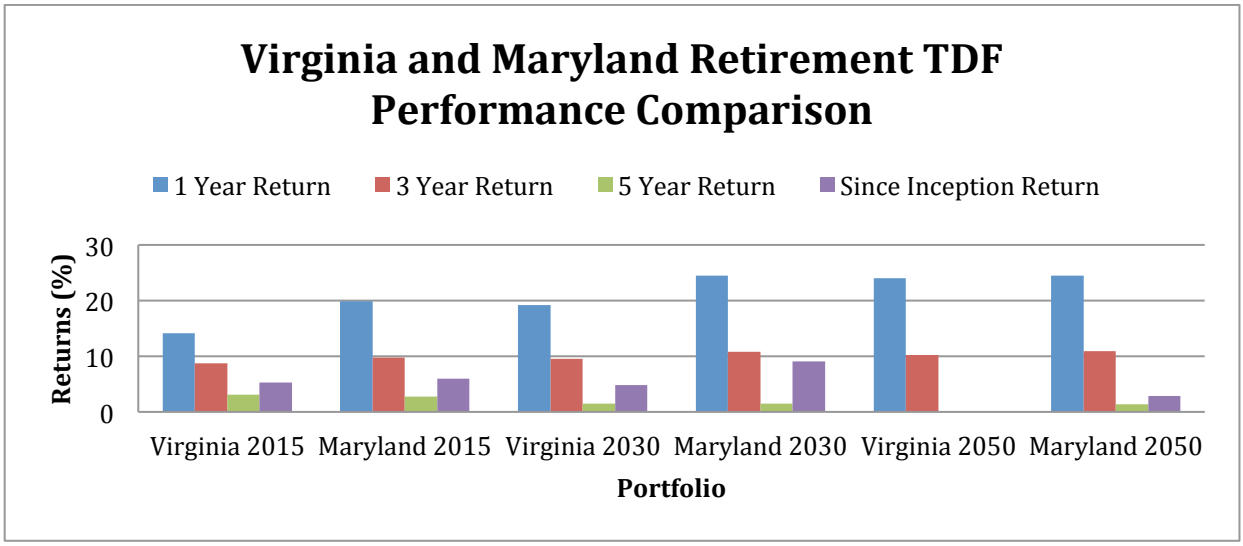
The funds used in Maryland also continue to shift after retirement. In Virginia, once an individual retires, their fund rolls into the Retirement Fund, which is the most stable fund available. The T. Rowe Price fund will hold a majority of stocks until approximately five years after the individual retires. This may increase growth, but it also leaves the individual more susceptible to market risk. The asset allocation in these two plans is different, with Virginia's plan carrying less risk. All of the TDFs used by the two states have different asset breakdowns.

The funds used by Virginia and Maryland also perform differently. This performance fluctuation is likely a result of the different asset breakdowns for the two portfolios. Since Virginia holds a smaller percentage of stocks as the TDF matures, its performance measure based on returns will be different than Maryland's. However, because Maryland has been using target date funds for a longer period of time, their returns more accurately reflect long-term portfolio performance. For performance comparison purposes, this report focuses on the 2015 Fund, the 2030 Fund, and the 2050 Fund. These portfolios show the performance for individuals at different points in their

[15] T. Rowe Price, "T. Rowe Price Retirement Funds." Last modified 2012. Accessed October, 2012. http://individual.troweprice.com/public/Retail/Mutual-Funds/Retirement-Funds.

careers. This comparison illustrates how different funds are performing at different points on the respective glidepaths. Figure 11 compares the performance of the funds for Virginia and Maryland.

Figure 11: Retirement Plan Comparison[16][17]



Maryland's retirement funds are performing better in just about every measure, but Virginia's returns are within one percentage point of Maryland's returns. The 5-year performance on the 2015 Fund is the only instance where Virginia is out-performing Maryland. The difference in performance is caused by the underlying funds and strategies that each state uses. Maryland invests in more stocks because they continue to adjust asset mixtures after the individual retires. This does not nullify a comparison, rather, it enhances it.

The goal of the retirement systems in both states is to adequately supply individuals with retirement income. If Maryland's TDFs are doing a better job of meeting that goal, it is worth noting. However, there is a flip side to this story. Virginia's asset mix may be keeping investors in VRS's target date funds safer from market fluctuations by investing more in bonds. Given the newness of target date funds, it is difficult to fully examine performance. There are also nuances that need to be accounted for such as different implementation dates and asset mixtures. However, given the data available, Maryland currently has higher returns than Virginia.

Having already looked at Virginia's historical performance, Table 10 gives Maryland's monetary returns on initial investments of $1,000, $5,000, and $10,000 for three different portfolios. Returns for each of these portfolios are calculated over 1, 3 and 5 years. To make the best comparison, a high risk, moderate risk, and low risk portfolio from Maryland have been selected.

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[16] T. Rowe Price, "T. Rowe Price Retirement Funds." Last modified 2012. Accessed October, 2012. http://individual.troweprice.com/public/Retail/Mutual-Funds/Retirement-Funds.

[17] Virginia Retirement System, "Investment Performance." Last modified 2012. Accessed October, 2012. https://vadcp.ingplans.com/einfo/pdfs/forms/virgna/650271/Sept12.pdf.

Table 10: Maryland's Monetary Performance

Maryland Retirement Target Date Fund 1 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2015	$1,199.20	$5,996.00	$11,992.00
2030	$1,244.60	$6,223.00	$12,446.00
2050	$1,224.90	$6,224.50	$12,449.00

Maryland Retirement Target Date Fund 3 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2015	$1,324.11	$6,620.57	$13,241.15
2030	$1,359.88	$6,799.42	$13,598.83
2050	$1,362.83	$6,814.16	$13,628.31

Maryland Retirement Target Date Fund Performance 5 year performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2015	$1,145.83	$5,729.15	$11,458.31
2030	$1,079.41	$5,397.04	$10,794.08
2050	$1,068.29	$5,341.46	$10,682.93

Another aspect of the funds that is worth comparing is cost. The different states have different cost ratios associated with their funds. A state with a higher fee will extract more money per year from the retiree since the fees are applied annually. According to the VRS information on target date funds, all Virginia TDFs have an expense ratio of .09%. The expense ratios for Maryland TDFs fluctuate depending because the funds are actively managed. Maryland portfolios that carry stock-heavy assets tend to be more expensive. Table 11 shows the fee ratios for Maryland's target date funds.

Table 11: Fee Ratios for Maryland Target Date Funds[18]

Portfolio	Fee Ratio
Retirement Income Fund	0.57%
2015	0.66%
2020	0.70%
2025	0.73%
2030	0.75%
2035	0.77%
2040	0.78%
2045	0.78%
2050	0.78%
2055	0.78%

The fee ratios do not indicate much about the actual cost of the portfolio. Conducting a simulation yields more information about cost, but there are assumptions that need to be made. The first is that the same amount of money has been invested in funds in each state. The second assumption is that there are constant returns for each of the three portfolios of 5%, 7%, and 10% that are compounded annually. This assumption is made to illustrate the differences in fees, not the differences in returns. The simulation uses a three-year time horizon for three different portfolios, the 2015, the 2030, and the 2050. Table 12 depicts the results.

Table 12: Costs of Virginia and Maryland Retirement TDFs

Virginia 2015: $29.79	Maryland 2015: $218.47
Virginia 2030: $30.96	Maryland 2030: $258.00
Virginia 2050: $32.77	Maryland 2050: $284.00

As illustrated by the cost ratios and the simulation, Maryland target date funds are more expensive. One of the reasons for this could be that Maryland's funds are actively managed, and Virginia's are passively managed. The fees will also have different effects depending on how much each individual is contributing to the fund. Individuals who are contributing the minimum will pay very little in each state, but they will still pay less in Virginia. For instance, an individual who makes the minimum contribution of $20 per pay period with a $10 employer match will not even have $1,000 invested by the end of their first year, so the fees would be very small for them. There are a variety of things that influence fees, but the end result is higher fees for Maryland's portfolios.

[18] T. Rowe Price, "T. Rowe Price Retirement Funds." Last modified 2012. Accessed October, 2012. http://individual.troweprice.com/public/Retail/Mutual-Funds/Retirement-Funds.

North Carolina's Retirement System[19]

GoalMaker, the TDF arm of North Carolina's Deferred Compensation Plan, was recently unveiled, and there is no information about portfolio performance at this point. As such, the comparison between the two programs will be less substantial than the comparison between Maryland and Virginia.

The most dramatic difference is that GoalMaker allows individuals to choose from one of 12 portfolios that best reflects their investing style. Once an individual has done this, they must opt into the automatic age adjustment aspect of the plan, otherwise their portfolio remains set at their predetermined mixture. As a result, there are three evolving pathways that GoalMaker portfolios can follow; there is a conservative path, a moderate path, and an aggressive path. If an individual opts to have their fund automatically rebalanced, their portfolio will follow one of the paths based on their risk tolerance and the number of years until their retirement date. Their portfolio will undergo a maximum of three shifts in asset makeup before the individual retires. If a state employee in North Carolina has 16 or more years until they retire, their portfolio will rebalance when they hit 15 years left, 10 years left, and 5 years left, and their initial risk tolerance will dictate what the exact asset breakdown is upon retirement. Virginia's portfolios go through a similar number of shifts, but they do not account for an individual's risk tolerance. This means that a state employee in Virginia will pick their plan based only on their target retirement date.

Another substantial difference is that GoalMaker uses Prudential to manage the funds. As a result, North Carolina's target date funds have a different asset breakdown. For individuals with 0-5 years until retirement, the amount of stable or fixed income value assets varies between the risk tolerance levels. If an individual opts for the more conservative plan, 76% of their assets will be in fixed income or stable value funds. A North Carolinian who decides to invest in the moderate path, possess a fund with 60% invested in stable value. For people who have a high-risk tolerance, only 46% of their assets will be in stable value or fixed income funds upon retirement. For a Virginian retiring in 2015, 55% of their investment will be put in safe assets. This puts Virginia's TDFs on par with the middle path for North Carolina's state employees. These are the major differences between North Carolina's retirement target date funds and the ones used by Virginia.

There was no information on fees for the North Carolina plan according to the GoalMaker brochure or the information online, so a comparison could not be made between VRS and GoalMaker. This is a comparison that can be made as North Carolina's funds are used over the next several years.

[19] All Information about North Carolina's Retirement System came from:
North Carolina Department of the State Treasury, "GoalMaker." Last modified 2012. Accessed October, 2012. http://www3.prudential.com/email/retirement/IMFPWeb/cws/nc/0185591-00002-00.pdf.

