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**FEBRUARY 14, 2019**

**AGENDA ITEM 4  
INFORMATION ITEM**

**SCHOLARSHARE INVESTMENT BOARD**

*Review of 2019 Asset Allocation Recommendation for ScholarShare 529*

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***Background***

Each year, the ScholarShare Investment Board (SIB or Board) and the program manager, TIAA-CREF Tuition Financing, Inc. (TFI), review the asset allocation of the investment portfolios for ScholarShare 529 (Plan) to determine if any changes are necessary to continue to meet its investment objectives.

For 2019, TFI has provided its “2019 Asset Allocation Recommendation” (Exhibit A), which highlights the analysis completed for their recommendation, which includes the concept of an enrollment-based glide path. The analysis also includes a focus on the probability of outpacing tuition inflation in the age-based portfolios and other compositional elements to the Plan portfolios. In reviewing the potential change to an enrollment-based glide path, TFI outlines the advantages as well as some additional considerations.

SIB’s independent consultants, Pension Consulting Alliance, LLC and AKF Consulting Group, reviewed TFI’s recommendation and have provided their initial analyses (Exhibit B and Exhibit C, respectively) for the Board’s review. The analyses highlight key observations associated with TFI’s recommended change to an enrollment-based glide path, including a review of the prevalence of this structure within the 529 industry, the potential benefits and challenges, and other final considerations for the Board. Due to the complexity associated with this proposed change, it is anticipated that any recommended action will be brought to the Board for review and approval at the SIB meeting tentatively scheduled for April 2019.

***Presenters***

Jeremy Thiessen, Senior Director, TIAA-CREF Tuition Financing, Inc.  
Glenn Friedman, Manager, TIAA-CREF Tuition Financing, Inc.  
Eric White, Managing Director, Pension Consulting Alliance, LLC  
Andrea Feirstein, Managing Director, AKF Consulting Group



# 2019 Asset Allocation Recommendation

Prepared by TIAA-CREF Tuition Financing, Inc.  
February 14, 2019

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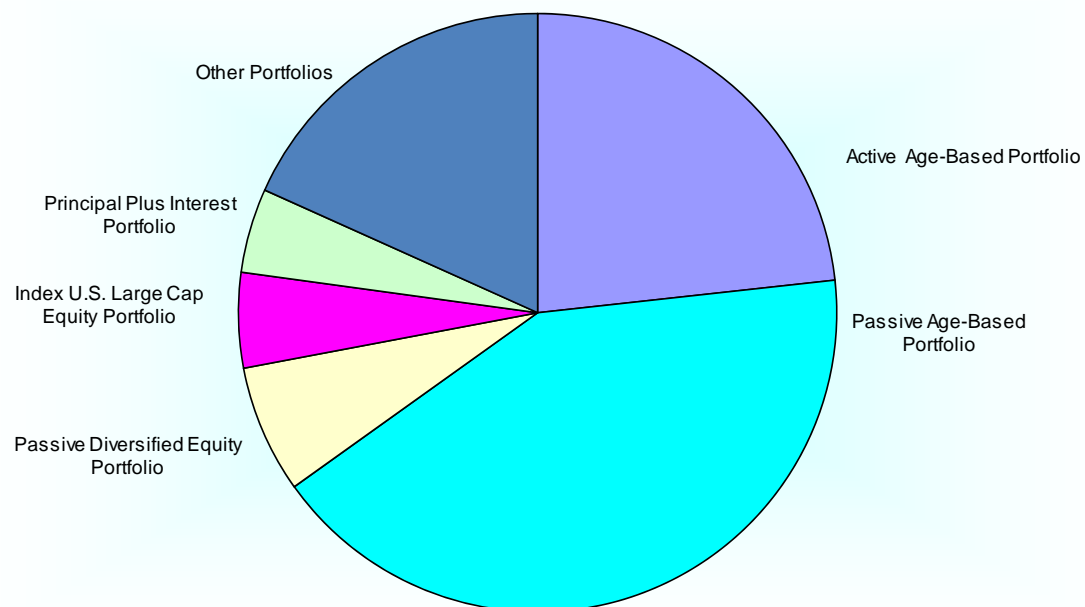


- TFI has completed this year's asset allocation study to evaluate the overall investment strategy for ScholarShare.
- This year's asset allocation study focused on:
  - The concept of an enrollment-based glide path and smoothing effects
  - The simulated probability of outpacing tuition inflation in the Age-Based Allocation Options
  - Other compositional elements to the portfolios
- Based on this review, TFI recommends converting to an enrollment-based glide path structure

# Assets by Investment Portfolio as of 09/30/18



Total Assets: \$8.79 Billion



Portfolio	% of Assets	\$ Millions	Portfolio	% of Assets	\$ Millions
Passive Age-Based Portfolio	41.86%	\$ 3,680	Index U.S. Large Cap Equity Portfolio	5.14%	\$ 452
Active Age-Based Portfolio	23.26%	\$ 2,045	Principal Plus Interest Portfolio	4.56%	\$ 401
Passive Diversified Equity Portfolio	6.91%	\$ 607	Other Portfolios (see below)	18.27%	\$ 1,607

Other Portfolios					
Portfolio	% of Assets	\$ Millions	Portfolio	% of Assets	\$ Millions
Index U.S. Equity Portfolio	4.83%	\$ 425	Index Bond Portfolio	0.64%	\$ 56
Active Diversified Equity Portfolio	3.06%	\$ 269	Passive Moderate Growth Portfolio	0.59%	\$ 52
Social Choice Portfolio	2.06%	\$ 181	Passive Conservative Portfolio	0.45%	\$ 39
Active Growth Portfolio	1.90%	\$ 167	Active Conservative Portfolio	0.39%	\$ 34
Index International Equity Portfolio	1.48%	\$ 130	Active International Equity Portfolio	0.34%	\$ 30
Passive Growth Portfolio	1.45%	\$ 127	Active Diversified Fixed Income Portfolio	0.25%	\$ 22
Active Moderate Growth Portfolio	0.65%	\$ 57	Passive Diversified Fixed Income Portfolio	0.20%	\$ 17

## Summary of Managed Allocation Option

- The Age-Based Option (or Managed Allocation Option) is a popular, highly utilized part of the investment menu for every 529 plan
  - Features a glide path that automatically adjusts asset allocations over time
  - Offers an easy, straightforward way for participants to invest
  - Constructed using various analytical tools, focusing on established techniques for asset allocation development and prospective risk and return
  - Professionally managed, monitored daily, and rebalanced as needed
- Typically comprises 60-70% of plan assets and receives most new contributions
- Used as a default option by less experienced investors

## Current Passive Age-Based Portfolio

Underlying Fund Fee	0.05%	0.06%	0.21%	0.51%	0.12%	0.26%	0.36%	N/A*	
Age of Beneficiary	TIAA-CREF Equity Index Fund	TIAA-CREF International Equity Index Fund	TIAA-CREF Emerging Markets Equity Index Fund	TIAA-CREF Real Estate Securities Fund	TIAA-CREF Bond Index Fund	TIAA-CREF Inflation-Linked Bond Fund	TIAA-CREF High Yield Fund	T-C Life Funding Agreement	Weighted Average Fund Fee**
0 - 4	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%	0.11%
5 - 8	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%	0.00%	0.12%
9 - 10	37.80%	14.40%	3.60%	4.20%	28.00%	8.00%	4.00%	0.00%	0.13%
11 - 12	31.50%	12.00%	3.00%	3.50%	35.00%	10.00%	5.00%	0.00%	0.13%
13 - 14	25.20%	9.60%	2.40%	2.80%	42.00%	12.00%	6.00%	0.00%	0.14%
15	18.90%	7.20%	1.80%	2.10%	42.00%	12.00%	6.00%	10.00%	0.13%
16	15.75%	6.00%	1.50%	1.75%	38.50%	11.00%	5.50%	20.00%	0.12%
17	12.60%	4.80%	1.20%	1.40%	31.50%	9.00%	4.50%	35.00%	0.10%
18 +	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%	0.07%

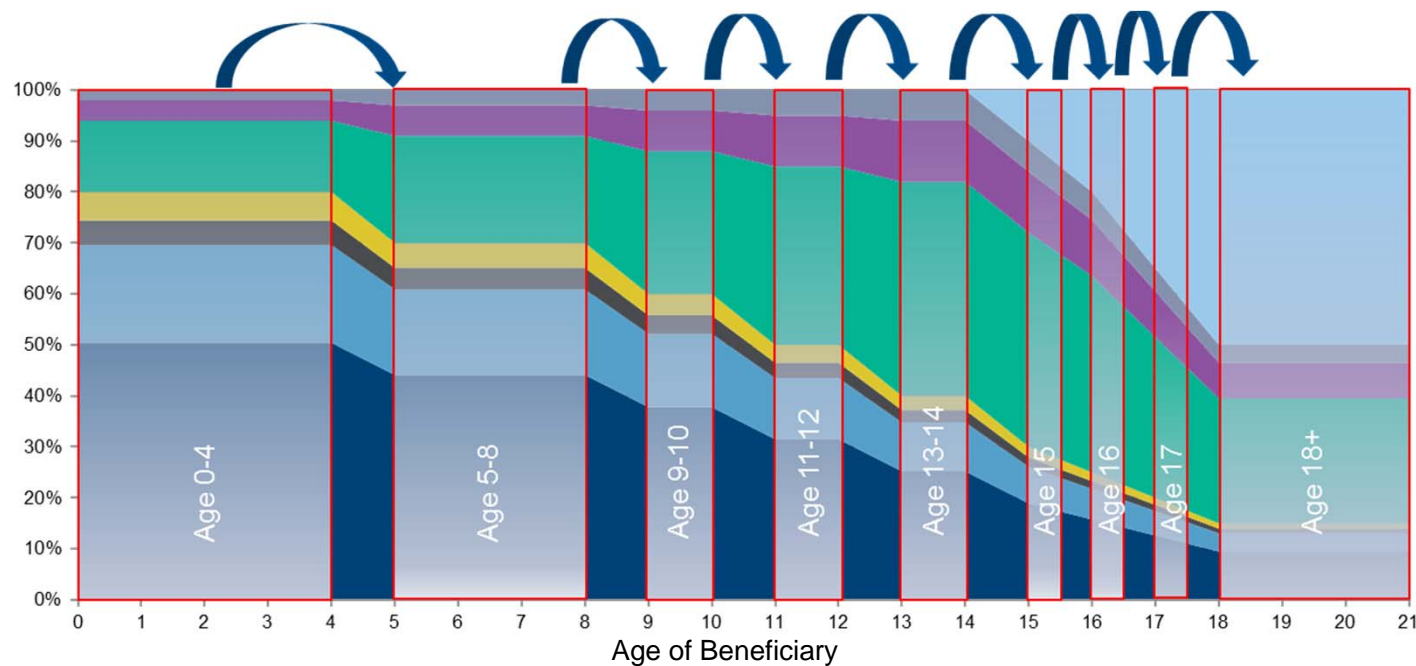
\*The T-C Life Funding Agreement is not a retail mutual fund, and as such, has no explicit fee.

\*\*Includes a 0.00% underlying fund fee for the T-C Life Funding Agreement.



## Managed Allocation Option

- Features nine static age bands, each with a distinct asset allocation that participants utilize at an appropriate stage in their investment horizon
- Investors “roll” from one age band to another on a predetermined schedule based on the beneficiary’s birthday, which requires a series of sales and purchases of units in each portfolio to adjust the asset allocation
- Band rolls occur quarterly, on the 20<sup>th</sup> of March, June, September, and December after the beneficiary turns an age that is a part of a new age band



## Managed Allocation Option

- In thinking of ways to improve the plan's most utilized investment options, there were a few considerations
  - Changing the banding structure or adding more age bands would have the effect of smoothing the glide path, but would still require a series of unit transactions when band rolling, which creates more complexity without many other benefits
  - Underlying funds are routinely monitored and evaluated
    - None are on our internal Watch List
    - Many have had very strong performance and delivered on their respective risk and return objectives, which has helped plan ratings
    - Therefore, no reason to make changes at the fund level
  - Smoothing the glide path by switching to a target date (enrollment date) model allows the option to maintain all the same underlying funds in the same allocations, while providing additional benefits (detailed later)
- The fact that ScholarShare is already very highly regarded creates a high hurdle for any new changes, but this proposal is significant enough that we feel it can truly enhance outcomes

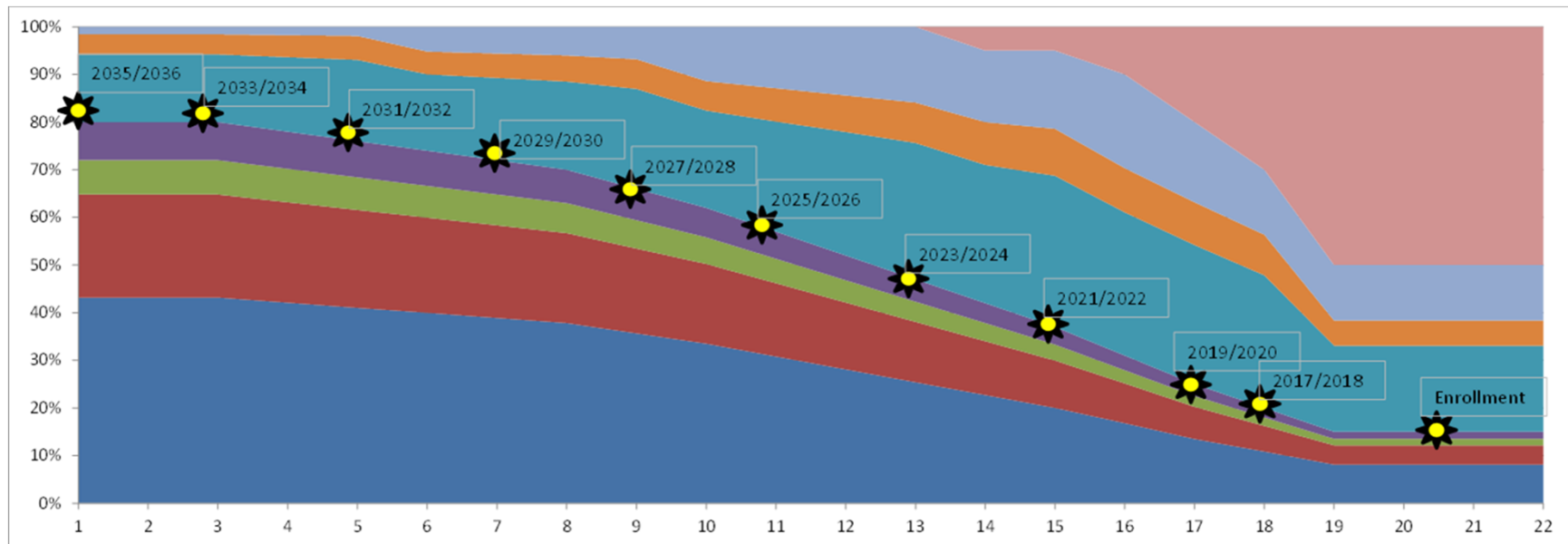


## Proposed Glide Path Structure

- We propose converting the age-based structure to an enrollment-based structure
- Participants would be grouped within an enrollment date fund, or cohort, for example, Enrollment 2035-2036, and remain in this cohort throughout their investment timeframe
- Instead of moving the participant between age bands, the participant will remain in the same enrollment date fund, and the fund will change asset allocations over time
- The glide path for each enrollment date fund is predetermined and would be based on the current glide path, which will minimize any disruption in the participant's investment experience upon conversion to this new structure
- While each model accomplishes similar goals, there are a few additional benefits to using a enrollment date model

## Proposed Glide Path Structure

- Participants stay in the same enrollment date fund as asset allocations shift quarterly
- At the end of the glide path, enrollment date funds will enter the Enrollment stage, which is the final, destination portfolio with a static investment allocation for use during expected payouts
- Below is an illustrative example of the glide path displaying all enrollment date funds at a single point in time