College Savings Plans Comparisons with Other States

Virginia, Maryland, and North Carolina all have state sponsored college savings plans, often referred to as 529 plans. The main goal of college savings plans is to provide parents with a way to invest in their child/children's college education. These funds allow individuals to invest in several different types of portfolios, including target date funds. This section of the report looks at the similarities and differences between the TDFs used in Virginia and the other two states. A notable fact and similarity between the three states is that none of the three states guarantee that these funds will provide adequate savings for college. Since all of the plans make this cautionary statement, the comparisons are based on asset mixture differences, performance differences, and some general distinctions between the plans.

Maryland College Savings Plan[20]

Maryland offers target date funds to potential investors as a way to save for their child's college expenses. These funds, like their retirement funds, are managed by T. Rowe Price, and work in a similar manner to the retirement TDFs. However, because these funds are dealing explicitly with college enrollment opportunities, time serves as a larger constraint. These portfolios glide into their next asset makeup every three years whereas the retirement TDFs take longer to change their asset balance. This is done to meet a time horizon an 18-year time horizon.

Given the shortened time horizon, the balances often shift from one extreme to the other over their lifetime. The 2027 and 2030 Maryland College Savings Plan target date funds are made up of 100% stocks. The 2024 fund is comprised of 13% bonds and 87% stocks, and the funds begin to quickly change over to heavier bond mixes as the child gets closer to college age. For instance, the 2015 portfolio has 40% stocks, 50% bonds, and 10% conservative and fixed income assets. Once the child is of college-going age, the funds move into their permanent college asset breakdown of 20% stocks, 40% bonds, and 40% conservative and fixed income assets.

This setup is different than Virginia's. VEST's James River Plan, the target date fund for children ages 0 to 3, is not 100% stocks. Instead this fund is 80% stocks and 20% bonds. This trend carries through all the funds. Unlike Maryland's two funds that are 100% stocks, Virginia has two funds that are 100% bonds and safe assets. The difference between these two funds in Virginia is that one of them, the Piedmont Fund for kids who are just enrolling in college, is a stable income fund. The other fund, the Blue Ridge Fund, is comprised of all bonds, but some of them are high yield bonds designed to increase returns while still being a safe asset. The different asset breakdowns will have an effect on performance. Figure 12 compares three Virginia portfolios to three used by Maryland.

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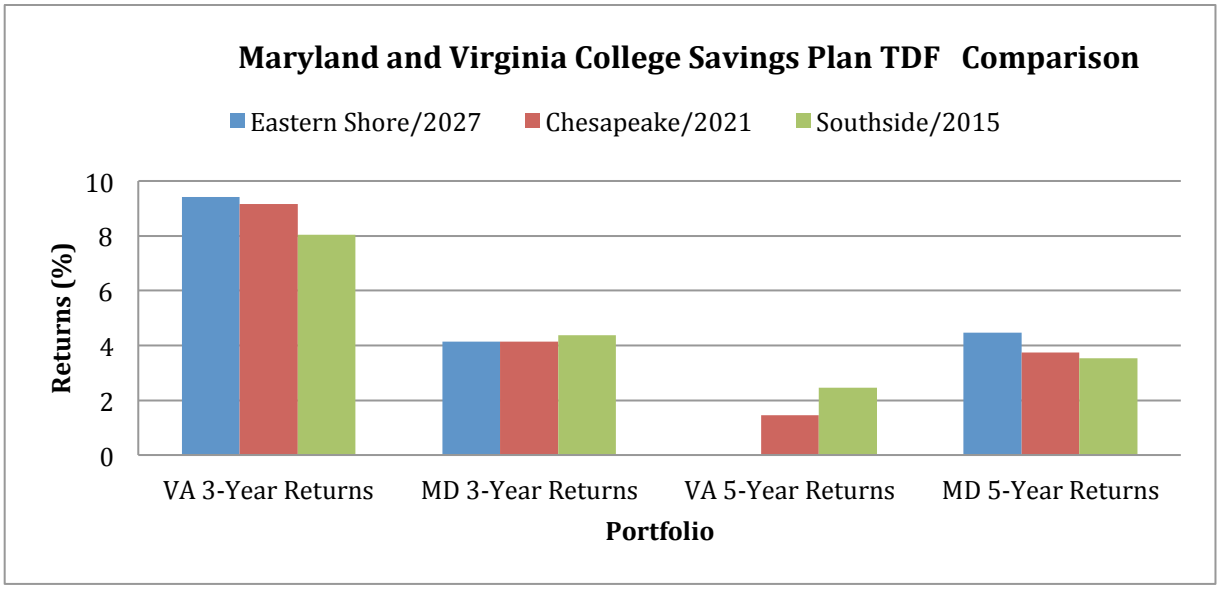
[20] All information about Maryland's College Savings Plan came from:
Maryland College Investment Plan, "2011–2012 Disclosure Statement and New Account Enrollment Form." Last modified 2011. Accessed October, 2012. http://www.collegesavingsmd.org/uploadedFiles/Current_Customers/MPCTdisclosure.pdf.

Figure 12: Comparison of College Savings Plans[21]



The three and five year returns are indicative of performance because there is more data available. The five-year returns illustrate the effects of the 2008 market crash on the College Savings Plan portfolios. Maryland's target date funds are performing worse over the three-year time horizon, but they are getting better returns over five years. These differences could be a result of management style. Maryland's portfolios are actively managed, and therefore, could have performed better during the recession.

In general, the two states are performing similarly, but returns do not tell the whole story when it comes to saving for college. It is important to have an idea what an individual investment will get in return. Table 12 captures performance for different investment amounts over 1, 3, and 5-year time horizons. The portfolios displayed correspond to the ones evaluated for Virginia.

[21] Maryland College Investment Plan, "2011–2012 Disclosure Statement and New Account Enrollment Form." Last modified 2011. Accessed October, 2012. http://www.collegesavingsmd.org/uploadedFiles/Current_Customers/MPCTdisclosure.pdf.

Table 12: Maryland's College Savings in Monetary Terms

Maryland College Savings Plan 1 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2027	$1,326.90	$6,634.50	$13,269.00
2021	$1,280.60	$6,403.00	$12,806.00
2015	$1,203.50	$6,017.50	$12,035.00

Maryland College Savings Play 3 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2027	$1,129.09	$5,645.44	$11,290.88
2021	$1,129.09	$5,645.44	$11,290.88
2015	$1,163.26	$5,816.28	$11,632.57

Maryland College Savings Plan 5 Year Performance			
Portfolio	$1,000 Investment	$5,000 Investment	$10,000 Investment
2027	$1,189.98	$6,160.54	$11,899.83
2021	$1,202.10	$6,235.89	$12,020.10
2015	$1,267.19	$6,643.25	$12,671.91

The expense ratios for the Virginia Education Savings Trust TDFs are higher than it is for the retirement portfolios. This is because there is a variety of different funds that makeup the overall investment portfolio for the VEST target date funds. The expense ratios decrease as the funds move to a safer asset mix, but these expenses are taken out every year. This can add up, and result in sizable deductions from the savings plans. Maryland's TDFs also have expense ratios that decrease the closer to college the child gets. Table 13 compares the expense ratios for the eight funds in both Virginia and Maryland. As the table shows, Virginia's College Savings TDFs are less expensive than Maryland's. The Maryland portfolios also carry an annual account fee of $20. Virginia's funds do not have this fee.

Table 13: Comparison of Expense Ratios[22]

Virginia	Maryland
James River: .78%	2030: .85%
Eastern Shore: .71%	2027: .85%
Alleghany: .66%	2024: .85%
Chesapeake: .61%	2021: .86%
Potomac: .54%	2018: .85%
Southside: .49%	2015: .79%
Blue Ridge: .37%	2012: .71%
Piedmont: .30%	College: .67%

The following simulation compares the costs of portfolio management in terms of actual dollars. The simulation compares the following portfolios: Piedmont/College, Chesapeake/2021, and Jamestown/2030. The simulation assumes that individuals in each state are investing a constant, upfront sum of $10,000 in each of these plans. It also assumes that the corresponding funds have the same returns compounded annually. The gross returns for the three respective sets of funds are 5%, 7%, and 10%. This assumption allows us to compare these funds based on which one is more expensive. The published returns are net of fees. It is also the goal to compare fees, so using different returns for the two states would negate that comparison. The comparison is made over a 3-year time horizon. The results are published in table 14 From these calculations, it is clear that Maryland's portfolios are more expensive than Virginia's.

Table 14: 3-Year Portfolio Cost

Virginia:	Maryland:
Jamestown: $284.00	2030: $369.50
Chesapeake: $209.84	2021: $355.84
Piedmont: $99.30	College: $281.79

North Carolina College Savings Plan[23]

[22] Maryland College Investment Plan, "2011–2012 Disclosure Statement and New Account Enrollment Form." Last modified 2011. Accessed October, 2012. http://www.collegesavingsmd.org/uploadedFiles/Current_Customers/MPCTdisclosure.pdf.

[23] All information about North Carolina's College Savings Plan came from: College Foundation of North Carolina, "NC 529 Plan." Last modified 2012. Accessed October, 2012. http://www.cfnc.org/save/save.jsp.

The North Carolina College Savings Plan also offers target date funds as an investment option. However, they offer three TDF pathways for investors: conservative, moderate, and aggressive. There are five portfolios in each path that are broken down based on the age of the college attendee. These portfolios are managed by Vanguard, and as with Virginia and Maryland, there is not guarantee that the investor will get their investment back. Even though there are three tracks, there are only six portfolios in the North Carolina College Savings Plan. The Vanguard portfolios are: aggressive growth, growth, moderate growth, conservative growth, income, and money market. The three tracks start with a distinct portfolio, and then glide into other portfolios over time. The time intervals used by the North Carolina TDFs are different than the ones used by Virginia's program, and some of the portfolios are used in multiple time periods within the different paths. Given the use of three distinctive paths, there are different asset breakdowns used in the North Carolina portfolios when compared to the Virginia portfolios. Table 15 is a breakdown of North Carolina's target date funds and their respective asset breakdowns.

Table 15: North Carolina's Asset Allocation[24]

Age Intervals	Aggressive Path Portfolios	Moderate Path Portfolios	Conservative Path Portfolios
0 to 5	Aggressive Growth: 100% Stocks	Growth: 75% Stocks 25% Bonds	Moderate Growth: 50% Stocks 50% Bonds
6 to 10	Growth: 75% Stocks 25% Bonds	Moderate Growth: 50% Stocks, 50% Bonds	Conservative Growth: 25% Stocks, 75% Bonds
11 to 15	Moderate Growth: 50% Stocks 50% Bonds	Conservative Growth: 25% Stocks 75% Bonds	Income: 75% Bonds 25% Money Market Instruments
16 to 18	Conservative Growth: 25% Stocks 75% Bonds	Income: 75% Bonds 25% Money Market Instruments	Income: 75% Bonds 25% Money Market Instruments
19 or Older	Income: 75% Bonds 25% Money Market Instruments	Income: 75% Bonds 25% Money Market Instrument	Money Market: 100% Money Market Instruments

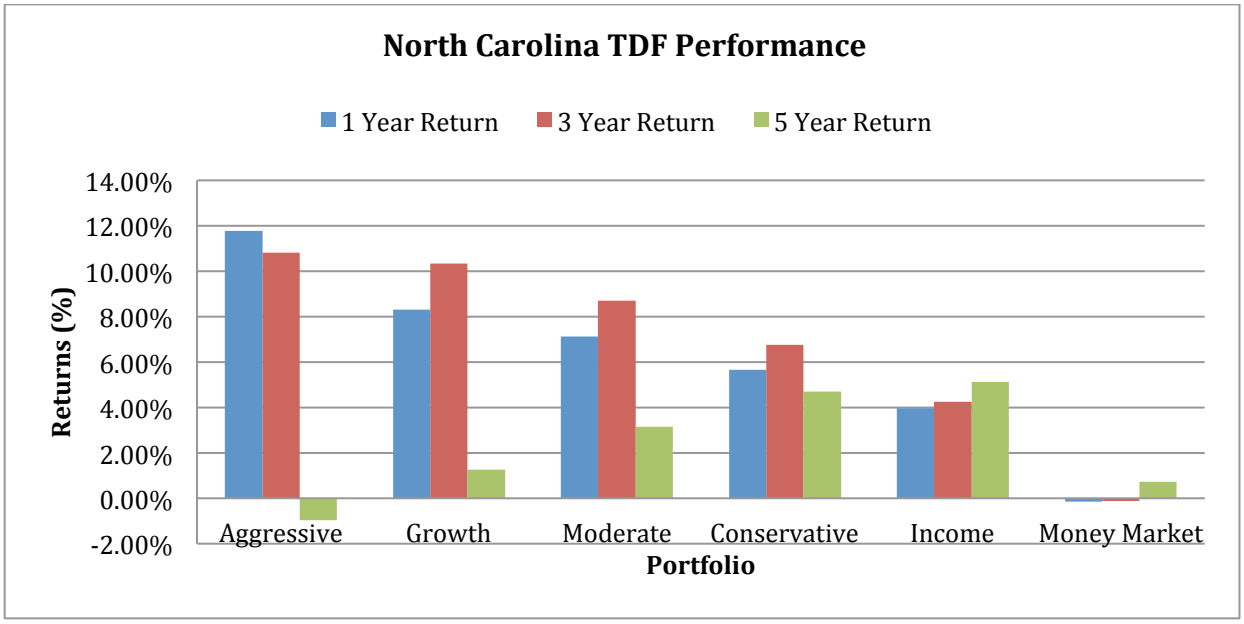
Virginia's portfolios shift every three years, and the starting asset mix is 80% stocks and 20% bonds.[25] The general transformation of Virginia is more similar to North Carolina's moderate

[24] College Foundation of North Carolina, "NC 529 Plan." Last modified 2012. Accessed October, 2012. http://www.cfnc.org/save/save.jsp.

pathway. The last two portfolios in the VEST funds are stable value accounts, and the funds shift gradually toward that point. They start with a higher asset breakdown than North Carolina's conservative path, but they do not initially carry 100% equities like North Carolina's aggressive path. As a result of the three paths, North Carolina's TDFs will perform differently from each other and from Virginia's target date funds.

Evaluating North Carolina's College Savings Plan target date fund performance is difficult because the funds have existed for barely over a year, and there are no yearly returns posted yet on the state's website. The state has yet to post any data under their target date fund performance section, so data was taken from Vanguard. Under the individual investment plans, North Carolina has performance measures for all of their funds, including the ones used in the target date funds. Figure 13 illustrates the performance of the six funds North Carolina uses as TDFs for their College Savings plan.

Figure 13: North Carolina's College Savings Plan Returns[26]



The six funds have similar one-year returns to Virginia's portfolios, but the most notable difference is in the long-term returns. Virginia does not have five-year returns for its two most aggressive portfolios, but the returns for North Carolina's are negative and very small respectively for the Aggressive and Growth portfolios. The aggressive path is the only one that uses the aggressive growth fund, so it is the only North Carolina fund that saw five-year losses. This illustrates one of the risks of target date funds, that if the market performs poorly early on when asset mixtures contain mostly equities, and then rebound later when the funds hold a majority of

[25] The subcategories of the North Carolina portfolios were unavailable for comparison.
[26] Vanguard, "Vanguard 529 Portfolios by Name." Last modified 2012. Accessed November, 2012. https://personal.vanguard.com/us/funds/529portfolios/byname.

bonds, the user has maximized their losses. This is a possibility for North Carolina aggressive path TDF users.

Another aspect of overall fund performance is cost. As demonstrated with Maryland, the cost ratios of funds can increase out of pocket expenses. To make the best comparison between Virginia and North Carolina, cost must be taken into consideration. Table 16 depicts the cost ratios for the North Carolina TDFs.

Table 16: North Carolina's cost ratio in its retirement TDFs[27]

Portfolio	Aggressive	Growth	Moderate	Conservative	Income	Money Market
Cost Ratio	0.36%	0.37%	0.37%	0.37%	0.39%	0.41%

North Carolina's cost ratios increase as the fund becomes more stable. This is different from Virginia, where the more equity based funds cost more to manage. This could be because as Virginia's funds use fewer actively managed portfolios as they become more conservative, thus reducing the number of different managers Virginia has to pay. North Carolina only uses Vanguard, so they only need to pay one manager.

The cost comparison between Virginia and North Carolina makes the same assumptions as the comparison between Virginia and Maryland.

Table 17: 3 Year Portfolio Costs

Virginia	North Carolina
James River: $284.00	Aggressive: $131.08
Chesapeake: $209.84	Moderate: $127.28
Piedmont: $99.30	Income: $129.10

This comparison illustrates that North Carolina's aggressive funds are less expensive than Virginia's. This makes the relative cost of higher returns more expensive for Virginians. However, the funds with more stable incomes are less expensive for Virginians, so when the person who the fund is intended for is in college, it will cost less to manage the fund than it would in North Carolina. These costs do not take taxes into account. Federal and State Income taxes will be levied against the money when it is withdrawn from the portfolio.

Virginia and North Carolina have some stark differences in their college savings plans. Some of Virginia's portfolios are performing better over longer time horizons. However, it is hard to make

[27] Vanguard, "Vanguard 529 Portfolios by Name." Last modified 2012. Accessed November, 2012. https://personal.vanguard.com/us/funds/529portfolios/byname?View=EF.

accurate comparisons because of how Vanguard operates their target date funds. The recession also skewed longer-term returns. A few of North Carolina's portfolios are less expensive to manage, but Virginia's stable growth portfolios are less expensive, reducing the cost when the individual is actually attending college. The asset breakdowns are different, and North Carolina allows for individuals with different risk tolerances to choose different glidepaths. There is only one glidepath option for Virginia investors. The comparison makes Virginia's target date funds more appealing in some respects, but there are aspects where North Carolina's funds are better.

Appendix A: Data

BlackRock net assets in Target date Funds since 2005							
Fund family	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Nest assets ($)	1,293,073,727	1,550,923,821	2,305,123,509	1,549,648,071	2,898,643,292	4,050,044,315	3,790,143,882

Glidepath of the VRS Age-Based Evolving Portfolios										
Years till retirement	**2055 Fund**	**2050 Fund**	**2045 Fund**	**2040 Fund**	**2035 Fund**	**2030 Fund**	**2025 Fund**	**2020 Fund**	**2015 Fund**	**Retirement Fund**
45	98%									
40	93%	93%								
35	88%	88%	88%							
30	83%	83%	83%	83%						
25	77%	77%	77%	77%	77%					
20	70%	70%	70%	70%	70%	70%				
15	63%	63%	63%	63%	63%	63%	63%			
10	55%	55%	55%	55%	55%	55%	55%	55%		
5	45%	45%	45%	45%	45%	45%	45%	45%	45%	
0	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%
Post-Retirement	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%
	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%
	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%

Asset Allocation of the VRS Age-Based Evolving Portfolio at different points in the Glide-path										
Years till retirement	**45**	**40**	**35**	**30**	**25**	**20**	**15**	**10**	**5**	**0**
US large cap stocks	45.83%	44.24%	41.90%	39.32%	36.54%	33.51%	30.14%	26.29%	21.65%	18.42%
US small cap stocks	9.84%	9.12%	8.74%	8.40%	8.02%	7.61%	7.16%	6.64%	6.02%	5.58%
International stocks	28.07%	26.58%	25.00%	23.31%	21.50%	19.52%	17.32%	14.80%	11.77%	9.66%
Real Estate	10.70%	9.52%	8.63%	7.73%	6.77%	5.72%	4.55%	3.21%	1.60%	0.47%
Commodities	3.96%	3.84%	3.83%	3.83%	3.84%	3.84%	3.85%	3.86%	3.86%	3.87%
Bonds	1.60%	6.71%	11.90%	15.80%	20.62%	25.99%	32.01%	38.91%	47.23%	52.94%
Inflation indexed bonds	0.00%	0.00%	0.00%	1.60%	2.71%	3.80%	4.98%	6.30%	7.86%	9.06%

VRS: Value of a $10,000 investment after a year based on historical average returns of the Evolving Portfolio								
	Annualized Returns				$10,000 after a year			
	1-yr	3-yr	5-yr	10-yr	10-yr	5-yr	3-yr	1-yr
Retirement Portfolio	13%	8%	5%	6%	$ 10,564	$ 10,451	$ 10,833	$ 11,265
2015 Portfolio	14%	9%	3%	5%	$ 10,530	$ 10,315	$ 10,871	$ 11,412
2020 Portfolio	16%	9%	3%	5%	$ 10,514	$ 10,252	$ 10,901	$ 11,602
2025 Portfolio	18%	9%	2%	5%	$ 10,469	$ 10,198	$ 10,933	$ 11,782
2030 Portfolio	19%	10%	1%	5%	$ 10,483	$ 10,144	$ 10,953	$ 11,923
2035 Portfolio	21%	10%	1%	4%	$ 10,413	$ 10,097	$ 10,976	$ 12,056
2040 Portfolio	22%	10%	1%	4%	$ 10,448	$ 10,050	$ 10,991	$ 12,188
2045 Portfolio	23%	10%	0%	4%	$ 10,356	$ 10,005	$ 11,002	$ 12,287
2050 Portfolio	24%	10%	0%	0%	$ 10,013	$ 10,013	$ 11,021	$ 12,399
2055 Portfolio	25%			12%	$ 11,154			$ 12,503