# Current vs. Proposed Passive Glide Paths

## Current Structure

Age of Beneficiary	0 - 4	5 - 8	9 - 10	11 - 12	13 - 14	15	16	17	18 +
TIAA-CREF Equity Index Fund	50.40%	44.10%	37.80%	31.50%	25.20%	18.90%	15.75%	12.60%	9.45%
TIAA-CREF International Equity Index Fund	19.20%	16.80%	14.40%	12.00%	9.60%	7.20%	6.00%	4.80%	3.60%
TIAA-CREF Emerging Markets Equity Index Fund	4.80%	4.20%	3.60%	3.00%	2.40%	1.80%	1.50%	1.20%	0.90%
TIAA-CREF Real Estate Securities Fund	5.60%	4.90%	4.20%	3.50%	2.80%	2.10%	1.75%	1.40%	1.05%
TIAA-CREF Bond Index Fund	14.00%	21.00%	28.00%	35.00%	42.00%	42.00%	38.50%	31.50%	24.50%
TIAA-CREF Inflation-Linked Bond Fund	4.00%	6.00%	8.00%	10.00%	12.00%	12.00%	11.00%	9.00%	7.00%
TIAA-CREF High Yield Fund	2.00%	3.00%	4.00%	5.00%	6.00%	6.00%	5.50%	4.50%	3.50%
TIAA Life Funding Agreement	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%	20.00%	35.00%	50.00%

Asset allocation adjustments occur via band rolls and move participant accounts to the next static portfolio

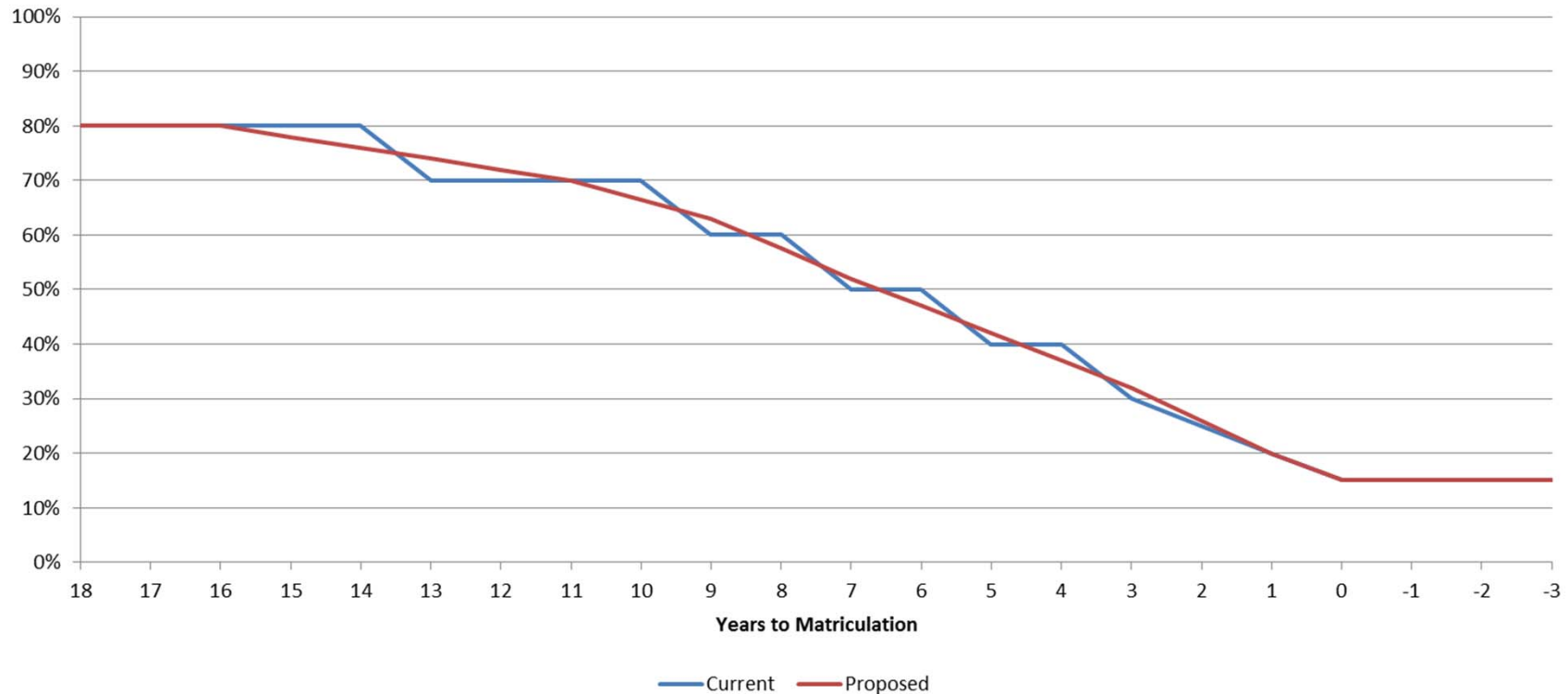
## Proposed Structure: Year 2018\*

Enrollment Year	2037 2038	2035 2036	2033 2034	2031 3032	2029 2030	2027 2028	2025 2026	2023 2024	2021 2022	2019 2020	Enrollment
TIAA-CREF Equity Index Fund	50.40%	50.40%	49.14%	46.62%	44.10%	39.69%	32.76%	26.46%	20.16%	12.60%	9.45%
TIAA-CREF International Equity Index Fund	19.20%	19.20%	18.72%	17.76%	16.80%	15.12%	12.48%	10.08%	7.68%	4.80%	3.60%
TIAA-CREF Emerging Markets Equity Index Fund	4.80%	4.80%	4.68%	4.44%	4.20%	3.78%	3.12%	2.52%	1.92%	1.20%	0.90%
TIAA-CREF Real Estate Securities Fund	5.60%	5.60%	5.46%	5.18%	4.90%	4.41%	3.64%	2.94%	2.24%	1.40%	1.05%
TIAA-CREF Bond Index Fund	14.00%	14.00%	15.40%	18.20%	21.00%	25.90%	33.60%	40.60%	40.60%	35.00%	24.50%
TIAA-CREF Inflation-Linked Bond Fund	4.00%	4.00%	4.40%	5.20%	6.00%	7.40%	9.60%	11.60%	11.60%	10.00%	7.00%
TIAA-CREF High Yield Fund	2.00%	2.00%	2.20%	2.60%	3.00%	3.70%	4.80%	5.80%	5.80%	5.00%	3.50%
TIAA Life Funding Agreement	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%	30.00%	50.00%

Asset allocation adjustments occur more frequently within each enrollment date fund for a more gradual shift

\*Starting allocation in each enrollment date fund.

# Glide Path Equity Comparison



- Because the proposed glide path adjusts asset allocations more frequently in a enrollment date structure, there is a more gradual step down in risk assets

# It's the Journey, Not the Destination

Years to Age	Matriculation	Change	Current	Proposed
0	18			80%
1	17			80%
2	16		80%	80%
3	15			78%
4	14	-10%		76%
5	13			74%
6	12		70%	72%
7	11			70%
8	10	-10%		67%
9	9		60%	63%
10	8			58%
11	7		50%	52%
12	6			47%
13	5		40%	42%
14	4			37%
15	3		30%	32%
16	2		25%	26%
17	1		20%	20%
18	0	-5%		
19	-1		15%	15%
20	-2			
21	-3			

Annotations for equity roll downs:

- Between ages 4 and 5: -2% (consisting of four -0.50% steps)
- Between ages 8 and 9: -4% (consisting of four -1% steps)
- Between ages 10 and 11: -6% (consisting of four -1.5% steps)
- Between ages 14 and 15: -5% (consisting of four -1.25% steps)
- Between ages 17 and 18: -5% (consisting of four -1.25% steps)

- Equity roll downs in the current model, even with nine age bands, can be as high as 10%
- With the proposed progressive model, equity roll downs will occur quarterly, by an amount between 0.50%-1.5%
- A smoother progression is generally favored by external parties like Morningstar, and builds on the internal capabilities of TIAA's work in the retirement target date fund space

## Costs and Other Things to Note

- The proposed smooth glide path was designed by using the current stepped glide path as a template, so
  - there are virtually no changes in asset allocations among underlying funds across the investment horizon
  - **there are no changes to participant costs**
- The operational costs associated with the transition will be absorbed by TFI
- Progressive glide paths are viewed positively by external parties
  - Morningstar recently called it an “industry best practice”
- Other 529 plans that currently use an enrollment date model:

Program Manager	Plan
Fidelity	U. Fund College Investing Plan
	UNIQUE College Investing Plan
	Delaware College Investment Plan
	Fidelity Arizona College Savings Plan
Invesco	CollegeBound 529 Plan (Advisor)
BlackRock	BlackRock CollegeAdvantage 529 (Advisor)
T. Rowe Price	T. Rowe Price College Savings Plan
	Maryland College Investment Plan
Sunday/BNY Mellon	Oregon College Savings Plan

# Portfolio Mapping

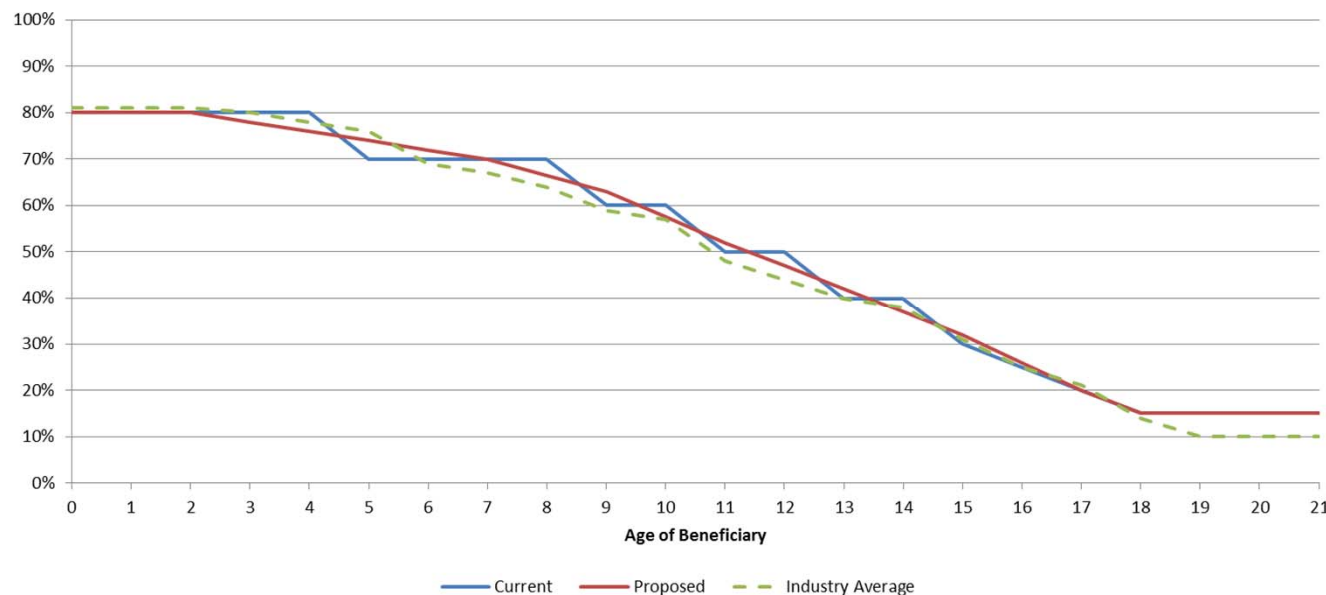
- Participants will be mapped to the enrollment date fund that matches the age of the beneficiary

Current ↓	Proposed ↓
Age-Based Portfolio	Enrollment Date Fund
Ages 0-4	2037 2038 (-1, 0)
	2035 2036 (1, 2)
	2033 2034 (3, 4)
Ages 5-8	2031 2032 (5, 6)
	2029 2030 (7, 8)
Ages 9-10	2027 2028 (9, 10)
Ages 11-12	2025 2026 (11, 12)
Ages 13-14	2023 2024 (13, 14)
Ages 15	2021 2022 (15, 16)
Ages 16	
Ages 17	2019 2020 (17)
Ages 18+	Enrollment (18 +)



## Benefit #1: Smoother Transitions

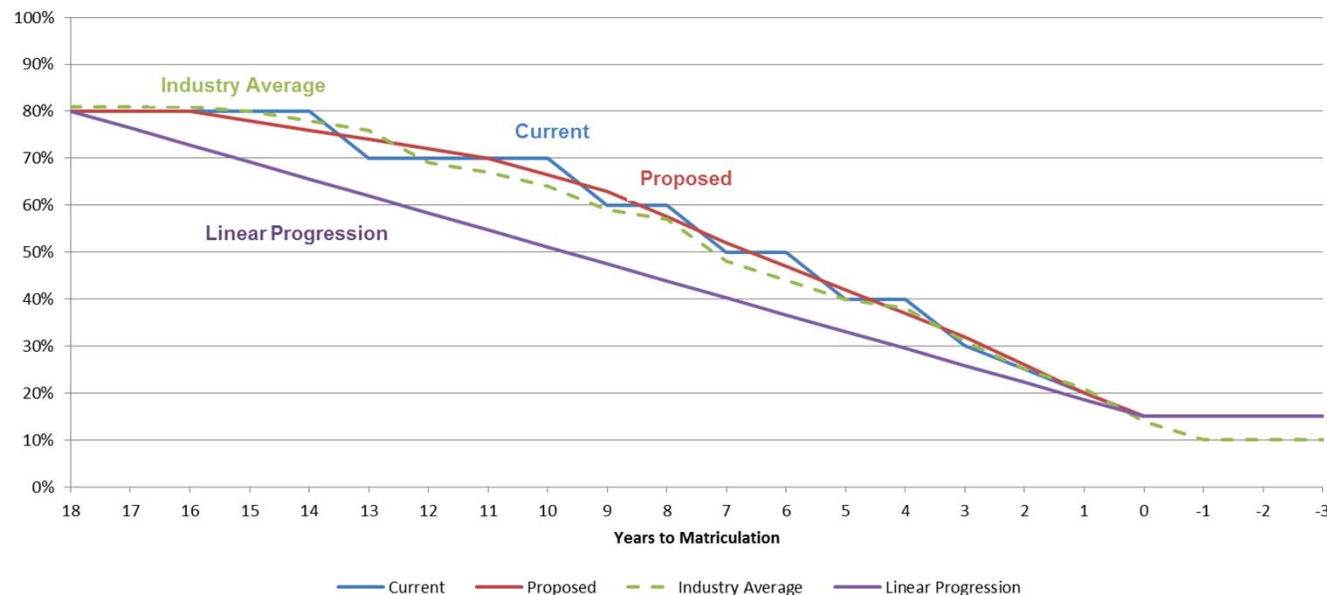
- The proposed framework builds on the nine age band model and rebalances more frequently and in smaller amounts, reducing the timing risk associated with making allocation changes to equity
- This adds another layer of risk mitigation that may improve investor results during periods of extreme market events



By smoothing the transitions, a similar risk profile is maintained across the glide path so as to not interrupt or significantly change overall investor experience

## Benefit #2: Not Just Smoothing, Smart Smoothing

- One of the concepts of a nine band approach is the idea of staying aggressive in the early part of the glide path, with limited changes in asset allocations, and then utilizing age bands in a smart way to gradually reduce risk when it counts
- The proposed glide path was created with this in mind and achieves this goal, but also smooths the progression through our **IntelliSmooth** framework