Potential range of annualized return for static and age based evolving portfolio			
Portfolio type	**50% equity (static)**	**Age based evolving equity**	**100% equity (static)**
Median annualized return	4.5%	5.0%	6.1%
Std Deviation	0.9%	1.2%	1.8%
Best Case scenario (0.01% chance)	7.4%	9.7%	13.2%
Worst case scenario (0.01 % chance)	1.0%	1.2%	-0.6%

VRS: Static versus age based evolving portfolio performance: Summary Statistics

Equity share	50% equity (static)	Age based evolving equity	100% equity (static)
Avg final balance	$ 210,953	$ 219,138	$ 295,587
Std Deviation	$ 34,841	$ 39,174	$ 107,329
Best Case scenario (0.01% chance)	$ 377,355	$ 465,144	$ 1,297,879
Worst case scenario (0.01 % chance)	$ 118,389	$ 119,519	$ 94,903
Median final balance	$ 207,898	$ 214,401	$ 275,379
95th Percentile	$ 273,228	$ 290,424	$ 501,179
5th percentile	$ 159,660	$ 163,875	$ 161,603
Out-of-pocket contribution	$ 113,804	$ 113,804	$ 113,804
Overall Return to Investment	**183%**	**188%**	**242%**

VRS: Simulated outcomes under TDF for 30, 20 and 10 investment horizon			
Time Horizon	**30 years till retirement**	**20 years till retirement**	**10 years till retirement**
Average Final Balance	$ 138,888	$ 57,039	$ 17,903
Standard Deviation	$ 21,710	$ 6,354	$ 1,217
Best case scenario (0.01% chance)	$ 259,922	$ 90,334	$ 23,147
Worst case scenario (0.01% chance)	$ 82,989	$ 37,768	$ 13,712
Median Balance	$ 136,796	$ 56,528	$ 17,848
95th percentile	$ 178,127	$ 68,324	$ 20,012
5th percentile	$ 107,709	$ 47,551	$ 15,993
Out-of-pocket contribution	$ 79,727	$ 39,679	$ 15,093
Overall Return on Investment	172%	142%	118%

Glide-path of the VEST age-based evolving portfolio								
Year	**Age**	**James River**	**Eastern Shore**	**Alleghany**	**Chesapeake**	**Potomac**	**Southside**	**Piedmont**
2012	0	80%						
2013	1	80%						
2014	2	80%						
2015	3	70%	70%					
2016	4	70%	70%					
2017	5	70%	70%					
2018	6	60%	60%	60%				
2019	7	60%	60%	60%				
2020	8	60%	60%	60%				

2021	9	50%	50%	50%	50%			
2022	10	50%	50%	50%	50%			
2023	11	50%	50%	50%	50%			
2024	12	40%	40%	40%	40%	40%		
2025	13	40%	40%	40%	40%	40%		
2026	14	40%	40%	40%	40%	40%		
2027	15	25%	25%	25%	25%	25%	25%	
2028	16	25%	25%	25%	25%	25%	25%	
2029	17	25%	25%	25%	25%	25%	25%	
2030	18	0%	0%	0%	0%	0%	0%	0%

Initial asset allocation across different funds in the VEST Age-Based evolving portfolio							
	James River (Ages 0-3)	**Eastern Shore (Ages 4-6)**	**Alleghany (Ages 7-9)**	**Chesapeake (Ages 10-12)**	**Potomac (Ages 13-15)**	**Southside (Ages 16-18)**	**Piedmont (Over 18)**
Large-Cap Domestic Equity	17.5%	17.5%	15.0%	13.8%	12.5%	7.5%	0.0%
Emerging Markets Equity	15.0%	12.5%	10.0%	7.5%	5.0%	2.5%	0.0%
Global Real Estate	15.0%	10.0%	10.0%	7.5%	5.0%	5.0%	0.0%
Small-/Mid-Cap Domestic Equity	11.3%	8.3%	6.7%	3.8%	2.5%	1.3%	0.0%
International Equity	8.8%	8.8%	7.5%	6.9%	6.3%	3.8%	0.0%
International Equity	8.8%	8.8%	7.5%	6.9%	6.3%	3.8%	0.0%
Market Fixed Income	7.5%	10.0%	12.5%	15.0%	17.5%	20.0%	0.0%
High Yield Bonds	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	0.0%
Emerging Markets Debt	5.0%	7.5%	7.5%	10.0%	10.0%	10.0%	0.0%
Small-Cap Domestic Equity	3.8%	4.2%	3.3%	3.8%	2.5%	1.3%	0.0%
Stable Value	2.5%	7.5%	15.0%	20.0%	27.5%	40.0%	100.0%

inVEST: Return on $10,000 investment after a year based on historical returns of the evolving inVEST portfolio									
	Annualized Returns				**$10,000 after a year**				
	1-yr	**3-yr**	**5-yr**	**10-yr**	**1 Year**	**3 year**	**5 Year**	**10-year**	**Inception Date**
James River	11.7	N/A	N/A	N/A	$ 11,171				Jan-11

(Ages 0-3)	1%								
Eastern Shore (Ages 4-6)	10.71%	10.08%	N/A	N/A	$ 11,071	$ 11,008			Feb-08
Alleghany (Ages 7-9)	10.12%	9.74%	0.72%	N/A	$ 11,012	$ 10,974	$ 10,072		Aug-05
Chesapeake (Ages 10-12)	9.47%	9.55%	1.00%	7.71%	$ 10,947	$ 10,955	$ 10,100	$ 10,771	Jan-02
Potomac (Ages 13-15)	8.30%	8.72%	1.60%	7.47%	$ 10,830	$ 10,872	$ 10,160	$ 10,747	Jan-00
Southside (Ages 16-18)	6.89%	8.19%	2.12%	7.17%	$ 10,689	$ 10,819	$ 10,212	$ 10,717	Jan-00
Piedmont (Over 18)	2.43%	3.29%	3.69%	3.94%	$ 10,243	$ 10,329	$ 10,369	$ 10,394	Jan-00

Cost-inflation adjusted cost of 4-year Public College			
Age	**Year to college**	**4-year cost**	**4-year cost adjusted for inflation**
0-3	18	$ 54,400	$ 130,920
4-6	15	$ 54,400	$ 113,094
7-9	12	$ 54,400	$ 97,695
10-12	9	$ 54,400	$ 84,392
13-15	6	$ 54,400	$ 72,901
16-18	3	$ 54,400	$ 62,975
18 or over	0	$ 54,400	$ 54,400

Potential range of annualized return for three VEST portfolios based on Monte Carlo Simulation			
	James River (Ages 0-3)	**Alleghany (Ages 7-9)**	**Potomac (Ages 13-15)**
Average	4.19%	3.97%	3.69%
SD	1.40%	1.36%	1.41%
Best case scenario (0.01% prob)	9.75%	9.05%	8.84%
Worst case Scenario (0.01% Prob)	-1.60%	-1.54%	-1.98%
Median Outcome	4.20%	3.97%	3.70%

Simulated outcomes for VEST Target Date Funds			
	$100/month plus $10,000 initial asset		
	James River (Ages 0-3)	**Alleghany (Ages 7-9)**	**Potomac (Ages 13-15)**
Average	$71,464	$41,751	$22,354
SD	$9,435	$4,140	$1,295
Best case scenario (0.01% prob)	$117,613	$59,671	$27,564
Worst case Scenario (0.01% Prob)	$45,788	$29,988	$18,083
Median Outcome	$70,586	$41,481	$22,313
95th Pct.	$88,423	$48,958	$24,516

5th Pct.	$57,464	$35,431	$20,297
Out-of-Pocket	$45,447	$30,056	$18,570
Return on Investment	155%	138%	120%

State Government Employment

Year	Virginia	North Carolina	Maryland
2001	146400	160878	107000
2002	144800	161242	108900
2003	142900	163200	106600
2004	145700	167075	107100
2005	149400	170767	107500
2006	152600	173335	107700
2007	153000	177112	108000
2008	154000	181316	109300
2009	152900	180433	110900
2010	153800	180620	113100
2011	155700	180393	113700

Local Government Employment

Year	Virginia	North Carolina	Maryland
2001	335600	389252	223000
2002	343500	395931	227500
2003	346900	401381	227700
2004	353600	408609	228500
2005	360700	415343	232700
2006	367700	424661	238300
2007	373400	433799	245500
2008	380500	439591	251300
2009	380900	438039	251300
2010	376500	434152	248600
2011	379800	430083	248600

VRS Returns

Target Retirement Date	1 Year Return	3 Year Return	5 Year Return	10 Year/Since Inception
2015	14.12	8.71	3.15	5.3
2020	16.02	9.01	2.52	5.14
2025	17.82	9.33	1.98	4.69
2030	19.23	9.53	1.44	4.83
2035	20.56	9.76	0.97	4.13
2040	21.88	9.91	0.5	4.48

2045	22.87	10.02	0.05	3.56
2050	23.99	10.21	0.13	0.13
2055	25.03	NA	NA	11.54

Maryland Returns

Target Retirement	1 Year Returns	3 Year Returns	5 Year Returns	10 Year Returns
2015	19.92	9.81	2.76	5.93
2020	21.81	10.28	2.3	8.77
2025	23.04	10.49	1.87	NA
2030	24.46	10.79	1.54	9.08
2035	25.23	10.88	1.32	NA
2040	25.59	10.89	1.34	9.01
2045	25.45	10.88	1.33	NA
2050	24.49	10.87	1.33	2.83
2055	25.47	10.91	1.33	NA

Comparison Between Virginia and Maryland

State and Year	1 Year Return	3 Year Return	5 Year Return	Since Inception Return
Virginia 2015	14.12	8.71	3.15	5.3
Maryland 2015	19.92	9.81	2.76	5.93
Virginia 2030	19.23	9.53	1.44	4.83
Maryland 2030	24.46	10.79	1.54	9.08
Virginia 2050	23.99	10.21	0.13	0.13
Maryland 2050	24.49	10.87	1.33	2.83

Maryland Performance Calculations

	1 Year	3 Year	5 Year
Maryland 2015	19.92	9.81	2.76
Maryland 2030	24.46	10.79	1.54
Maryland 2050	24.49	10.87	1.33
	0.1992	0.0981	0.0276
	0.2446	0.1079	0.0154
	0.2449	0.1087	0.0133
1000	1 Year	3 Year	5 Year
	1199.2	1098.1	1027.6
	1244.6	1107.9	1015.4
	1244.9	1108.7	1013.3
		1205.82361	1055.96176
		1227.44241	1031.03716
		1229.21569	1026.77689
		1324.11491	1085.1063

		1359.88345	1046.91513
		1362.83144	1040.43302
			1115.05524
			1063.03763
			1054.27078
			1145.83076
			1079.4084
			1068.29258
5000	1 Year	3 Year	5 Year
	5996	5490.5	5138
	6223	5539.5	5077
	6224.5	5543.5	5066.5
		6029.11805	5279.8088
		6137.21205	5155.1858
		6146.07845	5133.88445
		6620.57453	5425.53152
		6799.41723	5234.57566
		6814.15718	5202.16511
			5575.27619
			5315.18813
			5271.35391
			5729.15382
			5397.04202
			5341.46292
10000	1 Year	3 Year	5 Year
	11992	10981	10276
	12446	11079	10154
	12449	11087	10133
		12058.2361	10559.6176
		12274.4241	10310.3716
		12292.1569	10267.7689
		13241.1491	10851.063
		13598.8345	10469.1513
		13628.3144	10404.3302
			11150.5524
			10630.3763

			10542.7078
			11458.3076
			10794.084
			10682.9258

Fee Comparison Calculations

VA 2015	MD 2015	VA 2030	MD 2030	VA 2050	MD 2050
10000	10000	10000	10000	10000	10000
10500	10500	10700	10700	11000	11000
9.45	69.3	9.63	80.25	9.9	85.8
11025	11025	11449	11449	12100	12100
9.9225	72.765	10.3041	85.8675	10.89	94.38
11576.25	11576.25	12250.43	12250.43	13310	13310
10.418625	76.40325	11.025387	91.878225	11.979	103.818
29.791125	218.46825	30.959487	257.995725	32.769	283.998

Virginia College Savings Fund Returns

Portfolio	YTD Return	1 Year Return	3 Year Return	5 Year Return	10 Year Return
James River	14.1	23.21	NA	NA	NA
Eastern Shore	12.96	21.9	9.41	NA	NA
Alleghany	11.92	21.99	9.26	1.19	NA
Chesapeake	10.92	20.75	9.17	1.46	8.21
Potomac	9.41	15.16	8.5	1.98	7.91
Southside	7.6	14.76	8.05	2.45	7.55
Blue Ridge	4.28	7.46	6.84	2.27	6.77
Piedmont	1.9	2.61	3.36	3.75	3.96

Maryland College Savings Plan

Name	1 Year Returns	3 Year Returns	5 Year Returns
2012	13.91	4.37	4.47
2015	20.305	5.17	4.85
2018	24.45	4.69	4.32
2021	28.06	4.13	3.75
2024	31.44	3.98	3.47
2027	32.52	4.13	3.54
2030	32.69	NA	NA

Data Used for Comparison Table

Fund	Virginia 1 Year	Maryland 1 Year	Virginia 3 Year	Maryland 3 Year	Virginia 5 Year	Maryland 5 Year	Virginia Since	Maryland Since

							Inception	Inception
James River/2030	11.71	32.84	NA	NA	NA	NA	4.92	15.11
Eastern Shore/2027	10.71	32.69	10.08	4.13	NA	3.54	2.82	3.54
Alleghany/2024	10.12	31.44	9.74	3.98	0.72	3.47	4.64	6.12
Chesapeake/2021	9.47	28.06	9.55	4.13	1	3.75	5.67	4.8
Potomac/2018	8.3	24.45	8.72	4.69	1.6	4.32	4.35	4.97
Southside/2015	6.89	20.35	8.19	5.17	2.12	4.85	4.37	5.15
Blue Ridge/2012	4.02	13.91	6.77	4.37	2.03	4.47	4.27	5.03
Piedmont/College	2.43	7.56	3.29	3.86	3.69	4.08	4.34	3.34

College Savings Plan Cost Comparisons
Between Virginia and Maryland

Jamestown/2030	Virginia Cost	Maryland Cost
10000		
11000	85.8	113.5
12100	94.38	122.85
13310	103.818	133.135
	283.998	369.485
Chesapeake/2021		
10000		
10700	65.27	112.02
11449	69.8389	118.4614
12250.43	74.727623	125.353698
	209.836523	355.835098
Piedmont/College		
10000		
10500	31.5	90.35
11025	33.075	93.8675
11576.25	34.72875	97.560875
	99.30375	281.778375

North Carolina College Savings Plan

Portfolio	1 Year Return	3 Year Return	5 Year Return
Aggressive	11.76%	10.81%	-0.97%
Growth	8.30%	10.33%	1.27%
Moderate	7.12%	8.71%	3.16%
Conservative	5.67%	6.76%	4.71%
Income	3.96%	4.25%	5.13%
Money Market	-0.15%	-0.11%	0.73%

North Carolina Cost Calculations

Aggressive	
10000	
11000	39.6
12100	43.56
13310	47.916
	131.076
Moderate	
10000	
10700	40.66
11449	43.5062
12250.43	46.551634
	130.717834
Income	
10000	
10500	40.95
11025	42.9975
11576.25	45.147375
	129.094875

Appendix B: Employee Needs

As of February 2012, 158,200 people worked in Virginia state government. Another 387,700 people worked in local governments across the state.[28] Many of these employees use the state's retirement system. Target date funds are only used in Virginia's optional retirement plans, like the 457 plan. Optional plans serve to help employees meet their retirement goals. Given the substantial population who utilizes the Virginia Retirement System, this section serves to provide a perspective on how target date funds, as part of the optional retirement plans, help employees secure adequate retirement. This section focuses specifically on participation, funding, eligibility, and fees.

Participation

Automatic enrollment eliminates administrative barriers to retirement participation. Individuals must actively choose not to participate in one of VRS's optional retirement plans. However, target date funds are not the default investment, so participation in these funds still has barriers. Since the VRS target date funds are outperforming their benchmarks automatic enrollment in target date funds could prove to be beneficial.

The GAO issued a report reviewing the implementation of automatic enrollment in 401(k)s. The report states that participation in a 401(k) plan by those not automatically enrolled is considerably lower -- around 49% -- than those who are auto-enrolled. All of the studies referenced by the GAO estimate the participation in 401(k)s to be between 81% and 95% after automatic enrollment is introduced.[29] Another GAO study found that TDFs are quickly becoming the most popular fund for automatic enrollment.[30] The ease of using a target date fund is cited in the study as a specific reason for why they are becoming more popular.

By making target date funds the default investment in the VRS optional plans, the State would increase participations in a user-friendly fund. However, there are issues with adopting target date funds as a default investment. A report by the Employee Benefits Research Institute (EBRI) has stated that lack of transparency and easy access to information as a major issue with TDFs.[31] There is significant room for improvement regarding information disclosure in the following areas:

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[28] Virginia Employment Commission, "Non-Farm Employment By Industry." Last modified 2012. Accessed October, 2012. http://www.vec.virginia.gov/pdf/newpres1.pdf.

[29] Government Accountability Office, "Automatic Enrollment Shows Promise for Some Workers, but Proposals to Broaden Retirement Savings for Other Workers Could Face Challenges." Last modified 2009. Accessed October, 2012. http://www.gao.gov/new.items/d1031.pdf.

[30] Government Accountability Office, "Defined Contribution Plans: Key Information About Target Date Funds as Default Investments Should Be Provided to Plan Sponsors and Participants." Last modified 2011. Accessed October, 2012. http://www.gao.gov/assets/320/315448.pdf.

[31] Jack, VanDerhei. Employee Benefits Research Institute, "The Impact of Automatic Enrollment in 401(k) Plans on Future Retirement Accumulations: A Simulation Study Based on Plan Design Modifications of Large Plan Sponsors." Last modified 2011. Accessed October, 2012. http://www.ebri.org/pdf/briefspdf/EBRI_IB_04-2010_No341_Auto-Enrl.pdf.

- **Extent of "Tactical allocation":** "Tactical allocation" refers to an active decision by the funds' managers to stray from the series strategic glidepath. Currently there is no standard for how much of a tactical shift is acceptable.
- **Investment rationale**: The investment rationale behind the strategic asset-allocation path used in the target-date series.
- **Sub-asset classes:** The sub-asset classes likely to be represented in the funds' strategic asset-allocation path and their intended percentage of assets.
- **Fund-of-funds structure**: A list of the underlying funds included in the target-date series needs to be disclosed. While a general asset breakdown is available to users, the fund specific investments are not published.

Adequate Retirement Funding

The financial market strife caused by the 2007 market downturn re-focused the country on retirement system. Many people lost substantial value in their retirement savings, emphasizing the need for adequate funds for retirement. Virginia's optional retirement plans are designed to help retirees reach their desired standard of living. A 2011 Joint Legislative Audit and review Commission report reviewing the retirement system for state and local government employees suggests that employees need to hold between 79% and 99% of their working income at retirement to be able to sustain a similar standard of living.[32] An EBRI paper cites a study claiming that the ideal replacement rate is between 75% and 89%.[33] These replacement rates illustrate the need for retirement savings.

Target date funds help individuals meet their desired replacement rates. According to a study conducted by EBRI, the benefits of automatic enrollment in 401(k)s are felt most by the lowest earning groups. By being automatically enrolled in a 401(k), low-earning employees saw a 14% increase in their retirement replacement. If their minimum contribution rate was 6%, and assuming that the money was placed in a target date fund, low income employees could see a 52% increase in their replacement rate.[34] Virginia already enrolls state employees into one of the optional retirement plans, but if target date funds continue to perform better than their benchmarks and other funds offered by the state, shifting employees into TDFs might be prudent. However, there are performance risks associated with target date funds, such as no guarantee of any return on investment. These risks have been broken down explicitly in the Risks and Advantages section.

Eligibility

[32] Joint Legislative Audit and Review Commission, "Review of Retirement Benefits for State and Local Government Employees." Last modified 2011. Accessed September, 2012. http://jlarc.virginia.gov/reports/Rpt422.pdf.

[33] Jack, VanDerhei. Employee Benefits Research Institute, "Measuring Retirement Income Adequacy: Calculating Realistic Income Replacement Rates." Last modified 2006. Accessed October 2012. http://www.ebri.org/pdf/briefspdf/EBRI_IB_09-20061.pdf.