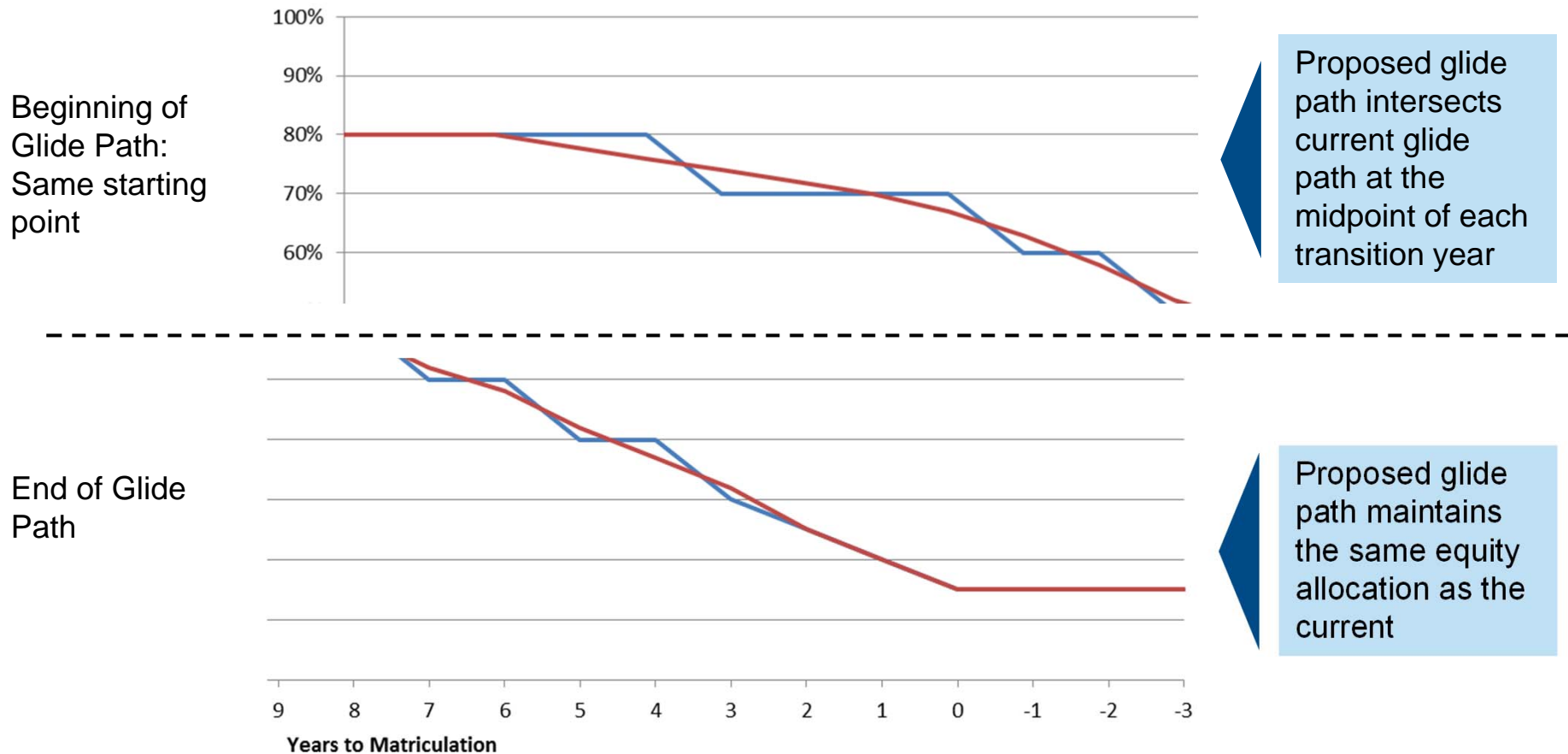


A linear or naïve progression across the glide path would also have a smoothing effect and is mathematically simpler, but creates a more conservative risk profile that may not deliver on savings objectives

# IntelliSmooth: Breaking Down the Smoothing Process

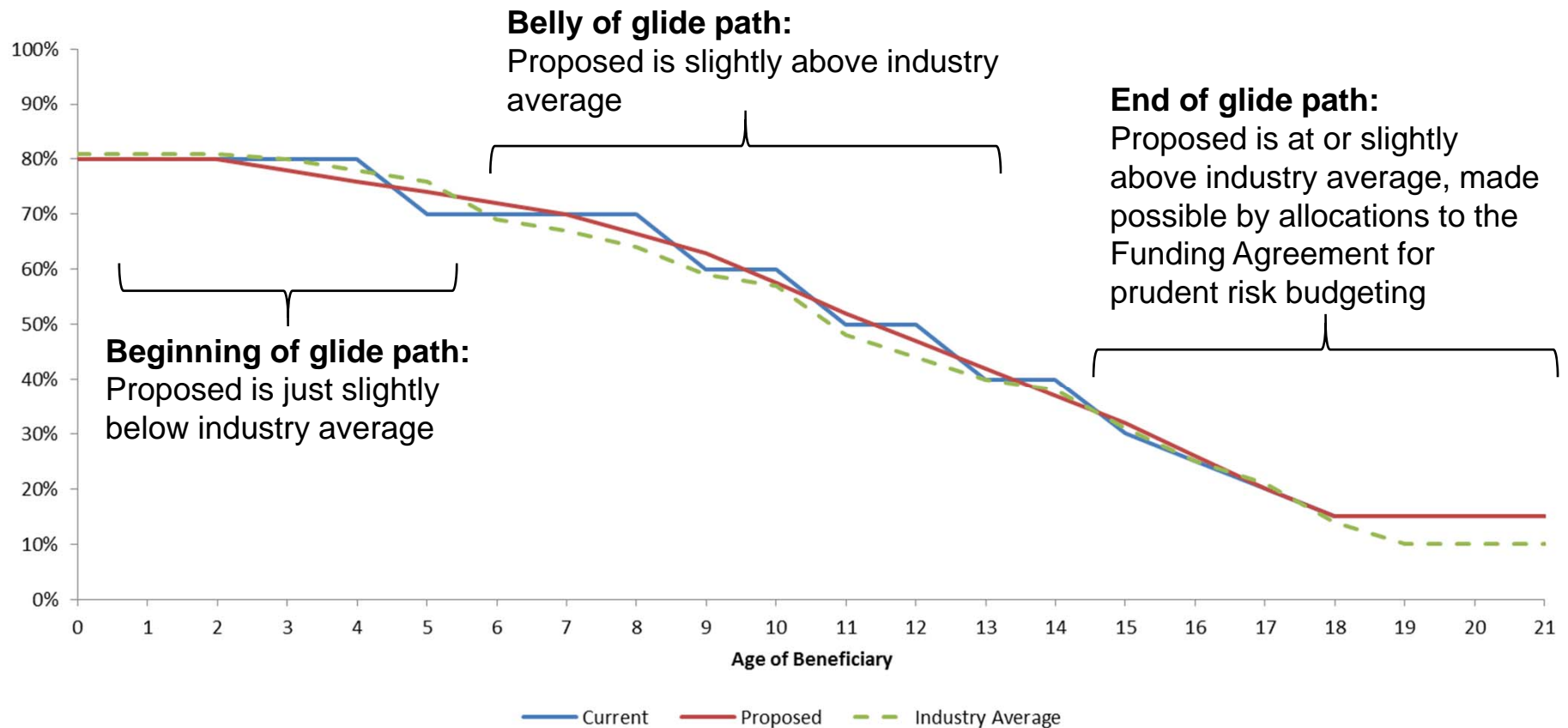


- Our IntelliSmooth framework builds upon the nine age-band structure to create a glide path with progressive transitions



- **End Result:** No change to risk profile across the time horizon

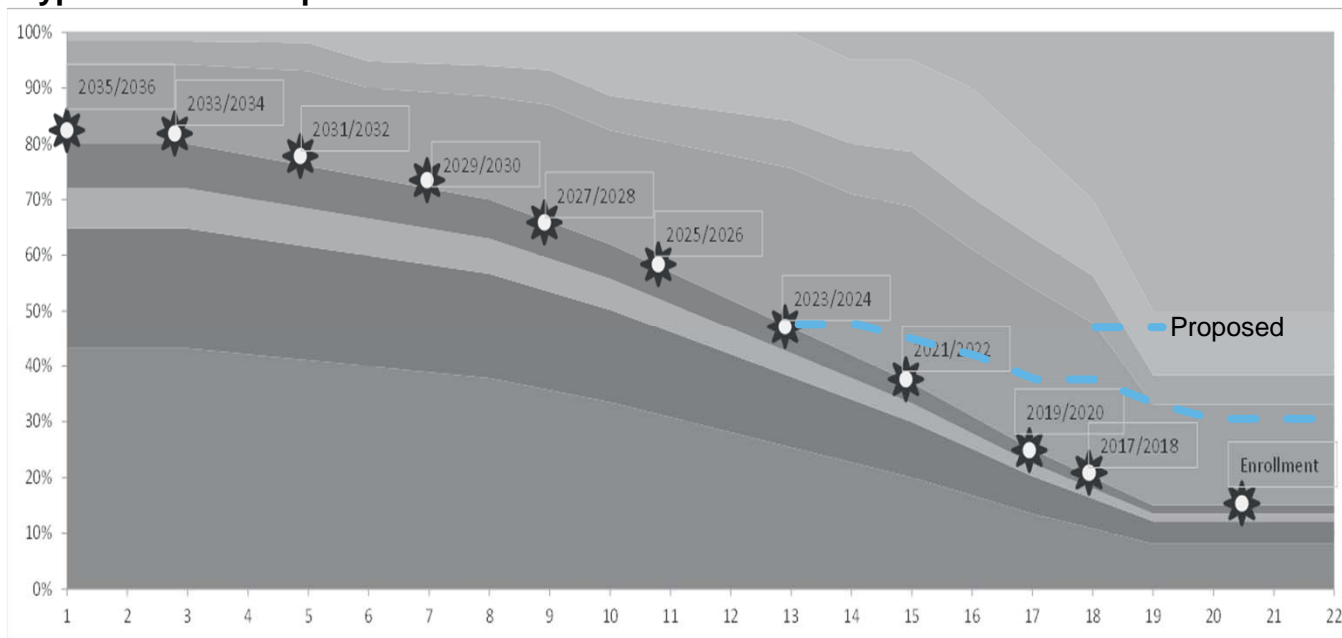
# Proposed Glide Path Equity vs. Industry Average



## Benefit # 3: Flexibility in Glide Path Shape

- An enrollment date structure separates the investor’s portfolio from the rigidity of the age band asset allocation.
- This allows additional flexibility in the glide path, which may be beneficial for adjusting the shape of the glide path down the road or customizing specific enrollment date funds
  - There are no immediate plans to create a different glide path for a specific Enrollment Date Fund or group of Enrollment Date Funds, but the option would be available for consideration

### Hypothetical Example

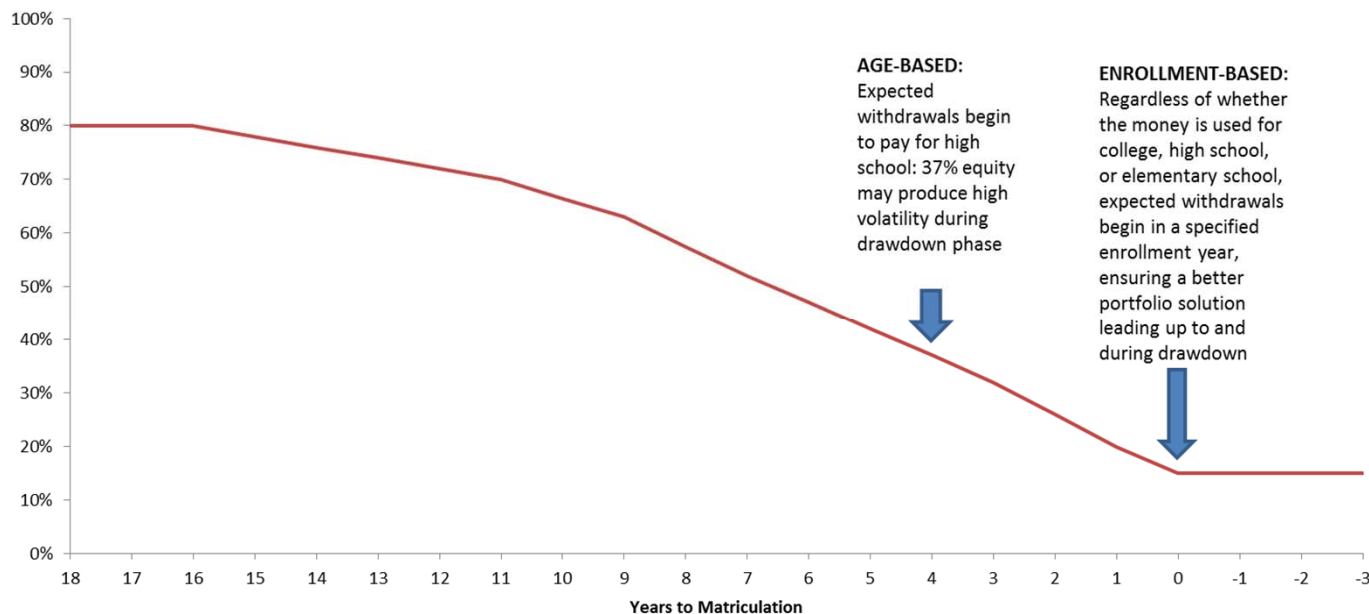


If there are future asset allocation changes (dashed blue line), they can be implemented more efficiently, and potentially customized by enrollment date fund for enhanced results

## Benefit # 4: K-12 Accommodation

- An age-based glide path may preselect an overly aggressive portfolio if the portfolio is to be used before college
- An enrollment-based glide path aligns all timelines for expected withdrawals to ensure a single, enrollment portfolio with more appropriate risk and return characteristics
- While California does not currently permit state tax benefits for withdrawals for K-12 expenses, an enrollment-based structure would be ready for changes to state law

### Illustrative Example



## Benefit # 5: Improved Performance Reporting

- The length of time that a participant currently spends in an age band can be as short as a single year, though standard performance reporting periods are 1Y, 3Y, 5Y, 10Y, Since Inception.
- Reporting performance for each enrollment date fund would specify the returns for the investor's portfolio, taking into account changes in asset allocations down the glide path

### Illustrative Example Current Reporting

Investment Portfolios	Average Annual Total Return					
	3 Month	YTD	1 Year	3 Year	5 Year	Since Inception
Passive Age-Based Portfolio 0-4	1.77%	0.80%	9.64%	8.10%	9.32%	10.13%
Blended Benchmark Returns	1.82%	0.69%	9.47%	8.07%	9.26%	10.13%
Passive Age-Based Portfolio 5-8	1.47%	0.45%	8.52%	7.42%	8.51%	9.19%
Blended Benchmark Returns	1.60%	0.47%	8.29%	7.33%	8.41%	9.15%
Passive Age-Based Portfolio 9-10	1.32%	0.30%	7.32%	6.62%	7.63%	8.18%
Blended Benchmark Returns	1.38%	0.26%	7.12%	6.59%	7.56%	8.17%
Passive Age-Based Portfolio 11-12	1.22%	0.19%	6.05%	5.74%	6.67%	7.08%
Blended Benchmark Returns	1.16%	0.04%	5.95%	5.83%	6.71%	7.18%
Passive Age-Based Portfolio 13-14	0.95%	-0.20%	4.80%	5.00%	5.83%	6.11%
Blended Benchmark Returns	0.94%	-0.19%	4.79%	5.08%	5.86%	6.20%
Passive Age-Based Portfolio 15	0.80%	-0.29%	3.88%	4.24%	4.92%	5.08%
Blended Benchmark Returns	0.76%	-0.23%	3.75%	4.18%	4.79%	5.01%
Passive Age-Based Portfolio 16	0.68%	-0.15%	3.48%	3.81%	4.37%	4.48%
Blended Benchmark Returns	0.69%	-0.15%	3.29%	3.66%	4.16%	4.32%