[34] Jack, VanDerhei. Employee Benefits Research Institute, "The Impact of Automatic Enrollment in 401(k) Plans on Future Retirement Accumulations: A Simulation Study Based on Plan Design Modifications of Large Plan Sponsors." Last modified 2011. Accessed October, 2012. http://www.ebri.org/pdf/briefspdf/EBRI_IB_04-2010_No341_Auto-Enrl.pdf.

All state employees are eligible to participate in VRS's optional retirement plans. Employees who were hired after January 1, 2008 are automatically enrolled in the program 90 days after the date of initial employment, and those hired prior to that date can still participate. One major restriction on eligibility is that employers must agree to be a participant in the optional plans, so for local government employees, their jurisdiction must be a participant for individuals to be eligible. If an employee stops working for a covered employer, their ability to contribute ceases. Any employee is also eligible to place their money in a TDF, and the default portfolio is the TDF that coincides most closely with the employee's date of birth.[35] Eligibility is generally open to most employees.

Withdrawal eligibility is tied to several factors. Employees may pull their money out when they: retire, terminate employment from the covered employer, use a Plan account to purchase an approved VRS service credit, experience a unforeseen emergency, have inadequate funds, account inactivity, or reach the age of 59 and ½. Payments may be made as a lump sum, periodic payments, annuity payments, or a combination of periodic and lump payments. There are service fees associated with withdrawal, and there is a 10% penalty for pulling funds out early. Individuals must also pay taxes on the income they receive from the fund when they take money out of one of the deferred compensation plans.

Taxes, Fees, and Adjustments

The tax structure of both the optional retirement plans may be a wash for employees. Contributions are untaxed, but withdrawals are taxed. This benefits retirees by allowing them to pay a lower income tax on the money extracted from the investments. Since contributions are not taxed, money put into the funds from an employee's income lowers their taxable income. Along with paying taxes, there is a 10% penalty for pulling funds out of the plan before an individual is eligible. It is important to know what taxes and fees may be placed on retirement income.

Fees are another important aspect of retirement plans. Whenever an individual makes an investment, there is always an expense and brokerage fee. For the VRS Defined Contribution Plans, which the deferred compensation plans fall under, the fees are different. For all TDFs, the annual operating fees are .09%, or 90 cents for every $1,000. The money market fund and stable value fund have higher annual fees, 10% and 27% respectively, but the bond fund and TIPS fund have lower operating expenses.[36] Employees who use target date funds will be paying lower costs than individuals who have invested in other funds.

The most important adjustment made is a Cost of Living Adjustment (COLA). This adjustment is made to offset any inflation that may reduce the value of funds held. It becomes

[35] Virginia Retirement System, "Frequently Asked Questions." Last modified 2012. Accessed October 2012. https://vadcp.ingplans.com/einfo/planinfo.aspx?cl=VIRGNA&pl=650271PU&page=plan_informationfaqswhathappens2&domain=vadcp.csplans.com&s=ftjkqnl4swztvsgfrjnckco0&d=ac25f75a9a7847f513fcf26a577a4979074d9c08.

[36] Virginia Employment Commission, "Virginia's Seasonally Adjusted Unemployment Rate." Last modified 2012. Accessed October 2012. http://www.vec.virginia.gov/pdf/newpres1.pdf.

effective two years after retirement. COLAs may not keep pace with inflation. The increase matches the first 2% of inflation, and then half of every 1% increase after that until inflation hits 6%. When inflation is nonexistent, or there is a period of deflation, there will not be a COLA.

Employees have many needs when they invest in a retirement system. The first need is getting them to participate, but these funds also need to provide adequate savings for eligible individuals. Fees, taxes, and adjustments also need to be taken into account. When all of these things are looked at, target date funds generally do a good job in meeting individual's needs. Understanding employee needs adds perspective needed to analyze the risks and advantages of target date funds in the state's optional retirement plans.

Appendix C: Monte Carlo Simulation

Historical returns of the evolving portfolios in the VRS can vary significantly depending on the time-span under consideration. This section sets aside historical data and uses hypothetical future returns data based on Monte Carlo simulations. In order to simulate future portfolio returns, a number of simplifying assumptions need to be made:

- An person starts working (and saving in a TDF) at age 30 and retires at 65
- Amount contributed is $100/month in the beginning with 5% increase per year.
- The portfolio consists of generic stocks and bonds and no other assets
- The fraction of equities will evolve based on the BlackRock glidepath starting at 35 years to retirement.
- There is a 0.09% annually compounded fee.
- Return on bonds remain fixed through the entire interval at an inflation adjusted annualized rate of 2.6%
- Long run equity returns is anchored at 6.63% and randomized for each year based an annualized volatility assumption of 10%. Thus return on the fraction held in stocks will be 6.63% plus or minus a random fraction of 10%.
- A scaling factor of 1.8 is used to ensure that the on average, equity volatility will converge towards 10%.
- The formula in excel is:

Return on equity in any given year = 6.63% + (RAND()-RAND()+RAND()-RAND())*10%*1.8[37]

Rand() represents a random number generator which generates a random number greater than or equal to 0 and less than 1. Two of the Rand() function generates positive random numbers while other two generate negative random numbers, thereby giving us both positive and negative outcomes.

A central assumption that can make a big difference on final outcomes is the long-term return estimates stocks and bonds. The report uses 6.63% as the long-run return on equities and 2.6% for bonds. These figures are very conservative and reflect adjustment for a 2.2% annual inflation. These return estimates were derived from the Charles Schwab investment firm's resource center (see Table C1 below).[38] Notice that the percent in equity and percent in bonds sum up to 100%. Likewise, total return on investment for a year is the return on bonds plus return on equities (B+C). Based on this model specification and model parameters, a Monte Carlo simulation of annual portfolio returns and corresponding account balance at target date were performed using 10,000 replications. This simulates year-to-year variation of annualized equity returns and consequently generates 10,000 possible target date fund outcomes.

[37] The basic algorithm was developed by Tom O'Haver, University of Maryland, March 1997 (Revised 1999). Available at: http://www.inform.umd.edu/MCTP/Courses/Mathematics/simulations/Investment.html

[38] http://www.schwab.com/public/schwab/resource_center/expert_insight/investing_strategies/portfolio_planning/qa_estimating_long_term_market_returns.html

Table C1 Long-term return estimates for stocks and bonds investments

Asset class	Estimated returns	Weighted average return
Large-cap stocks	6.5% compounded annually	**6.63% (Equity)**
Mid-/small-cap stocks	8.0% compounded annually	
International stocks	6.3% compounded annually	
Bonds	2.6% compounded annually	**2.6% (Bond)**
Cash investments	2.2% compounded annually	

Source: Charles Schwab Investment firm's resource center webpage

Using these parameters we set up the formula that calculates the net principal in every year.

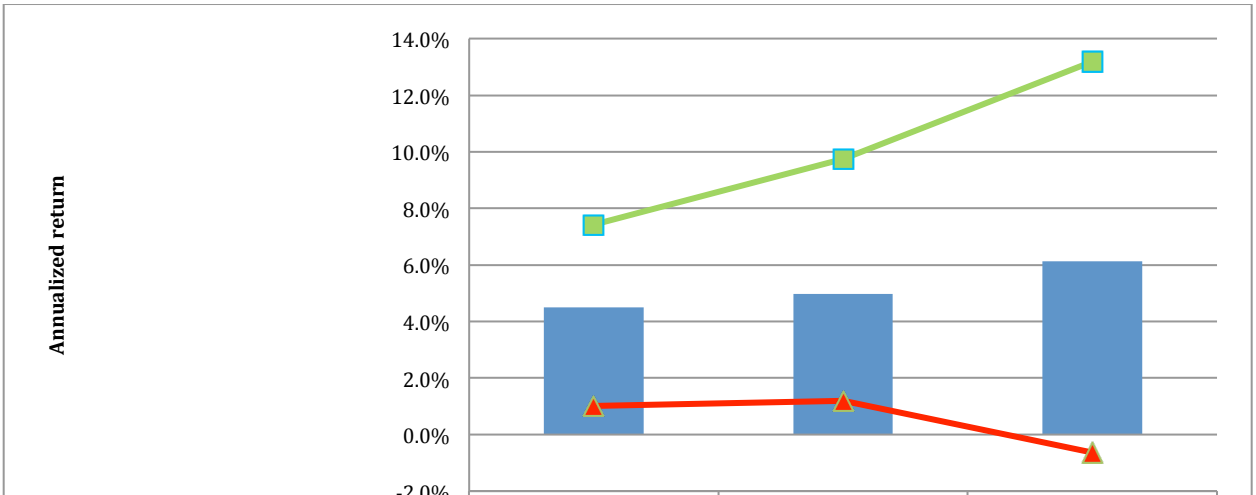
Principle as of year *t* =		**[Y]**
	Principle (t-1) **[Principle n year t-1]**	**[A]**
+	***% in equity * Principle(t-1)*(random) return on equity investment in year t***	**[B]**
+	***% in bond * Principle(t-1)*(fixed) return on bond asset***	**[C]**
+	***Total amount contributed this year***	**[D]**

Simulated Outcomes: Static Equity Share Portfolio Vs. Evolving Portfolio

The first part compares the performance of the age based evolving portfolio under BlackRock's glidepath with two alternate portfolios: a static portfolio with 50% of assets in stocks and another portfolio with 100% of the assets invested in stocks (no bonds). In all three cases the assumptions is that the individual aged 30 starts from an initial retirement balance of zero dollars and continuously invests $100 per month in the first month with annual contribution escalation of 5% for 35 years. Recall that the returns have been pre adjusted for an annual inflation rate of 2.2%.

Table C1 highlights two broad and recurring themes of the study: higher returns correspond to higher volatility of outcomes. Meanwhile, the age-based evolving portfolio on average has the best of both worlds: higher returns for young investors better prepared to deal with markets risks and stable but low growth rates at an older age.

Figure C1: Comparison Between Target Date Funds and Static Funds
(Monthly $100 contribution plus 5% annual escalation)



	50% equity (static)	Age based evolving equity	100% equity (static)
Median annualized return	4.5%	5.0%	6.1%
Best Case scenario (0.01% chance)	7.4%	9.7%	13.2%
Worst case scenario (0.01 % chance)	1.0%	1.2%	-0.6%

Note: Annualized returns calculated as geometric mean of compounded annual returns (returns for equity + returns for bond) for 35 years.

Figure C1 presents results of the Monte Carlo simulation for a hypothetical 30-year-old investor who has just been employed and expects to work until 65.

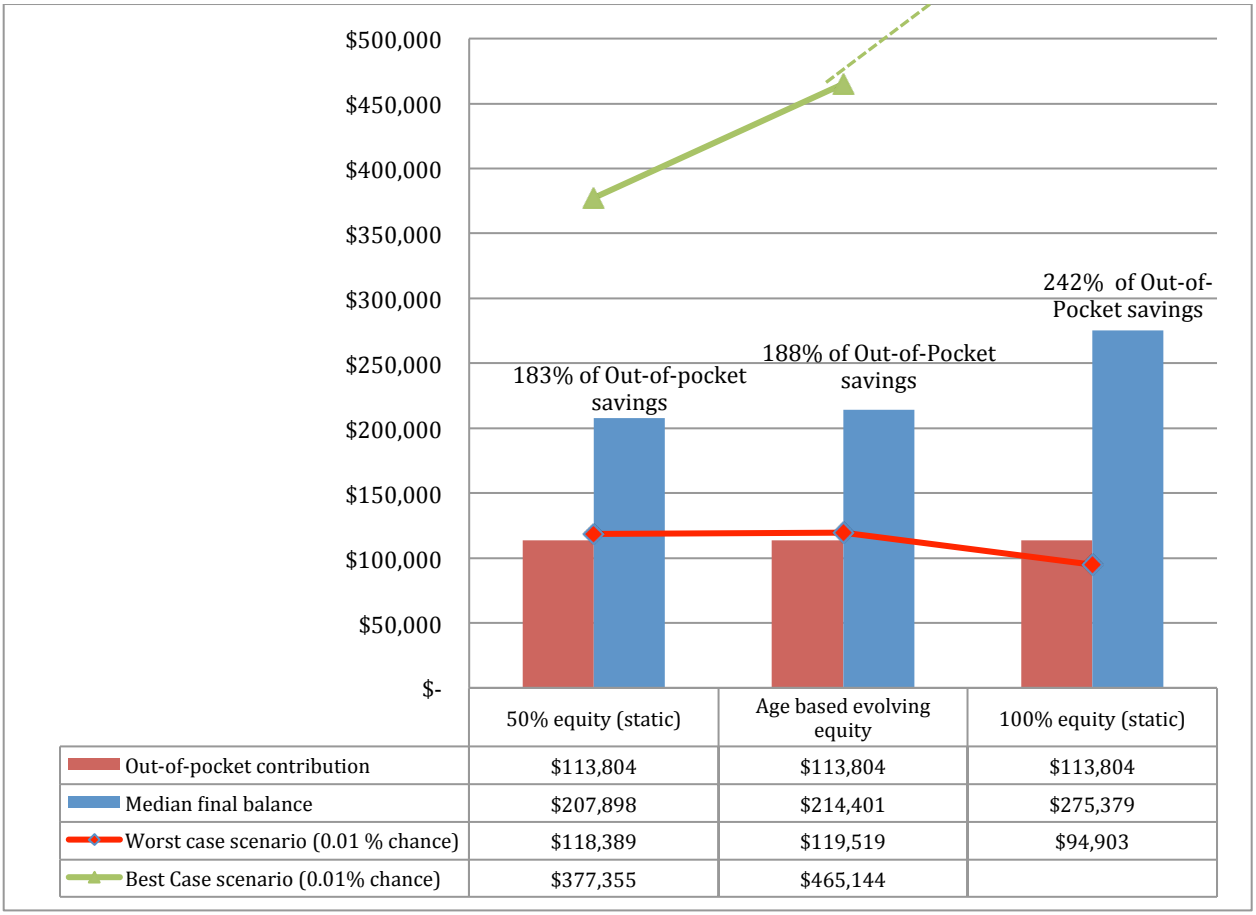
- With a non-evolving 50% equity portfolio, the median investor can expect on average an annual return of 4.5% for 35 years. However, this comes with a 0.01% probability that the portfolio will only return 1% per year. This would be her worst-case scenario under a 50% non-evolving portfolio.

- Meanwhile, with an age-based evolving portfolio, the median investor can expect on average of 5% return every year during her 35-year investment horizon. However, this comes with a 0.01% probability that the portfolio will only return 1.2% per year, her worst-case scenario.

- Finally the high-risk-high-return 100% equity portfolio can be expected to deliver 6.1% annual return on investment but in the worst-case scenario, the portfolio can end up returning -0.6%. This implies that there is a small chance that the investor might end up with a retirement balance that is less than her out-of-pocket contribution.

Translating these results in dollar terms we get the following results shown in Figure C2:

Figure C2: Simulated Potential Incomes for Target Date Portfolios
(Monthly $100 contribution plus 5% annual escalation)



	50% equity (static)	Age based evolving equity	100% equity (static)
Out-of-pocket contribution	$113,804	$113,804	$113,804
Median final balance	$207,898	$214,401	$275,379
Worst case scenario (0.01 % chance)	$118,389	$119,519	$94,903
Best Case scenario (0.01% chance)	$377,355	$465,144	

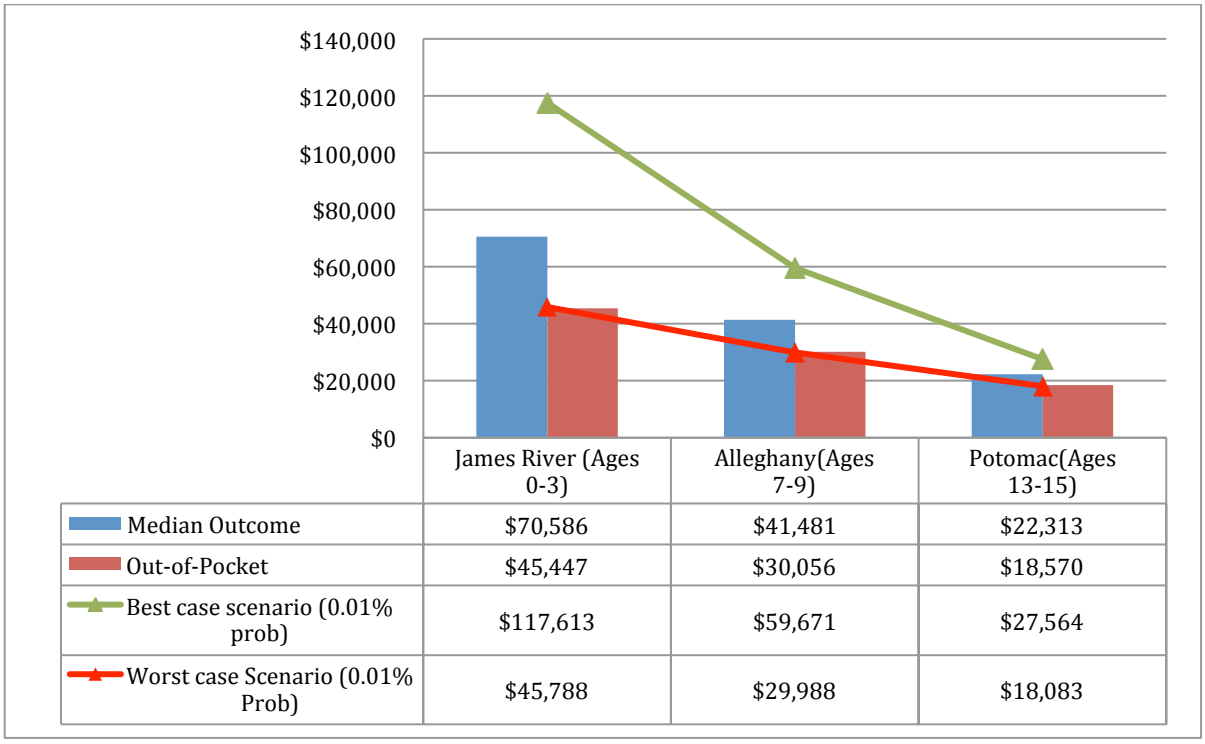
- The median investors in our simulated sample can expect to make roughly $207,000 with a static 50% stock portfolio, $214,000 with an age-based evolving portfolio and $275,000 with a static 100% stock portfolio.
- While the upside potential of the 100% stock portfolio is very high (the best case scenario numbers somewhere in the region of $1,000,000 and has been suppressed in the chart), the downside risk is higher than both the 50% equity option and age-based evolving option.
- Comparing the static 50% stock option and age-based evolving portfolio, three things need to be mentioned:

    - First, in both cases, the downside potential is no worse than the total value of out-of-pocket contribution.
    - Second, the downside potential in the worst-case scenario is only slightly better for the age based evolving portfolio compared to the age-based evolving portfolio.
    - Third, and most importantly, while the downside potential of the two is roughly comparable, the upside potential for the age-based evolving portfolio is higher than that for the 50% stock portfolio.

Simulated outcomes: 30, 20 and 10 years till retirement

This section looks at how the outcomes would differ for employees who will invest into target date funds for 30, 20 and 10 years. Previously, it was assumed that the hypothetical investor starts working (and saving in a TDF) at age 30 and retires at 65. It is assumed that there are three hypothetical investors aged 35, 45 and 55, who invest in an age-based evolving portfolio for 30, 20 and 10 years respectively. The rest of the assumptions are the same as above.

Figure C3: Simulated outcomes for VRS portfolio given a 30, 20 and 10-year investment horizon.



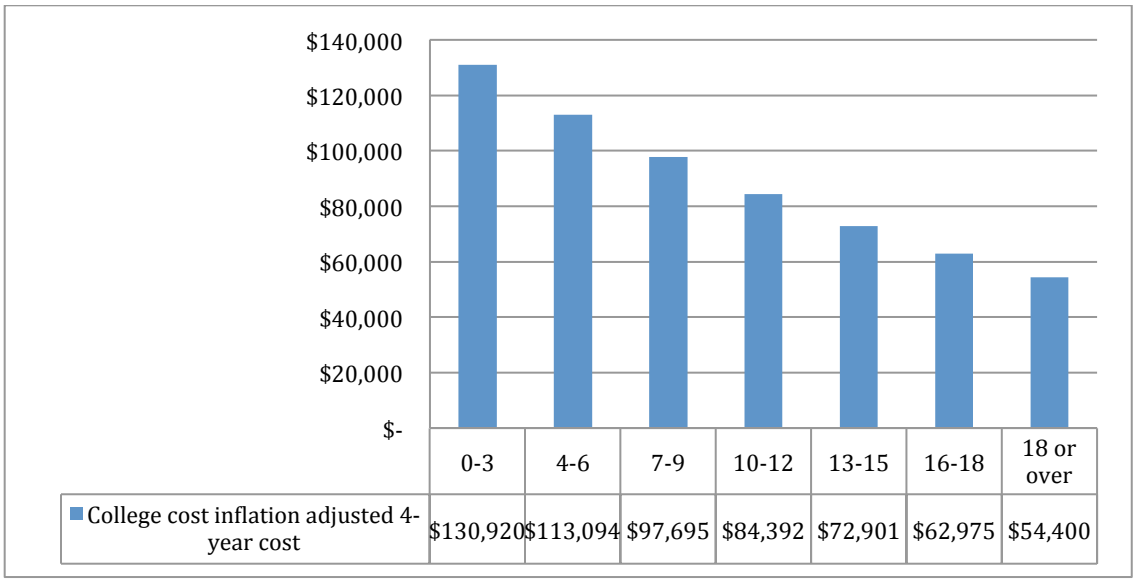
	James River (Ages 0-3)	Alleghany(Ages 7-9)	Potomac(Ages 13-15)
Median Outcome	$70,586	$41,481	$22,313
Out-of-Pocket	$45,447	$30,056	$18,570
Best case scenario (0.01% prob)	$117,613	$59,671	$27,564
Worst case Scenario (0.01% Prob)	$45,788	$29,988	$18,083

The reduced investment horizon can have a significant impact on target date fund balance at retirement. For example, just a 5 year reduction in investment horizon (and the number of working years going forward) reduces the savings at target date from 188% of out-of-pocket savings to 172% of out-of-pocket savings (see figure 9 below). For investor with 10 years to retire, investment in target date funds can on average lead to a retirement balance that is 18% greater than what was put into the portfolio through out-of-pocket contributions. However, there is a slight chance that the final balance could also be slightly lower than what was put in. However, even under these circumstances, the tax-deferred nature of Virginia's deferred compensation plans means that the tax saving may offset such market losses.