### Proposed Reporting

Investment Portfolios	Average Annual Total Return					
	3 Month	YTD	1 Year	3 Year	5 Year	Since Inception
Enrollment 2037-2038	1.77%	0.80%	9.64%	8.10%	9.32%	10.13%
Blended Benchmark Returns	1.82%	0.69%	9.47%	8.07%	9.26%	10.13%
Enrollment 2035-2036	1.47%	0.45%	8.52%	7.42%	8.51%	9.19%
Blended Benchmark Returns	1.60%	0.47%	8.29%	7.33%	8.41%	9.15%
Enrollment 2033-2034	1.32%	0.30%	7.32%	6.62%	7.63%	8.18%
Blended Benchmark Returns	1.38%	0.26%	7.12%	6.59%	7.56%	8.17%
Enrollment 2031-2032	1.22%	0.19%	6.05%	5.74%	6.67%	7.08%
Blended Benchmark Returns	1.16%	0.04%	5.95%	5.83%	6.71%	7.18%
Enrollment 2029-2030	0.95%	-0.20%	4.80%	5.00%	5.83%	6.11%
Blended Benchmark Returns	0.94%	-0.19%	4.79%	5.08%	5.86%	6.20%
Enrollment 2027-2028	0.80%	-0.29%	3.88%	4.24%	4.92%	5.08%
Blended Benchmark Returns	0.76%	-0.23%	3.75%	4.18%	4.79%	5.01%
Enrollment 2023-2024	0.68%	-0.15%	3.48%	3.81%	4.37%	4.48%
Blended Benchmark Returns	0.69%	-0.15%	3.29%	3.66%	4.16%	4.32%



- Advantages to an enrollment date glide path
  - Smoother transitions
  - Flexibility in glide path shape
  - K-12 accommodation
  - Improved performance reporting
- Considerations
  - Changes to the Managed Allocation Option affect the largest number of participants in ScholarShare
  - Structural changes to the underlying foundation of an investment option require planning and operational oversight
- **Overall, we favor the move to an enrollment-based structure, and if approved, would like to implement it in 2019**

# Enrollment Date Glide Path Target Project Timeline



Enrollment Based Transition Project Timeline		
	Start Date	Target Completion Date (Target is 6-8 months from approval)
<b>Board Review and Approval to Implement</b>	4/4/19	10/14/19
<b>Investments</b>		
Proposed Investment Lineup Presented to Board for Review and Approval	4/4/19	4/4/19
Investment Mapping Strategy & Planning Finalized	4/4/19	5/1/19
Investment Mapping & Execution	10/11/19	10/14/19
<b>Recordkeeping/Operations</b>		
Custody Operations / Fund Accounting / Reporting	4/4/19	9/1/19
Set-up (Participant Web Portal & Operational Readiness)	4/4/19	9/15/19
Testing	9/15/19	10/11/19
<b>Plan Disclosure Booklet</b>		
Plan Disclosure Booklet Prepared, Approved, Released	4/4/19	10/15/19
<b>Marketing</b>		
Account Owner (AO) Communication Plan Finalized	4/4/19	5/1/19
Communication Plan Prepared and Finalized (changes to FAQs for account owners, web and call center)	4/4/19	5/1/19
60 Day AO Communication Distributed by Mail/Email	4/4/19	8/15/19
30 Day AO Communication Distributed by Mail/Email	4/4/19	9/15/19
Online NASU and secure website update	4/4/19	10/14/19
Public website update	4/4/19	10/14/19
Prospect marketing materials and collateral update	4/4/19	10/14/19
<b>Enrollment Based Portfolio Go-live Date</b>		<b>Target 6-8 months from approval</b>

# Appendix

# Current and Proposed Passive Age-Based Portfolio: Year by Year



## Proposed

Target Date Fund	2037 2038	2035 3036	2033 3034	2031 2032	2029 2030	2027 2028	2025 2026	2023 2024	2021 2022	2019 2020	Enrollment											
Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Years to Matriculation	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3
TIAA-CREF Equity Index Fund	50.40%	50.40%	50.40%	49.14%	47.88%	46.62%	45.36%	44.10%	41.90%	39.69%	36.23%	32.76%	29.61%	26.46%	23.31%	20.16%	16.38%	12.60%	9.45%	9.45%	9.45%	9.45%
TIAA-CREF International Equity Index Fund	19.20%	19.20%	19.20%	18.72%	18.24%	17.76%	17.28%	16.80%	15.96%	15.12%	13.80%	12.48%	11.28%	10.08%	8.88%	7.68%	6.24%	4.80%	3.60%	3.60%	3.60%	3.60%
TIAA-CREF Emerging Markets Equity Index Fund	4.80%	4.80%	4.80%	4.68%	4.56%	4.44%	4.32%	4.20%	3.99%	3.78%	3.45%	3.12%	2.82%	2.52%	2.22%	1.92%	1.56%	1.20%	0.90%	0.90%	0.90%	0.90%
TIAA-CREF Real Estate Securities Fund	5.60%	5.60%	5.60%	5.46%	5.32%	5.18%	5.04%	4.90%	4.66%	4.41%	4.03%	3.64%	3.29%	2.94%	2.59%	2.24%	1.82%	1.40%	1.05%	1.05%	1.05%	1.05%
TIAA-CREF Bond Index Fund	14.00%	14.00%	14.00%	15.40%	16.80%	18.20%	19.60%	21.00%	23.45%	25.90%	29.75%	33.60%	37.10%	40.60%	40.60%	40.60%	37.80%	35.00%	24.50%	24.50%	24.50%	24.50%
TIAA-CREF Inflation-Linked Bond Fund	4.00%	4.00%	4.00%	4.40%	4.80%	5.20%	5.60%	6.00%	6.70%	7.40%	8.50%	9.60%	10.60%	11.60%	11.60%	11.60%	10.80%	10.00%	7.00%	7.00%	7.00%	7.00%
TIAA-CREF High Yield Fund	2.00%	2.00%	2.00%	2.20%	2.40%	2.60%	2.80%	3.00%	3.35%	3.70%	4.25%	4.80%	5.30%	5.80%	5.80%	5.80%	5.40%	5.00%	3.50%	3.50%	3.50%	3.50%
TIAA Life Funding Agreement	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.00%	10.00%	20.00%	30.00%	50.00%	50.00%	50.00%	50.00%

## Current

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
TIAA-CREF Equity Index Fund	50.40%	50.40%	50.40%	50.40%	50.40%	44.10%	44.10%	44.10%	44.10%	37.80%	37.80%	31.50%	31.50%	25.20%	25.20%	18.90%	15.75%	12.60%	9.45%	9.45%	9.45%	9.45%
TIAA-CREF International Equity Index Fund	19.20%	19.20%	19.20%	19.20%	19.20%	16.80%	16.80%	16.80%	16.80%	14.40%	14.40%	12.00%	12.00%	9.60%	9.60%	7.20%	6.00%	4.80%	3.60%	3.60%	3.60%	3.60%
TIAA-CREF Emerging Markets Equity Index Fund	4.80%	4.80%	4.80%	4.80%	4.80%	4.20%	4.20%	4.20%	4.20%	3.60%	3.60%	3.00%	3.00%	2.40%	2.40%	1.80%	1.50%	1.20%	0.90%	0.90%	0.90%	0.90%
TIAA-CREF Real Estate Securities Fund	5.60%	5.60%	5.60%	5.60%	5.60%	4.90%	4.90%	4.90%	4.90%	4.20%	4.20%	3.50%	3.50%	2.80%	2.80%	2.10%	1.75%	1.40%	1.05%	1.05%	1.05%	1.05%
TIAA-CREF Bond Index Fund	14.00%	14.00%	14.00%	14.00%	14.00%	21.00%	21.00%	21.00%	21.00%	28.00%	28.00%	35.00%	35.00%	42.00%	42.00%	42.00%	38.50%	31.50%	24.50%	24.50%	24.50%	24.50%
TIAA-CREF Inflation-Linked Bond Fund	4.00%	4.00%	4.00%	4.00%	4.00%	6.00%	6.00%	6.00%	6.00%	8.00%	8.00%	10.00%	10.00%	12.00%	12.00%	12.00%	11.00%	9.00%	7.00%	7.00%	7.00%	7.00%
TIAA-CREF High Yield Fund	2.00%	2.00%	2.00%	2.00%	2.00%	3.00%	3.00%	3.00%	3.00%	4.00%	4.00%	5.00%	5.00%	6.00%	6.00%	6.00%	5.50%	4.50%	3.50%	3.50%	3.50%	3.50%
TIAA Life Funding Agreement	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%	20.00%	35.00%	50.00%	50.00%	50.00%	50.00%

# Current and Recommended Active Age-Based Portfolio



## Proposed

Target Date Fund	2037 2038	2035 3036	2033 3034	2031 2032	2029 2030	2027 2028	2025 2026	2023 2024	2021 2022	2019 2020	Enrollment											
Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Years to Matriculation	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3
T. Rowe Price Instl Large Cap Growth Fund	22.68%	22.68%	22.68%	22.11%	21.55%	20.98%	20.41%	19.85%	18.85%	17.86%	16.30%	14.74%	13.32%	11.91%	10.49%	9.07%	7.37%	5.67%	4.25%	4.25%	4.25%	4.25%
T. Rowe Price Instl Large Cap Value Fund	22.68%	22.68%	22.68%	22.11%	21.55%	20.98%	20.41%	19.85%	18.85%	17.86%	16.30%	14.74%	13.32%	11.91%	10.49%	9.07%	7.37%	5.67%	4.25%	4.25%	4.25%	4.25%
TIAA-CREF Small Cap Equity Fund	5.04%	5.04%	5.04%	4.91%	4.79%	4.66%	4.54%	4.41%	4.19%	3.97%	3.62%	3.28%	2.96%	2.65%	2.33%	2.02%	1.64%	1.26%	0.95%	0.95%	0.95%	0.95%
TIAA-CREF Real Estate Securities Fund	5.60%	5.60%	5.60%	5.46%	5.32%	5.18%	5.04%	4.90%	4.66%	4.41%	4.03%	3.64%	3.29%	2.94%	2.59%	2.24%	1.82%	1.40%	1.05%	1.05%	1.05%	1.05%
DFA Large Cap Intl Portfolio	19.20%	19.200%	19.200%	18.7200%	18.2400%	17.76%	17.28%	16.80%	15.96%	15.12%	13.80%	12.48%	11.28%	10.08%	8.88%	7.68%	6.24%	4.80%	3.60%	3.60%	3.60%	3.60%
DFA Emerging Markets Core Equity I Portfolio	4.80%	4.800%	4.800%	4.6800%	4.5600%	4.44%	4.32%	4.20%	3.99%	3.78%	3.45%	3.12%	2.82%	2.52%	2.22%	1.92%	1.56%	1.20%	0.90%	0.90%	0.90%	0.90%
MetWest Total Return Bond Fund	10.00%	10.00%	10.00%	11.00%	12.00%	13.00%	14.00%	15.00%	16.75%	18.50%	21.25%	24.00%	26.50%	29.00%	29.00%	29.00%	27.00%	25.00%	17.50%	17.50%	17.50%	17.50%
PIMCO Real Return Instl Fund	4.00%	4.00%	4.00%	4.40%	4.80%	5.20%	5.60%	6.00%	6.70%	7.40%	8.50%	9.60%	10.60%	11.60%	11.60%	11.60%	10.80%	10.00%	7.00%	7.00%	7.00%	7.00%
PIMCO Income Instl Fund	4.00%	4.00%	4.00%	4.40%	4.80%	5.20%	5.60%	6.00%	6.70%	7.40%	8.50%	9.60%	10.60%	11.60%	11.60%	11.60%	10.80%	10.00%	7.00%	7.00%	7.00%	7.00%
T. Rowe Price Instl Floating Rate Fund	2.00%	2.00%	2.00%	2.20%	2.40%	2.60%	2.80%	3.00%	3.35%	3.70%	4.25%	4.80%	5.30%	5.80%	5.80%	5.80%	5.40%	5.00%	3.50%	3.50%	3.50%	3.50%
T-C Life Funding Agreement	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.00%	10.00%	20.00%	30.00%	50.00%	50.00%	50.00%	50.00%

## Current

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
T. Rowe Price Instl Large Cap Growth Fund	22.68%	22.68%	22.68%	22.68%	22.68%	19.85%	19.85%	19.85%	19.85%	17.01%	17.01%	14.18%	14.18%	11.34%	11.34%	8.51%	7.09%	5.67%	4.25%	4.25%	4.25%	4.25%
T. Rowe Price Instl Large Cap Value Fund	22.68%	22.68%	22.68%	22.68%	22.68%	19.85%	19.85%	19.85%	19.85%	17.01%	17.01%	14.18%	14.18%	11.34%	11.34%	8.51%	7.09%	5.67%	4.25%	4.25%	4.25%	4.25%
TIAA-CREF Small Cap Equity Fund	5.04%	5.04%	5.04%	5.04%	5.04%	4.40%	4.40%	4.40%	4.40%	3.78%	3.78%	3.14%	3.14%	2.52%	2.52%	1.88%	1.57%	1.26%	0.95%	0.95%	0.95%	0.95%
TIAA-CREF Real Estate Securities Fund	5.60%	5.60%	5.60%	5.60%	5.60%	4.90%	4.90%	4.90%	4.90%	4.20%	4.20%	3.50%	3.50%	2.80%	2.80%	2.10%	1.75%	1.40%	1.05%	1.05%	1.05%	1.05%
DFA Large Cap Intl Portfolio	19.20%	19.20%	19.20%	19.20%	19.20%	16.80%	16.80%	16.80%	16.80%	14.40%	14.40%	12.00%	12.00%	9.60%	9.60%	7.20%	6.00%	4.80%	3.60%	3.60%	3.60%	3.60%
DFA Emerging Markets Core Equity I Portfolio	4.80%	4.80%	4.80%	4.80%	4.80%	4.20%	4.20%	4.20%	4.20%	3.60%	3.60%	3.00%	3.00%	2.40%	2.40%	1.80%	1.50%	1.20%	0.90%	0.90%	0.90%	0.90%
MetWest Total Return Bond Fund	10.00%	10.00%	10.00%	10.00%	10.00%	15.00%	15.00%	15.00%	15.00%	20.00%	20.00%	25.00%	25.00%	30.00%	30.00%	30.00%	27.50%	22.50%	17.50%	17.50%	17.50%	17.50%
PIMCO Real Return Instl Fund	4.00%	4.00%	4.00%	4.00%	4.00%	6.00%	6.00%	6.00%	6.00%	8.00%	8.00%	10.00%	10.00%	12.00%	12.00%	12.00%	11.00%	9.00%	7.00%	7.00%	7.00%	7.00%
PIMCO Income Instl Fund	4.00%	4.00%	4.00%	4.00%	4.00%	6.00%	6.00%	6.00%	6.00%	8.00%	8.00%	10.00%	10.00%	12.00%	12.00%	12.00%	11.00%	9.00%	7.00%	7.00%	7.00%	7.00%
T. Rowe Price Instl Floating Rate Fund	2.00%	2.00%	2.00%	2.00%	2.00%	3.00%	3.00%	3.00%	3.00%	4.00%	4.00%	5.00%	5.00%	6.00%	6.00%	6.00%	5.50%	4.50%	3.50%	3.50%	3.50%	3.50%
T-C Life Funding Agreement	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%	20.00%	35.00%	50.00%	50.00%	50.00%	50.00%

# Passive Multi-Fund and Single-Fund Portfolios



Underlying Fund Fee	0.05%	0.06%	0.21%	0.51%	0.12%	0.26%	0.36%	N/A*	
Age of Beneficiary	TIAA-CREF Equity Index Fund	TIAA-CREF International Equity Index Fund	TIAA-CREF Emerging Markets Equity Index Fund	TIAA-CREF Real Estate Securities Fund	TIAA-CREF Bond Index Fund	TIAA-CREF Inflation-Linked Bond Fund	TIAA-CREF High Yield Fund	T-C Life Funding Agreement	Weighted Average Fund Fee**
Passive Diversified Equity Portfolio	63.00%	24.00%	6.00%	7.00%					0.09%
Passive Growth Portfolio	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%		0.12%
Passive Moderate Growth Portfolio	25.20%	9.60%	2.40%	2.80%	42.00%	12.00%	6.00%		0.14%
Passive Diversified Fixed Income Portfolio					70.00%	20.00%	10.00%		0.17%
Passive Conservative Portfolio					35.00%	10.00%	5.00%	50.00%	0.09%
Index International Equity Portfolio		80.00%	20.00%						0.09%

## Passive Single Fund Investment Portfolios

Investment Portfolios	Percent Allocation	Underlying Mutual Fund	Fund Fee
Index Bond Portfolio	100.00%	TIAA-CREF Bond Index Fund	0.12%
Index U.S. Large Cap Equity Portfolio	100.00%	TIAA-CREF S&P 500 Index Fund	0.06%
Index U.S. Equity Portfolio	100.00%	TIAA-CREF Equity Index Fund	0.05%

\*The T-C Life Funding Agreement is not a retail mutual fund, and as such, has no explicit fee.

\*\*Includes a 0.00% underlying fund fee for the T-C Life Funding Agreement.

# Active Multi-Fund and Single-Fund Portfolios



Underlying Fund Fee	0.56%	0.57%	0.41%	0.51%	0.24%	0.53%	0.37%	0.45%	0.50%	0.57%	N/A*	
Active Age-Based Portfolio Age of Beneficiary	T. Rowe Price Instl Large Cap Growth Fund	T. Rowe Price Instl Large Cap Value Fund	TIAA-CREF Small Cap Equity Fund	TIAA-CREF Real Estate Securities Fund	DFA Large Cap International Portfolio	DFA Emerging Markets Core Equity I Portfolio	MetWest Total Return Bond Fund	PIMCO Real Return Instl Fund	PIMCO Income Instl Fund	T. Rowe Price Instl Floating Rate Fund	T-C Life Funding Agreement	Weighted Average Fund Fee**
Active Diversified Equity Portfolio	28.35%	28.35%	6.30%	7.00%	24.00%	6.00%						0.47%
Active Growth Portfolio	19.85%	19.85%	4.40%	4.90%	16.80%	4.20%	15.00%	6.00%	6.00%	3.00%		0.46%
Active Moderate Growth Portfolio	11.34%	11.34%	2.52%	2.80%	9.60%	2.40%	30.00%	12.00%	12.00%	6.00%		0.45%
Active Diversified Fixed Income Portfolio							50.00%	20.00%	20.00%	10.00%		0.43%
Active Conservative Portfolio							25.00%	10.00%	10.00%	5.00%	50.00%	0.22%
Active International Equity Portfolio					80.00%	20.00%						0.30%

## Active Single Fund Investment Portfolios

Investment Portfolios	Percent Allocation	Underlying Mutual Fund	Fund Fee
Social Choice Portfolio	100.00%	TIAA-CREF Social Choice Equity Fund	0.18%
Principal Plus Interest Portfolio	100.00%	TIAA-CREF Life Co. Funding Agreement	N/A*

\*The T-C Life Funding Agreement is not a retail mutual fund, and as such, has no explicit fee.

\*\*Includes a 0.00% underlying fund fee for the T-C Life Funding Agreement.



# The Importance of Diversification: Annual Returns (%)

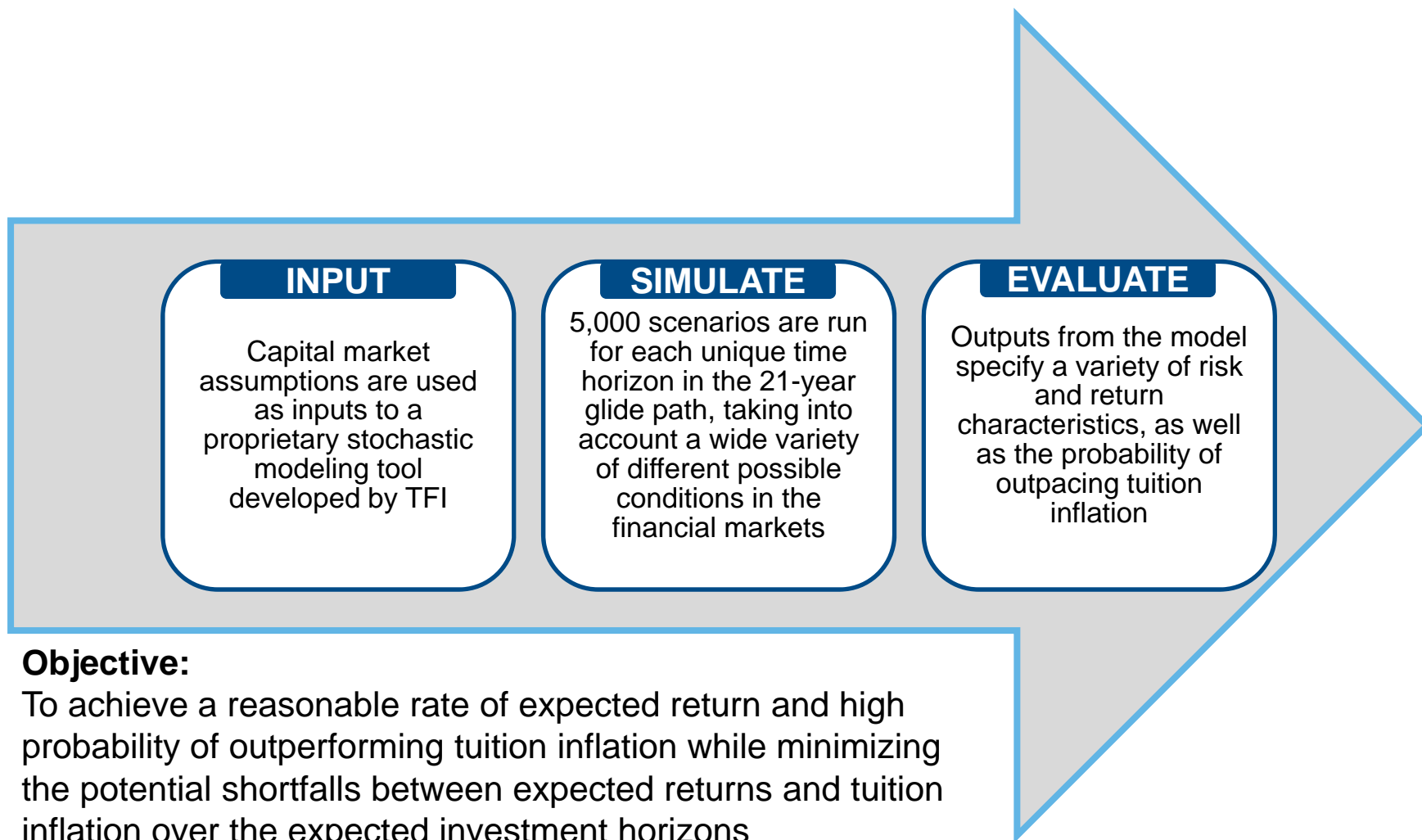


	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Highest	10.9 Global Bond	78.5 EM Stocks	27.9 Real Estate	13.6 TIPS	19.7 Real Estate	33.6 US Stocks	28.0 Real Estate	2.8 Real Estate	14.8 HY Bond	37.3 EM Stocks
	5.2 Bond	52.5 Bank Loan	18.9 EM Stocks	8.3 Real Estate	18.2 EM Stocks	22.8 Intl Stocks	12.6 US Stocks	0.7 ST Bond	12.7 US Stocks	25.0 Intl Stocks
	5.0 ST Bond	46.0 HY Bond	16.9 US Stocks	7.8 Bond	17.3 Intl Stocks	6.3 HY Bond	6.0 Bond	0.6 Bond	11.2 EM Stocks	21.1 US Stocks
	2.0 MM	31.8 Intl Stocks	14.3 HY Bond	6.4 Global Bond	16.4 US Stocks	5.4 Bank Loan	3.6 TIPS	0.5 US Stocks	10.4 Bank Loan	8.7 Real Estate
	-2.4 TIPS	28.3 US Stocks	10.4 Bank Loan	5.4 HY Bond	14.6 HY Bond	2.9 Real Estate	3.5 HY Bond	0.1 Bank Loan	8.6 Real Estate	7.5 Global Bond
	-23.2 HY Bond	28.0 Real Estate	7.8 Intl Stocks	1.6 ST Bond	9.8 Bank Loan	0.6 ST Bond	1.8 Bank Loan	0.0 MM	4.7 TIPS	7.0 HY Bond
	-29.3 Bank Loan	11.4 TIPS	6.5 Bond	1.5 Bank Loan	7.0 TIPS	0.0 MM	0.8 ST Bond	-0.8 Intl Stocks	2.7 Bond	4.3 Bank Loan
	-37.3 US Stocks	5.9 Bond	6.3 TIPS	1.0 US Stocks	4.2 Bond	-2.0 Bond	0.0 MM	-1.4 TIPS	1.6 Global Bond	3.5 Bond
	-37.7 Real Estate	3.8 ST Bond	5.2 Global Bond	0.0 MM	1.6 Global Bond	-2.6 EM Stocks	-0.5 Global Bond	-2.8 HY Bond	1.3 ST Bond	3.0 TIPS
	-43.4 Intl Stocks	2.6 Global Bond	2.8 ST Bond	-12.1 Intl Stocks	1.3 ST Bond	-4.0 Global Bond	-2.2 EM Stocks	-3.6 Global Bond	1.0 Intl Stocks	0.8 ST Bond
Lowest	-53.3 EM Stocks	0.2 MM	0.0 MM	-18.4 EM Stocks	0.0 MM	-8.6 TIPS	-4.9 Intl Stocks	-14.9 EM Stocks	0.1 MM	0.5 MM

## The Importance of Diversification: Notes



Bond	uses the Bloomberg Barclays US Aggregate Bond Index, which measures the performance of the U.S. investment-grade, fixed-rate bond market, including government and credit securities, agency mortgage pass through securities, asset-backed securities and commercial mortgage-backed securities.
TIPS	uses the Bloomberg Barclays US TIPS Index, which measures the performance of fixed-income securities with fixed-rate coupon payments that adjust for inflation as measured by the Consumer Priced Index for All Urban Consumers.
HY Bond	uses the ICE BofAML US HY Cash Pay BB-B Constrained Index, which measures the performance of securities that pay interest in cash and have a credit rating of BB or B.
Real Estate	uses the FTSE NAREIT All Equity REITs Index, which is an unmanaged, market capitalization weighted index of all publicly-traded REITs that invest predominantly in the equity ownership of real estate. The index is designed to reflect the performance of all publicly-traded equity REITs as whole.
Intl Stocks	uses the MSCI EAFE Index, which is a free-float-adjusted market capitalization index designed to measure developed market equity performance, excluding the United States and Canada.
EM Stocks	uses the MSCI Emerging Markets Index, which tracks the performance of the leading stocks in 23 MSCI emerging countries in the following areas: Europe, Asia, Africa, Latin America and the Middle East.
US Stocks	uses Russell 3000 Index, which measures the performance of 3,000 of the largest publicly traded U.S. companies, based on market capitalization, and it measures the performance of about 98% of the total market capitalization of the publicly traded U.S. equity market.
Bank Loan	uses the S&P/LSTA Performing Loan Index, which is a subset of the S&P/LSTA Leveraged Loan Index, and comprises non-investment-grade and non-rated loans. Tracking only performing loans, unlike its parent index, it removes defaulted issues at the price they reach directly following the default.
Global Bond	uses the Citigroup World Government Bond Index, which comprises sovereign debt from over 20 countries, denominated in a variety of currencies.
ST Bond	uses the Bloomberg Barclays US Govt/Credit 1-3 Yr Index, which measures all medium and larger issues of U.S. government, investment-grade corporate, and investment-grade international dollar-denominated bonds that have maturities of between 1 and 3 years and are publicly issued.
MM	uses the iMoneyNet Fund Averages - All Government, which is the average of all major government money market mutual fund yields published weekly for 7- and 30-day simple and compound yields.



# 2018 Asset Allocation Assumptions



		Capital Market Assumptions (source: Nuveen Solutions)	
Variables	Benchmarks	Long-Term Returns (Geometric Mean)	Volatility (Standard Deviation)
<b>U.S. Equity</b>	Russell 3000 Index	5.70%	15.40%
<b>Large Cap Growth Equity</b>	Russell 1000 Growth Index	4.39%	17.27%
<b>Large Cap Value Equity</b>	Russell 1000 Value Index	6.94%	14.61%
<b>Small Cap Equity</b>	Russell 2000 Index	4.92%	21.09%
<b>Developed International Equity</b>	MSCI EAFE Index	6.51%	17.03%
<b>Emerging Markets Equity</b>	MSCI Emerging Markets Index	7.72%	19.42%
<b>Core Fixed Income</b>	Bloomberg Barclays U.S. Aggregate Bond Index	3.73%	5.53%
<b>Core Plus Fixed Income</b>	Bloomberg Barclays U.S. Universal Index	3.88%	5.35%
<b>Floating Rate Fixed Income</b>	Credit Suisse Leveraged Loan Index	5.09%	5.18%
<b>Global Fixed Income</b>	FTSE World Government Bond Index	2.61%	5.90%
<b>Emerging Markets Debt</b>	JPM EMBI Global Diversified Index	4.85%	11.45%
<b>High Yield Fixed Income</b>	BofAML US HY BB/B Cash Pay Index	4.62%	8.48%
<b>TIPS</b>	Bloomberg Barclays Inflation-Linked U.S. TIPS Index	2.85%	6.49%
<b>Intermediate-Term TIPS</b>	Bloomberg Barclays Inflation-Linked 1-10 Year U.S. TIPS Index	3.22%	7.93%
<b>Short-Term Fixed Income</b>	Bloomberg Barclays U.S. 1-3 Year Government/Credit Bond Index	3.47%	1.83%
<b>Real Estate Securities</b>	FTSE NAREIT All Equity REITs Index	5.31%	19.40%
<b>CPI</b>	Consumer Price Index - All Urban Consumers	2.34%	0.49%
<b>3 Month T-Bill</b>	BofAML US Treasury Bill 3 Month Index	2.40%	0.29%
<b>Money Market</b>	iMoneyNet Money Fund Report Averages All Taxable	2.00%	0.42%
<b>TIAA Life Funding Agreement</b>	Funding Agreement	3.30%	3.00%
<b>Additional Variables (sources: The College Board and TIAA-CREF Tuition Financing, Inc.)</b>			
<b>National Private Tuition Inflation</b>		4.44%	2.24%
<b>National Public Tuition Inflation</b>		4.94%	2.64%

# 2018 Asset Allocation Assumptions



Return/Risk Profile for Capital Market Assumptions



# Tuition Inflation



Tuition data are sourced from the 2017 College Board Trends in Tuition Pricing.

**Private 4-year Tuition Inflation:**

$$T(t) = 0.02259 + i(t) + 0.01267 * S(t-1) + 0.16691 * B(t) + 0.24043 * R(t-1) - 0.20215 * GDP + e1(t)$$

Expected Value = 4.44%

**Public Tuition Inflation:**

$$T(t) = 0.04316 + i(t) - 0.00665 * S(t-1) + 0.24016 * B(t) + 0.17294 * R(t-1) - 0.92799 * GDP + e2(t)$$

Expected Value = 4.94%

where T(t) is the tuition inflation rate in year t,

i(t) is the CPI inflation rate in year t,

S(t) is the real stock total return (Russell 3000 Index) in year t,

B(t) is the real core fixed income total return (Barclays Capital U.S. Aggregate Bond Index) in year t,

R(t) is the 3 Month T-Bill real return in year t,

GDP is the expected real GDP percent change (2.2%) for the next 10 years (source: Federal Reserve Bank of Philadelphia),

e1(t) is the random error term following a logistic distribution (0%, 0.01%) with a zero mean and standard deviation of 1.99%,

e2(t) is the random error term following a lognormal distribution (-0.01%, 0.01%) with a zero mean and standard deviation of 2.22%

Regression is based on data from 1977-2017.