Simulated Outcomes based on Monte Carlo Simulation for inVEST

Before moving on to the simulated outcomes in terms of college savings at target date, it might be useful to take a step back and look at how much a 4-year public college might actually cost. Figure C3 below presents approximate cost of tuition and boarding for a hypothetical 4-year public college, with and without adjustment for tuition cost inflation:

Figure C3: Cost of 4-Year Public College



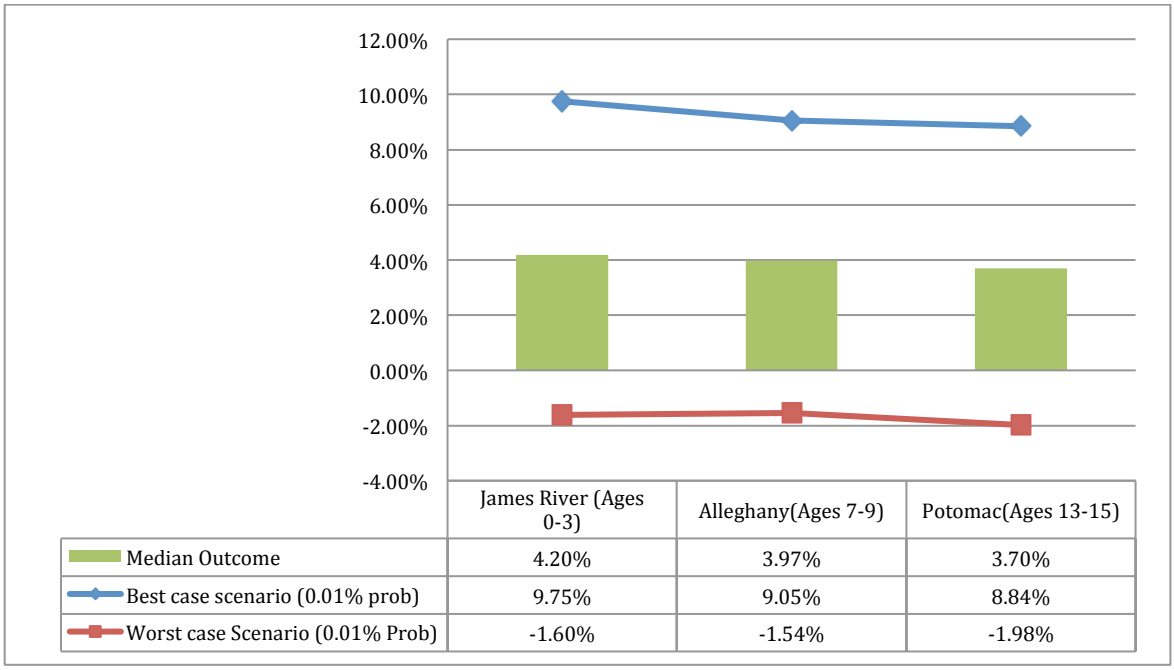
Source: Own calculation based on findings by U.S. Department of Education. [39]

The numbers highlight an interesting point: parents of newborns who wish to start saving early will have to set aside more than twice ($130,920) what parents with children who are just about to enter college ($54,400) if they are to beat the rapidly rising college costs which is currently outpacing the general inflation rate by approximately 2 percent points. Taking this further, it can be concluded that parents who can put up large up-upfront sums for college savings have an upper hand over parents who need to start saving from a very early age. From this point of departure, it would be interesting to see whether using the VEST age-based evolving portfolio can remedy this situation and level the playing field.

Figure 13 below shows potential range of outcomes for a VEST age-based evolving portfolio user in terms of long-term annual returns.

[39] For the 2010–11 academic year, annual current dollar prices for undergraduate tuition, room, and board were estimated to be $13,600 at public institutions ($36,300 at private not-for-profit institutions).Between 2000–01 and 2010–11, prices for undergraduate tuition, room, and board at public institutions rose 42 percent, and prices at private not-for-profit institutions rose 31 percent, after adjustment for inflation. Thus we use 4.2% as the annual college cost inflation rate.
Source: U.S. Department of Education, National Center for Education Statistics. (2012). Digest of Education Statistics, 2011 (NCES 2012-001),

Figure C4: Simulated Potential inVEST Returns



	James River (Ages 0-3)	Alleghany(Ages 7-9)	Potomac(Ages 13-15)
Median Outcome	4.20%	3.97%	3.70%
Best case scenario (0.01% prob)	9.75%	9.05%	8.84%
Worst case Scenario (0.01% Prob)	-1.60%	-1.54%	-1.98%

The key results can be summarized as follows:

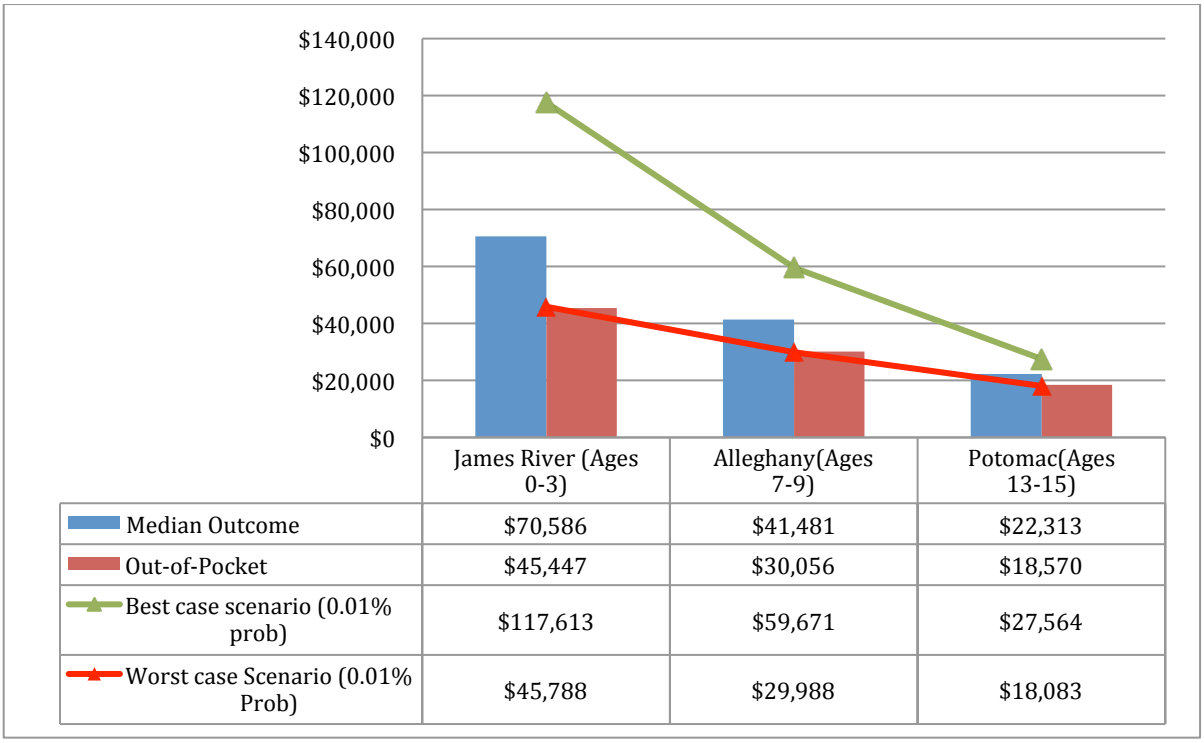
- In all three portfolios, the worst-case scenario is negative for all three portfolios, reflecting the fact that with shorter time horizon, the volatility of portfolio returns tends to be higher.
- The median investor can expect to earn 4.20% annually for 18 years in the James River portfolio, 3.97% for 12 years in the Alleghany portfolio and 3.70% for 6 years in the Potomac portfolio.
- Using these median outcomes we can estimate how much money investors need to deposit into the VEST account every month so that they have enough saved for 4-years of public college when their children turn 18:

Table C1: Required Monthly Savings

Age of child	Monthly deposit	Investment horizon	Final Balance
0-3	$400/mo	18 years	~$130,920
7-9	$520/mo	12 years	~$97,695
13-15	$900/mo	6 years	~$72,901

The range of potential outcomes in dollar terms under slightly different scenario is presented below. It is assumed that individuals start with a $10,000 upfront contribution followed by $100 per month and this amount is increased by 5% every year until the target date when the investments stop and the portfolio also stops evolving.

Figure C5 Range of potential outcomes for three representative VEST portfolios adjusted for initial lump-sum investment of $10,000



	James River (Ages 0-3)	Alleghany(Ages 7-9)	Potomac(Ages 13-15)
Median Outcome	$70,586	$41,481	$22,313
Out-of-Pocket	$45,447	$30,056	$18,570
Best case scenario (0.01% prob)	$117,613	$59,671	$27,564
Worst case Scenario (0.01% Prob)	$45,788	$29,988	$18,083

On average, parents with children aged 0-3 can expect a final balance of $70,774 at the target date when their children are of college-going age. The figure is $41,972 for parents with children whose current age is 7-9 and $22,330 for parents with children aged 13-15.