For 2017-2018 school year, average tuition and fees were: \$9,970 for all in-state public colleges and \$34,740 for private 4-year colleges; based on most recent data 70% enrolled in public colleges and 30% enrolled in private colleges. The enrollment-weighted average tuition and fees for all colleges were \$17,401 = \$9,970\* 70% + \$34,740 \* 30%. The forecasted enrollment-weighted average tuition and fees for year 1 are \$18,208.56 = \$9,970 \* (1+4.94%) \* 70% + \$34,740\* (1 + 4.44%) \* 30%. Therefore, the public / private enrollment weighted tuition inflation rate for year 1 is: 4.64% = \$18,208.56 / \$17,401.00 - 1

# Correlations



	TC Life Funding Agreement	BofAML U.S. 3-Month Treasury Bill / iMoneyNet	FTSE World Gov't Bond Index	JPM EMBI Global Diversified Index	BBarclays U.S. Aggregate Bond Index	BBarclays U.S. Universal Index	BBarclays U.S. TIPS Year Index	BBarclays U.S. TIPS 1-10 Year Index	BBarclays U.S. 1-3 Year Gov't / Credit Bond Index	BofAML US HY BB/B Cash Pay Index	Credit Suisse Leveraged Loan Index	FTSE NAREIT All Equity REITs Index	Russell 3000 Index	Russell 1000 Value Index	Russell 1000 Growth Index	Russell 2000 Index	MSCI EAFE Index	MSCI Emerging Markets Index
TC Life Funding Agreement	1.00																	
BofAML U.S. 3-Month Treasury Bill / iMoneyNet	0.33	1.00																
FTSE World Gov't Bond Index	0.61	-0.07	1.00															
JPM EMBI Global Diversified Index	0.44	-0.03	0.20	1.00														
BBarclays U.S. Aggregate Bond Index	0.85	-0.04	0.75	0.37	1.00													
BBarclays U.S. Universal Index	0.85	0.06	0.47	0.71	0.89	1.00												
BBarclays U.S. TIPS Year Index	0.60	-0.07	0.33	0.20	0.43	0.89	1.00											
BBarclays U.S. TIPS 1-10 Year Index	0.60	0.12	0.45	0.72	0.70	0.87	0.96	1.00										
BBarclays U.S. 1-3 Year Gov't / Credit Bond Index	0.76	0.11	0.68	0.25	0.88	0.19	0.37	0.23	1.00									
BofAML US HY BB/B Cash Pay Index	0.43	-0.01	0.15	0.48	0.21	0.56	0.26	0.61	0.15	1.00								
Credit Suisse Leveraged Loan Index	-0.16	-0.21	-0.18	0.84	0.07	0.48	0.43	0.56	-0.37	0.96	1.00							
FTSE NAREIT All Equity REITs Index	0.18	0.23	0.02	-0.05	0.06	0.42	0.05	0.30	0.08	-0.06	0.62	1.00						
Russell 3000 Index	0.10	-0.07	0.14	0.52	0.19	0.16	0.08	0.20	0.13	0.57	0.72	-0.12	1.00					
Russell 1000 Value Index	0.08	-0.12	0.05	0.41	-0.02	0.12	0.07	0.07	-0.03	0.49	0.36	0.21	0.91	1.00				
Russell 1000 Growth Index	0.04	-0.09	0.07	0.46	0.01	0.19	0.01	0.26	0.01	0.55	0.35	0.16	0.92	0.81	1.00			
Russell 2000 Index	0.08	-0.07	0.15	0.26	0.13	0.12	0.06	0.16	0.11	0.30	0.23	0.07	0.47	0.41	0.41	1.00		
MSCI EAFE Index	0.18	-0.05	0.17	0.31	0.22	0.18	0.13	0.31	0.16	0.52	0.69	-0.06	0.53	0.50	0.49	0.33	1.00	
MSCI Emerging Markets Index	-0.05	-0.03	0.11	0.29	0.16	0.49	0.06	0.60	0.12	0.42	0.80	-0.07	0.42	0.35	0.32	0.26	0.59	1.00



# Current Passive Age-Based Portfolio Simulation Results



Bene's Age	Asset Allocations							
	Domestic Equities	Int'l Equities	Emerging Market Equities	Real Estate Securities	Core Fixed Income	Inflation-Linked Bond	High Yield Fund	Funding Agreement
0	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
1	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
2	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
3	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
4	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
5	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%	0.00%
6	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%	0.00%
7	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%	0.00%
8	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%	0.00%
9	37.80%	14.40%	3.60%	4.20%	28.00%	8.00%	4.00%	0.00%
10	37.80%	14.40%	3.60%	4.20%	28.00%	8.00%	4.00%	0.00%
11	31.50%	12.00%	3.00%	3.50%	35.00%	10.00%	5.00%	0.00%
12	31.50%	12.00%	3.00%	3.50%	35.00%	10.00%	5.00%	0.00%
13	25.20%	9.60%	2.40%	2.80%	42.00%	12.00%	6.00%	0.00%
14	25.20%	9.60%	2.40%	2.80%	42.00%	12.00%	6.00%	0.00%
15	18.90%	7.20%	1.80%	2.10%	42.00%	12.00%	6.00%	10.00%
16	15.75%	6.00%	1.50%	1.75%	38.50%	11.00%	5.50%	20.00%
17	12.60%	4.80%	1.20%	1.40%	31.50%	9.00%	4.50%	35.00%
18	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%
19	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%
20+	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%

Investment Horizon (in years)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Average Annual Return over Investment Horizon	Standard Deviation of Returns over Investment Horizon	Average Annual Tuition Inflation over Investment Horizon	Probability of Exceeding Tuition Inflation	Probability of Achieving 90 cents per Dollar of Future Tuition	Probability of Non-Negative Return	Annualized Shortfall
21	4.58%	1.84%	4.64%	48.94%	60.96%	99.44%	-2.14%
20	4.55%	1.83%	4.64%	48.68%	61.60%	99.28%	-2.11%
19	4.52%	1.86%	4.64%	47.98%	61.18%	99.16%	-2.09%
18	4.53%	1.86%	4.64%	48.44%	61.48%	98.96%	-2.08%
17	4.53%	1.88%	4.64%	47.26%	61.62%	99.26%	-2.04%
16	4.52%	1.86%	4.64%	48.04%	62.38%	99.36%	-2.02%
15	4.46%	1.88%	4.64%	46.92%	62.64%	98.94%	-2.00%
14	4.39%	1.89%	4.64%	46.02%	62.44%	98.86%	-2.01%
13	4.34%	1.90%	4.64%	44.10%	63.08%	98.78%	-1.95%
12	4.35%	1.86%	4.64%	43.84%	64.44%	99.16%	-1.90%
11	4.30%	1.87%	4.64%	42.66%	64.98%	98.90%	-1.88%
10	4.20%	1.86%	4.64%	40.14%	64.46%	98.64%	-1.87%
9	4.20%	1.94%	4.64%	41.04%	66.92%	98.58%	-1.89%
8	4.18%	1.87%	4.64%	39.52%	70.44%	98.60%	-1.79%
7	4.13%	1.93%	4.64%	38.66%	72.90%	98.26%	-1.80%
6	4.03%	1.91%	4.64%	36.20%	76.82%	98.02%	-1.79%
5	4.03%	1.96%	4.64%	35.38%	82.38%	98.34%	-1.74%
4	3.93%	2.02%	4.64%	36.02%	87.04%	97.36%	-1.84%
3	3.99%	2.28%	4.64%	37.06%	93.18%	96.54%	-1.91%
2	4.00%	2.82%	4.64%	38.62%	97.60%	93.00%	-2.20%
1	3.93%	3.92%	4.64%	40.70%	99.72%	84.80%	-2.99%

\*Annualized Shortfall is the expected annual percentage difference between tuition inflation and returns among all scenarios that fail to exceed tuition inflation.

# Recommended Passive Age-Based Portfolio Simulation Results



Bene's Age	Asset Allocations							
	Domestic Equities	Int'l Equities	Emerging Market Equities	Real Estate Securities	Core Fixed Income	Inflation-Linked Bond	High Yield Fund	Funding Agreement
0	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
1	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
2	50.40%	19.20%	4.80%	5.60%	14.00%	4.00%	2.00%	0.00%
3	49.14%	18.72%	4.68%	5.46%	15.40%	4.40%	2.20%	0.00%
4	47.88%	18.24%	4.56%	5.32%	16.80%	4.80%	2.40%	0.00%
5	46.62%	17.76%	4.44%	5.18%	18.20%	5.20%	2.60%	0.00%
6	45.36%	17.28%	4.32%	5.04%	19.60%	5.60%	2.80%	0.00%
7	44.10%	16.80%	4.20%	4.90%	21.00%	6.00%	3.00%	0.00%
8	41.90%	15.96%	3.99%	4.66%	23.45%	6.70%	3.35%	0.00%
9	39.69%	15.12%	3.78%	4.41%	25.90%	7.40%	3.70%	0.00%
10	36.23%	13.80%	3.45%	4.03%	29.75%	8.50%	4.25%	0.00%
11	32.76%	12.48%	3.12%	3.64%	33.60%	9.60%	4.80%	0.00%
12	29.61%	11.28%	2.82%	3.29%	37.10%	10.60%	5.30%	0.00%
13	26.46%	10.08%	2.52%	2.94%	40.60%	11.60%	5.80%	0.00%
14	23.31%	8.88%	2.22%	2.59%	40.60%	11.60%	5.80%	5.00%
15	20.16%	7.68%	1.92%	2.24%	40.60%	11.60%	5.80%	10.00%
16	16.38%	6.24%	1.56%	1.82%	37.80%	10.80%	5.40%	20.00%
17	12.60%	4.80%	1.20%	1.40%	35.00%	10.00%	5.00%	30.00%
18	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%
19	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%
20+	9.45%	3.60%	0.90%	1.05%	24.50%	7.00%	3.50%	50.00%

Investment Horizon (in years)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Average Annual Return over Investment Horizon	Standard Deviation of Returns over Investment Horizon	Average Annual Tuition Inflation over Investment Horizon	Probability of Exceeding Tuition Inflation	Probability of Achieving 90 cents per Dollar of Future Tuition	Probability of Non-Negative Return	Annualized Shortfall
21	4.58%	1.84%	4.64%	48.54%	60.58%	99.34%	-2.13%
20	4.51%	1.87%	4.64%	47.72%	59.84%	99.10%	-2.14%
19	4.54%	1.82%	4.64%	48.44%	62.28%	99.20%	-2.06%
18	4.54%	1.85%	4.64%	47.76%	61.44%	99.34%	-2.03%
17	4.49%	1.89%	4.64%	46.88%	61.18%	98.86%	-2.05%
16	4.49%	1.88%	4.64%	47.06%	62.00%	99.12%	-2.04%
15	4.42%	1.87%	4.64%	45.26%	62.12%	99.00%	-1.96%
14	4.42%	1.85%	4.64%	45.56%	63.30%	99.16%	-1.95%
13	4.37%	1.89%	4.64%	44.38%	63.16%	98.68%	-1.93%
12	4.33%	1.89%	4.64%	43.26%	63.98%	98.80%	-1.91%
11	4.31%	1.88%	4.64%	42.96%	65.02%	98.70%	-1.86%
10	4.28%	1.90%	4.64%	42.32%	66.28%	98.60%	-1.89%
9	4.22%	1.91%	4.64%	41.48%	67.18%	98.80%	-1.87%
8	4.19%	1.94%	4.64%	40.78%	70.58%	98.22%	-1.82%
7	4.11%	1.89%	4.64%	37.44%	73.22%	98.60%	-1.77%
6	4.08%	1.93%	4.64%	37.66%	77.24%	98.30%	-1.77%
5	3.98%	1.97%	4.64%	35.50%	80.84%	97.78%	-1.79%
4	3.93%	2.04%	4.64%	34.72%	87.04%	97.64%	-1.81%
3	3.97%	2.20%	4.64%	36.60%	93.82%	96.58%	-1.86%
2	3.93%	2.82%	4.64%	37.84%	97.02%	92.36%	-2.26%
1	3.94%	4.06%	4.64%	41.82%	99.78%	83.98%	-3.02%

\*Annualized Shortfall is the expected annual percentage difference between tuition inflation and returns among all scenarios that fail to exceed tuition inflation.

# Current Active Age-Based Portfolio Simulation Results



Bene's Age	Asset Allocations									
	Large Cap Growth	Large Cap Value	Small Cap Equity	Real Estate Securities	Int'l Equities	Emerging Market Equities	Core Fixed Income	Inflation-Linked Bond	Floating Rate	Funding Agreement
0	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
1	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
2	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
3	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
4	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
5	19.85%	19.85%	4.40%	4.90%	16.80%	4.20%	21.00%	6.00%	3.00%	0.00%
6	19.85%	19.85%	4.40%	4.90%	16.80%	4.20%	21.00%	6.00%	3.00%	0.00%
7	19.85%	19.85%	4.40%	4.90%	16.80%	4.20%	21.00%	6.00%	3.00%	0.00%
8	19.85%	19.85%	4.40%	4.90%	16.80%	4.20%	21.00%	6.00%	3.00%	0.00%
9	17.01%	17.01%	3.78%	4.20%	14.40%	3.60%	28.00%	8.00%	4.00%	0.00%
10	17.01%	17.01%	3.78%	4.20%	14.40%	3.60%	28.00%	8.00%	4.00%	0.00%
11	14.18%	14.18%	3.14%	3.50%	12.00%	3.00%	35.00%	10.00%	5.00%	0.00%
12	14.18%	14.18%	3.14%	3.50%	12.00%	3.00%	35.00%	10.00%	5.00%	0.00%
13	11.34%	11.34%	2.52%	2.80%	9.60%	2.40%	42.00%	12.00%	6.00%	0.00%
14	11.34%	11.34%	2.52%	2.80%	9.60%	2.40%	42.00%	12.00%	6.00%	0.00%
15	8.51%	8.51%	1.88%	2.10%	7.20%	1.80%	42.00%	12.00%	6.00%	10.00%
16	7.09%	7.09%	1.57%	1.75%	6.00%	1.50%	38.50%	11.00%	5.50%	20.00%
17	5.67%	5.67%	1.26%	1.40%	4.80%	1.20%	31.50%	9.00%	4.50%	35.00%
18	4.25%	4.25%	0.95%	1.05%	3.60%	0.90%	24.50%	7.00%	3.50%	50.00%
19	4.25%	4.25%	0.95%	1.05%	3.60%	0.90%	24.50%	7.00%	3.50%	50.00%
20+	4.25%	4.25%	0.95%	1.05%	3.60%	0.90%	24.50%	7.00%	3.50%	50.00%

Investment Horizon (in years)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Average Annual Return over Investment Horizon	Standard Deviation of Returns over Investment Horizon	Average Annual Tuition Inflation over Investment Horizon	Probability of Exceeding Tuition Inflation	Probability of Achieving 90 cents per Dollar of Future Tuition	Probability of Non-Negative Return	Annualized Shortfall
21	4.59%	1.66%	4.64%	48.60%	62.20%	99.70%	-2.00%
20	4.59%	1.66%	4.64%	49.50%	63.04%	99.60%	-2.00%
19	4.53%	1.69%	4.64%	47.72%	61.86%	99.62%	-2.00%
18	4.57%	1.68%	4.64%	47.78%	63.06%	99.52%	-1.91%
17	4.46%	1.70%	4.64%	46.00%	61.76%	99.42%	-1.93%
16	4.45%	1.65%	4.64%	45.68%	62.70%	99.70%	-1.88%
15	4.44%	1.68%	4.64%	45.18%	63.14%	99.50%	-1.85%
14	4.38%	1.67%	4.64%	43.86%	63.70%	99.46%	-1.84%
13	4.37%	1.70%	4.64%	42.90%	64.64%	99.44%	-1.77%
12	4.29%	1.68%	4.64%	41.84%	64.60%	99.48%	-1.77%
11	4.30%	1.68%	4.64%	42.02%	66.52%	99.46%	-1.74%
10	4.20%	1.64%	4.64%	39.58%	67.22%	99.44%	-1.72%
9	4.20%	1.67%	4.64%	38.52%	69.18%	99.26%	-1.68%
8	4.18%	1.68%	4.64%	38.08%	72.42%	99.46%	-1.66%
7	4.16%	1.70%	4.64%	37.92%	76.52%	99.14%	-1.64%
6	4.02%	1.72%	4.64%	34.64%	79.08%	99.02%	-1.65%
5	4.02%	1.78%	4.64%	34.46%	83.94%	98.86%	-1.65%
4	4.02%	1.84%	4.64%	35.06%	90.50%	98.82%	-1.66%
3	4.03%	2.05%	4.64%	35.90%	95.48%	98.14%	-1.73%
2	3.94%	2.54%	4.64%	37.00%	98.56%	94.58%	-2.07%
1	3.98%	3.79%	4.64%	40.90%	99.90%	85.62%	-2.86%

\*Annualized Shortfall is the expected annual percentage difference between tuition inflation and returns among all scenarios that fail to exceed tuition inflation.

# Recommended Active Age-Based Portfolio Simulation Results



Bene's Age	Asset Allocations									
	Large Cap Growth	Large Cap Value	Small Cap Equity	Real Estate Securities	Int'l Equities	Emerging Market Equities	Core Fixed Income	Inflation-Linked Bond	Floating Rate	Funding Agreement
0	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
1	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
2	22.68%	22.68%	5.04%	5.60%	19.20%	4.80%	14.00%	4.00%	2.00%	0.00%
3	22.11%	22.11%	4.91%	5.46%	18.72%	4.68%	15.40%	4.40%	2.20%	0.00%
4	21.55%	21.55%	4.79%	5.32%	18.24%	4.56%	16.80%	4.80%	2.40%	0.00%
5	20.98%	20.98%	4.66%	5.18%	17.76%	4.44%	18.20%	5.20%	2.60%	0.00%
6	20.41%	20.41%	4.54%	5.04%	17.28%	4.32%	19.60%	5.60%	2.80%	0.00%
7	19.85%	19.85%	4.41%	4.90%	16.80%	4.20%	21.00%	6.00%	3.00%	0.00%
8	18.85%	18.85%	4.19%	4.66%	15.96%	3.99%	23.45%	6.70%	3.35%	0.00%
9	17.86%	17.86%	3.97%	4.41%	15.12%	3.78%	25.90%	7.40%	3.70%	0.00%
10	16.30%	16.30%	3.62%	4.03%	13.80%	3.45%	29.75%	8.50%	4.25%	0.00%
11	14.74%	14.74%	3.28%	3.64%	12.48%	3.12%	33.60%	9.60%	4.80%	0.00%
12	13.32%	13.32%	2.96%	3.29%	11.28%	2.82%	37.10%	10.60%	5.30%	0.00%
13	11.91%	11.91%	2.65%	2.94%	10.08%	2.52%	40.60%	11.60%	5.80%	0.00%
14	10.49%	10.49%	2.33%	2.59%	8.88%	2.22%	40.60%	11.60%	5.80%	5.00%
15	9.07%	9.07%	2.02%	2.24%	7.68%	1.92%	40.60%	11.60%	5.80%	10.00%
16	7.37%	7.37%	1.64%	1.82%	6.24%	1.56%	37.80%	10.80%	5.40%	20.00%
17	5.67%	5.67%	1.26%	1.40%	4.80%	1.20%	35.00%	10.00%	5.00%	30.00%
18	4.25%	4.25%	0.95%	1.05%	3.60%	0.90%	24.50%	7.00%	3.50%	50.00%
19	4.25%	4.25%	0.95%	1.05%	3.60%	0.90%	24.50%	7.00%	3.50%	50.00%
20+	4.25%	4.25%	0.95%	1.05%	3.60%	0.90%	24.50%	7.00%	3.50%	50.00%

Investment Horizon (in years)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Average Annual Return over Investment Horizon	Standard Deviation of Returns over Investment Horizon	Average Annual Tuition Inflation over Investment Horizon	Probability of Exceeding Tuition Inflation	Probability of Achieving 90 cents per Dollar of Future Tuition	Probability of Non-Negative Return	Annualized Shortfall
21	4.60%	1.66%	4.64%	50.00%	61.84%	99.80%	-2.07%
20	4.57%	1.67%	4.64%	48.32%	62.66%	99.70%	-1.98%
19	4.55%	1.69%	4.64%	48.56%	62.32%	99.64%	-1.99%
18	4.51%	1.65%	4.64%	46.86%	62.00%	99.62%	-1.94%
17	4.50%	1.70%	4.64%	47.54%	62.92%	99.48%	-1.93%
16	4.45%	1.69%	4.64%	46.28%	63.08%	99.58%	-1.91%
15	4.42%	1.73%	4.64%	45.10%	62.94%	99.50%	-1.88%
14	4.38%	1.69%	4.64%	42.88%	62.52%	99.48%	-1.81%
13	4.34%	1.67%	4.64%	42.62%	63.96%	99.48%	-1.80%
12	4.30%	1.68%	4.64%	42.22%	64.54%	99.44%	-1.80%
11	4.30%	1.68%	4.64%	41.80%	67.60%	99.48%	-1.72%
10	4.27%	1.69%	4.64%	41.08%	67.68%	99.42%	-1.72%
9	4.20%	1.69%	4.64%	38.96%	69.56%	99.42%	-1.68%
8	4.12%	1.69%	4.64%	37.62%	72.12%	99.26%	-1.66%
7	4.12%	1.73%	4.64%	37.38%	75.24%	99.32%	-1.67%
6	4.06%	1.73%	4.64%	36.12%	79.32%	99.08%	-1.63%
5	4.01%	1.73%	4.64%	34.10%	84.38%	99.18%	-1.62%
4	3.98%	1.86%	4.64%	34.32%	89.84%	98.56%	-1.68%
3	3.93%	2.11%	4.64%	35.12%	94.54%	96.98%	-1.81%
2	3.99%	2.54%	4.64%	38.14%	98.72%	94.84%	-2.05%
1	3.91%	3.80%	4.64%	40.48%	99.84%	85.48%	-2.87%

\*Annualized Shortfall is the expected annual percentage difference between tuition inflation and returns among all scenarios that fail to exceed tuition inflation.

## Definitions



- **(1) Expected Return.** The average of a distribution of possible annualized investment returns over an investment horizon of n years generated by Monte Carlo simulation. The returns are based on the assumption that each year money will be invested according to the asset class allocation assigned to the beneficiary's age.
- **(2) Standard Deviation of Returns.** A statistic used as a measure of the dispersion or variation in the distribution of annualized investment returns over an investment horizon of n years generated by Monte Carlo simulation, equal to the square root of the arithmetic mean of the squares of the deviations from the expected return. A higher standard deviation indicates a higher volatility.
- **(3) Average Annual Tuition Inflation.** The average of a distribution of possible annualized tuition inflation rates over an investment horizon of n years generated by the Monte Carlo simulation.
- **(4) Probability of Exceeding Tuition Inflation.** The likelihood that the annualized investment return exceeds the average tuition inflation rate over an investment horizon of n years, out of all the possible trials simulated by the Monte Carlo simulation.
- **(5) Probability of Achieving 90 Cents per Dollar of Future Tuition.** The likelihood that each dollar of investment today will grow to cover at least 90% of future tuition based on one dollar of today's tuition rising with tuition inflation over an investment horizon of n years.
- **(6) Probability of Non-negative Return.** The likelihood that the investment will achieve at least 0% of annualized return (preserving principal) over an investment horizon of n years.
- **(7) Annualized Shortfall.** The average of a distribution of the differences (shortfalls) between annualized investment returns and annualized tuition inflation rates over an investment horizon of n years among those scenarios that have annualized investment return failing to keep pace with tuition inflation.

- 1** Outpacing tuition inflation is associated with longer time horizons and a steady plan for derisking your portfolio over time
- 2** Asset class diversification is a key element and can improve your long term risk/reward profile
- 3** The various underlying funds in ScholarShare have distinct characteristics and are used in a way to moderate the potential volatility that portfolios experience, particularly during college years
- 4** The shape, slope, and levels of the probabilities of outpacing tuition inflation for the enrollment-based glide path are similar to those of the age-based glide path, and help validate model results

**Date:** February 14, 2019

**To:** ScholarShare Investment Board (SIB)

**From:** Pension Consulting Alliance, LLC (PCA)  
Eric White, CFA, Kay Ceserani, Ashley Yoshida

**RE: Discussion of TFI 2019 Annual Review**

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## Summary

This memo provides PCA's initial observations regarding TIAA-CREF Tuition Financing, Inc.'s (TFI) recommendation to move to an enrollment-based glidepath as part of their annual review and recommendation for the 2019 asset allocation for the ScholarShare College Savings Plan (Plan). TFI's proposal to move to enrollment-based funds does not call for changes in asset allocation as the glidepath for each enrollment-based fund is predetermined and would follow the current glidepath albeit with more frequent adjustments along the investment period.

**Overall, PCA concurs with TFI's analysis and believes the current glidepath is well optimized.** PCA also favors an enrollment-based glidepath as it provides participants a smoother transition from the equity heavy years to those weighted more to fixed income where asset-allocation shifts occur on a more frequent basis (such as quarterly in TFI's proposal). Enrollment-based glidepaths also offer a superior option for K-12 savers as investors are better able to target a specific date and risk allocation.

Another benefit is that an enrollment-based glidepath accurately reflects participants' actual experience, where the returns of the fund represent the experience of the participant from age zero to matriculation (assuming the initial investment is made at birth). Under ScholarShare's current construct, performance results are shown for each of the age-based portfolios over varies periods of time (1-, 3-, 5-years, etc.). However, investors are only invested in each of these segments of the glidepath for a short period of time. This is important for both evaluation purposes but also for the potential use of tactical asset allocation shifts. While the proposed progressive roll-down structure helps mitigate market-timing risk, these types of funds can be more difficult to monitor versus peers due to a smaller number of similar products and the expected life of each fund.

**Observations**

From a structural standpoint, PCA believes moving to an enrollment-based framework makes sense for several reasons: 1) proposal preserves current risk profile over investment period, 2) provides more frequent rebalancing which should improve participants' results during periods of market stress, 3) each enrollment-based fund's performance reflects the participants experience over the life of the investment, and 4) creates framework to implement TFI's best thinking on a go forward basis (e.g. rebalancing on a more frequent basis). However, the progressive structure of the funds also creates some challenges in monitoring them. Such as, a limited number of programs (portfolios) structured with the same framework, loss or lack of performance history, and endpoint sensitivity as each fund's expected life is finite. Additionally, PCA finds TFI's asset allocation analysis to be comprehensive, insightful, and uses consistent and reasonable inputs to develop their conclusions.

**Discussion**

***Enrollment-based Structure***

Currently there are 14 states (including District of Columbia) with direct Plans that offer enrollment-based products. Of the 14, five made the switch to a progressive structure within the last three years: Rhode Island in 2016, Washington DC in 2017, and Ohio, Oregon, and Washington most recently in 2018. The number of years between funds being added in a program has narrowed with new programs (except for the District of Columbia) ranging from one- to two-years; historically, states have added funds on a three-year cycle. This mismatch in the frequency in which enrollment-based funds are offered (or vintage years) makes an apples-to-apples comparison more cumbersome.

Peer Comparison

PCA reviewed ScholarShare's age-based portfolios versus Morningstar's peer universes, which are divided up into four segments, based on age and in some cases equity allocation. These comparisons provide a reasonable view on how one 529 program's age-based portfolios compare to another. However, it isn't perfect as each program employs its own scheme on the number of steps in the glidepath and mix of assets. Enrollment-based funds add another level of complexity, as they are dynamic and move through the glidepath from beginning to end. As noted above, there are a select number of other states with somewhat similar offerings which could be used to create a custom universe for each of the enrollment-based funds.

The following table lists each of the states that currently utilize an enrollment-based (or progressive) glidepath. The top row lists the four universes Morningstar currently divides 529 portfolios into. For each state the funds offered by enrollment year are then indicated. When funds have more than one year associated with them, such as TFI's proposal, cells were merged to span the years indicated.



### States with Progressive Glidepaths - Direct 529 Plans

	0-6									7-12					13-18					19+							
	2038	2037	2036	2035	2034	2033	2032	2031	2030	2029	2028	2027	2026	2025	2024	2023	2022	2021	2020	2019	2018	2017	2015	2014	Today/Graduate	Stable Value	
CA			X		X		X		X		X		X		X		X		X		X				X		
AK			X			X			X			X			X											X	
AZ			X			X			X			X			X						X					X	
DC*					X			X			X			X			X			X							
DE			X			X			X			X			X					X						X	
IN			X			X			X			X			X					X							
MA			X			X			X			X			X					X						X	
MD			X			X			X			X			X					X						X	
NH			X			X			X			X			X					X						X	
NV			X			X			X			X			X					X						X	
OH*	X		X		X		X		X		X		X		X		X		X								
OR*			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
RI*			X		X		X		X		X		X		X		X		X							X	
VA						X			X			X			X					X			X				X
WA*			X		X		X		X		X		X		X		X		X		X						

\*Inception date DC=3/24/2017, OH =5/18/2018, OR= 7/23/2018, RI= 7/8/2016, WA=4/2018  
Source: Morningstar Direct

#### Performance History

In converting to an enrollment-based structure, it is likely ScholarShare will lose its performance history for most, if not all, the portfolios. While this may seem concerning, PCA points out there is currently a data deficiency as over the last few years many states have modified their glidepaths adding additional steps (portfolios) while reducing the equity step-downs. As track records build, PCA expects the data universe providers to increase the number of peer universes to more closely align with how programs are structured today.

#### Endpoint Sensitivity

PCA notes, having one fund is advantageous to an investor as the performance reflects what they would have received over the life of their investment. In contrast, to know an individual's results invested in the traditional age-based scheme one would have to string together the returns of each portfolio in the glidepath. Unlike traditional age-based portfolios, enrollment-based funds, in a sense, have an expiration date which makes comparisons for future investors more challenging.

Today, consumers can look at historical performance for each of the age-based portfolios (age-bands) which can span a decade or more and represent a specific asset mix (i.e. 90% equity/10% fixed). Given enrollment-based funds move through the glidepath, past performance of these funds won't provide consumers the same type of information as the age-based funds. In many ways, performance for enrollment-based funds will be more accurate as potential participants will be able to see the results of current investors, which encompass the dynamic changes of the portfolios over time. This differs from how information is currently presented to potential participants, wherein they can only see the results for individual age-bands but not a composite of what it looks like for actual participants who move between age-bands.

One potential drawback of this will be that it becomes far clearer the differences in savings outcomes by participant cohort (enrollment-based fund) depending on the market environment over their investment timeframe, especially during the early (equity-heavy) portion of the time-period.

**Asset Allocation**

TFI continues to believe their current glidepaths are sound and that they should meet TFI's expectation for a reasonable rate of expected return while minimizing the potential "shortfalls" between expected returns and tuition inflation over the investment horizons.

TFI provided a detailed summary of their analysis for both the actively managed and passively managed age-based portfolios. The analysis showed the expected return and standard deviation of the different portfolios, as well as the likelihood of the portfolios' returns falling short of the rate of tuition inflation for the current age-based portfolio's as well as the proposed enrollment-based funds.

TFI utilized Nuveen Solutions 2018 capital market assumptions in their analysis. In comparison TFI and PCA's expected returns are somewhat similar, but in almost all cases (except core fixed income) TFI's expected volatility is lower than PCA's.

**2018 Capital Market Assumptions**

	Nuveen Solutions		PCA		Difference	
	Expected Return	Expected Volatility (Std. Deviation)	Expected Return	Expected Volatility (Std. Deviation)	Expected Return	Expected Volatility (Std. Deviation)
US Equity	5.70	15.40	5.75	19.00	(0.05)	(3.60)
Developed Intl Equity	6.51	17.03	6.45	21.00	0.06	(3.97)
Emerging Markets	7.72	19.42	7.35	26.00	0.37	(6.58)
Core Fixed Income	3.73	5.53	3.40	5.50	0.33	0.03
REITS	5.31	19.40	5.75	22.00	(0.44)	(2.60)
TIPs	2.85	6.49	2.75	7.00	0.10	(0.51)
High Yield	4.62	8.48	4.75	13.00	(0.13)	(4.52)
Inflation	2.34	0.49	2.25	1.50	0.09	(1.01)

Capital market assumptions underpin all simulation analysis therefore the similarities in return assumptions result in similar simulation outcomes despite the differences in simulation methodology. The differences in PCA and TFI's return assumptions off-set results along the investment horizon, but overall result in somewhat similar expected outcomes.

PCA reviewed the proposed progressive-funds ability to meet TFI's stated objectives: achieve a reasonable rate of expected return and a high probability of outperforming tuition inflation, while minimizing shortfalls in meeting the expected returns over the investment horizon. Our findings are in line with those of TFI in that gradually shifting out of equities into fixed-income and inflation protection classes improves the outcome of investors on average by reducing market timing risk given the relatively large spread between expected returns for equities versus fixed income.

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## MEMORANDUM

**TO:** JULIO MARTINEZ, EXECUTIVE DIRECTOR  
STANLEY ZETO, DEPUTY EXECUTIVE DIRECTOR  
SCHOLARSHARE INVESTMENT BOARD

**FROM:** AKF CONSULTING GROUP

**DATE:** JANUARY 9, 2019

**RE:** TARGET DATE FUNDS IN 529 PLANS

### I. INTRODUCTION

In September 2018, TIAA-CREF Tuition Financing, Inc. (“TFI”) proposed to ScholarShare Investment Board (“SIB” or “Board”) Staff glidepath changes to the Age-Based Options in the ScholarShare College Savings Plan (“ScholarShare”). Specifically, TFI proposed “converting the age-based structure to an enrollment-based, target date structure.” With the proposed structure, beneficiaries would be placed in a single, evolving target date fund based upon an expected year of enrollment. While the recommendation is still in its preliminary stage with details pending, this proposal would result in the following changes:

Current Structure	Proposed Structure
<ul style="list-style-type: none"><li>• “Age-Based” portfolios</li><li>• 9 age-bands</li><li>• Beneficiary is placed into an age-based portfolio based upon current age</li><li>• Beneficiary assets are moved into new age-bands over time based upon age</li><li>• Asset allocation shifts occur only between each age-band (maximum of eight shifts)</li></ul>	<ul style="list-style-type: none"><li>• “Enrollment-Based” portfolios</li><li>• 11 target date funds</li><li>• Account owner may select a target date fund based upon the beneficiary’s expected enrollment year</li><li>• Beneficiary assets remain in the same portfolio throughout investment horizon</li><li>• Quarterly asset allocation shifts</li></ul>

Upon review of TFI’s proposal, SIB Staff asked AKF Consulting Group to research the prevalence of target date funds across 529 Plans and comment upon the pros and cons of TFI’s proposal. To that end, Section II of this memo summarizes our research on the use of enrollment-based, target date structures across 529 Direct and Advisor plans. Section III concludes with our observations on the proposal. We essentially conclude that an evolving, target date structure offers ScholarShare an opportunity to distinguish the Plan in an increasingly competitive market environment. In light of this, we recommend that the Board seek complete conversion and planning details from TFI, carefully consider the challenges we have highlighted, and then determine whether to move forward with the proposed change.

## II. PREVALENCE OF TARGET DATE FUNDS

In undertaking our research, we reviewed Plan websites and Program Disclosure Statements as of November 20, 2018. Our research is based upon two major characteristics of target date funds:

- ***Progressive glidepath structure.*** Progressive glidepaths (i) retain beneficiary assets within a single portfolio, in which asset allocation evolves over time until an expected future date, and (ii) tend to shift asset allocations more frequently and in smaller amounts, thereby reducing the abruptness of equity step-downs and exposure to market risks.
- ***“Enrollment-based” portfolio naming convention.*** Target date structures tend to use “enrollment-based” or “year-to-enrollment” descriptors in the titling of the age-based options. TFI’s proposed target date fund names would be based on expected enrollment years and would replace the existing age-band titles based upon the current age of the beneficiary.

***Progressive glidepath structure.*** The following chart shows the 529 Plans Morningstar identified in 2016 that use progressive glidepaths.<sup>1</sup> The table also includes Plans (in blue) that have implemented this structure since 2016.

Program Manager	Investment Advisor <sup>2</sup>	State (Plan)	Plan Type
Ascensus	Ascensus	District of Columbia <sup>3</sup>	Direct
	Ascensus	Indiana	Direct and Advisor
	Putnam	Nevada (Putnam)	Advisor
	SSGA	Nevada (SSGA Upromise)	Direct
	Invesco	Rhode Island	Direct and Advisor
BlackRock	BlackRock	Arkansas	Advisor
		Ohio	Advisor
BNY <sup>4</sup>	Sellwood	Oregon	Direct
	Lockwood	Washington	Direct
Capital Research	Capital Research	Virginia	Advisor
Fidelity	Fidelity	Arizona Delaware Massachusetts	Direct
		New Hampshire	Direct and Advisor
OTTA	Wilshire	Ohio	Direct
T. Rowe Price	T. Rowe Price	Alaska	Direct (2) and Advisor
		Maryland	Direct
Virginia 529	Mercer	Virginia	Direct
<b>8 Program Managers</b>	<b>12 Investment Advisors</b>	<b>15 States</b>	<b>23 Plans</b>

<sup>1</sup> See the “529 College-Savings Plan Landscape” Industry Survey, dated May 26, 2016, based upon December 2015 data

<sup>2</sup> Includes the party responsible for asset allocation whether it is the investment advisor associated or partnered with the Program Manager or an issuer’s independent investment consultant (e.g., Sellwood, Wilshire and Mercer in Oregon, Ohio and Virginia, respectively)

<sup>3</sup> Ascensus assumed management of the District of Columbia’s Plan in March 2017

<sup>4</sup> BNY launched Washington’s Direct Plan in April 2018 and assumed management of the Oregon Plan in September 2018

As the chart above shows, only 12 investment advisors currently implement a progressive glidepath structure across 23 Direct and Advisor Plans, which represents 26% of the ninety different 529 Plans offered nationwide. Interestingly, Morningstar’s 2016 Industry Survey positively acknowledged that TFI’s asset allocation across nine age-bands mimicked a progressive structure without actually being one. Since then, many Program Managers have implemented similarly progressive glidepaths by merely increasing the number of age-bands in age-based options. In light of this, TFI’s proposed implementation of a true progressive glidepath is particularly noteworthy.

Based upon the information presented above, we reviewed the number of portfolios offered and the frequency of asset allocation shifts across the progressive glidepath structures. Results are shown in the following table:

Investment Advisor (Program Manager, if different)	529 Plan(s) Managed		Number of Portfolios	Frequency of Asset Allocation Shifts <sup>5</sup>
	Direct	Advisor		
Ascensus	DC IN	IN	7	Semi-annually
BlackRock	--	AR OH	7 5	Quarterly
Capital Research	--	VA	7	Every three years
Fidelity	AZ DE MA NH	NH	8	Every three years
Invesco (Ascensus)	RI	RI	11	Monthly
Lockwood (BNY)	WA	--	10	At least every two years
Mercer (Virginia 529)	VA	--	8	Annually
Putnam (Ascensus)	--	NV	8	Quarterly
Sellwood (BNY)	OR	--	25	Quarterly
SSGA (Ascensus)	NV	--	8	Quarterly
T. Rowe Price	AK (2) MD --	-- AK	8 6	Quarterly
Wilshire (OTTA)	OH	--	10	Every two years

As shown above, the frequency of asset allocation shifts varies widely from monthly (e.g., Rhode Island Direct and Advisor Plans) to every three years (e.g., Virginia Advisor and Fidelity-managed Plans). Nine Plans, represented by five investment advisors, make the shift on a quarterly basis.

**“Enrollment-based” portfolio naming convention.** The table on the next page lists Direct and Advisor Plans that name portfolios based upon expected enrollment rather than the beneficiary’s age when the account is opened. The last column of the table provides examples of enrollment-based portfolio names across these Plans. Note, in Advisor Plans, the enrollment-based portfolio names typically include the name of the Investment Manager that often serves as Program Manager.

<sup>5</sup> With clarification by BNY, Capital Research, Fidelity, OTTA and Virginia 529 customer service representatives

	States	Investment Advisor (Program Manager)	Name of Option	Name of Initial Portfolio
Direct Plans	AK (2) MD	T. Rowe Price	Enrollment-Based portfolios	Portfolio 2039
	AZ DE MA NH	Fidelity	Age-Based Portfolios	Portfolio 2036
	DC	Ascensus	Year of College Enrollment	DC College Savings 2034 Portfolio
	IN	Ascensus	Year of Enrollment	2036 Enrollment Portfolio
	NV SSGA	SSGA (Ascensus)	College Date Portfolios	SSGA College 2036 Portfolio
	OH	Wilshire (OTTA)	Advantage Age-Based Portfolios	2036
	OR	Sellwood (BNY)	College Enrollment Year Investment Option	2037
	RI	Invesco (Ascensus)	Age-Based Portfolios	CollegeBound 2037-2038 Portfolio
	VA	Mercer (VA529)	Age-Based Portfolios	2036 Portfolio
	WA	Lockwood (BNY)	Year of Enrollment Investment Option	Enrollment Date 2036
Advisor Plans	AK	T. Rowe Price	Enrollment-Based portfolios	Portfolio 2033-2036
	AR	BlackRock	Year-of-Enrollment Portfolios	iShares 2036 College Portfolio
	CO	Legg Mason	Years to Enrollment Option	Years to Enrollment (10-12 Years)
	IN	Ascensus	Year of Enrollment	2034 Enrollment Portfolio
	NH	Fidelity	Age-Based Portfolios	FA 529 Portfolio 2037
	OH	BlackRock	Target Date Investment Option	BlackRock College 2032 Option
	RI	Invesco (Ascensus)	Age-Based Portfolios	Invesco CollegeBound 2037-2038 Portfolio
	VA	Capital Research	American Funds College Target Date Series	American Funds College 2036 Fund

With the exception of Nevada Putnam,<sup>6</sup> all of the Plans that use a progressive glidepath follow the “enrollment-based” naming convention for individual Portfolios. Ohio Direct is noteworthy because it offers four evolving portfolio options but only the Advantage Age-Based Option referenced above and included in this memo is truly progressive. The other “Age-Based Options” are designed and managed by Vanguard, each using stepped glidepath approach. We also note that the Colorado Advisor Plan (highlighted yellow above) is included even though it does not employ the progressive glidepath structure. This Plan simply uses the “enrollment-based” naming convention. Colorado Advisor offers the choice of “enrollment-based” and “age-based” portfolios for the same exact portfolios. Interestingly, enrollment-based portfolios are only offered to beneficiaries with no more than 12 years to matriculation.

<sup>6</sup> Nevada Putnam’s “Age-Based Asset Allocation Investment Option” names Portfolios based upon the age of the beneficiary despite the progressive, target date fund structure (for example, “Age-Based – New Born” and “Age-Based – Age 1”)





### III. OBSERVATIONS AND CONCLUSION

According to our research, true progressive target date funds are available in 529 Plans represented by 12 different investment advisors. To this point, ScholarShare would not be unique in offering a target date fund structure. We surmise that the relatively low presence of this structure reflects the necessity for an experienced asset allocation team with target date retirement expertise and, perhaps, the cost of creating and maintaining target date portfolios. To test this theory, we reviewed (i) the asset allocation teams and (ii) program management fees across the Plans that employ a progressive glidepath structure:

Investment Advisor (Program Manager, if different)	529 Plan Managed		Retirement Experience?	Program Management Fees
	Direct	Advisor		
Ascensus	DC IN	IN	Unclear	0.25% - 0.33%
BlackRock	--	AR OH	Yes	0.19% - 0.35%
Capital Research	--	VA	Yes	Unclear <sup>7</sup>
Fidelity	AZ DE MA NH	NH	Yes	0.04% - 0.30%
Invesco (Ascensus)	RI	RI	Yes	0.15% - 0.25% <sup>8</sup>
Lockwood (BNY)	WA	--	Unclear	0.12%
Mercer (VCSP)	VA	--	Yes	0.10%
Putnam (Ascensus)	--	NV	Yes	0.25%
Sellwood (BNY)	OR	--	Unclear	0.25%
SSgA (Ascensus)	NV	--	Yes	0.22%
T. Rowe Price	AK(2) MD	AK	Yes	0% - 0.25%
Wilshire (OTTA)	OH	--	Yes	0.04% <sup>9</sup>

Based on our findings, target date portfolio offerings and asset allocation team experience appear to be directly correlated. Most of the asset allocation teams shown above have strong retirement expertise. On the other hand, we do not see a clear a correlation with program management fees, which probably reflects other factors that are critical to pricing decisions (e.g., asset size of the Plan).

<sup>7</sup> 0% for “Management fees” stated but unclear whether Capital Research collects the “Other expenses” of 0.14%-0.21% and/or any portion of the 0.28%-0.40% in “Acquired underlying fund fees and expenses”

<sup>8</sup> 0% for Rhode Island residents

<sup>9</sup> Includes 0.02% OTTA Fee and 0.02% Portfolio Accounting and Administration Fee to Ascensus



Messrs. Martinez and Zeto, January 9, 2019

Our observations on TFI's proposed glidepath changes, include the following:

- **Benefits:**
  - **Smoother glidepath** – A major benefit of the new structure is the reduced market timing risk resulting from more frequent asset allocation shifts. While Morningstar already recognizes TFI's progressive-like glidepath structure, we believe a true progressive structure would solidify ScholarShare's consistently Positive Process Pillar.
  - **Greater flexibility** – An enrollment-based glidepath provides greater flexibility across a broader audience because withdrawals can be timed for a specific enrollment year regardless of the current age of beneficiary and education level. Furthermore, while K-12 withdrawals are treated as nonqualified for California State tax purposes, this new naming convention would offer an option for some account owners notwithstanding the negative State tax treatment.
  
- **Challenges:**
  - **Operations** – TFI should clearly delineate for the Board and Staff any conversion or other operational hurdles.
  - **Fees** – The Board and Staff should understand and consider whether the creation of a brand new glidepath, conversion from the current structure and more frequent reallocations would result in any fee impact for account owners.
  - **Timing** – If this glidepath change were to be implemented, the conversion should avoid seasons when transaction volumes and customer service call traffic are higher. And if possible, this change should be in sync with any other planned changes and thus be reflected in a single Supplement or updated Program Disclosure Statement. On a whole, given the substantial change in the structure, we would likely recommend the release of an updated Program Disclosure Statement.
  - **Communication** – Communication about this structural change should begin several months in advance of implementation to fully inform account owners.

Overall, we view TFI's proposal favorably and believe that converting to the proposed target date fund structure would positively distinguish an already strong ScholarShare for three reasons. First, a smoother glidepath reduces exposure to market risk over time. Second, it provides additional protection from loss of capital in near college-age beneficiaries. And third, naming portfolios based upon enrollment year offers greater flexibility and choice for all beneficiaries. As long as the known challenges to implementing the glidepath change can be addressed efficiently and cost effectively, the potential benefits to ScholarShare participants could be significant.

We welcome the opportunity to discuss any part of our research in more detail. Thank you.