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DEPARTMENT OF STATE TREASURER  
INVESTMENT MANAGEMENT DIVISION

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To: Supplemental Retirement Board of Trustees  
From: Kevin SigRist and Rhonda Smith  
CC: Steve Toole, Mary Buonfiglio, and Mary Laurie Cece  
Date: November 4, 2015  
Subject: North Carolina 403(b) Program Custom Portfolios

This memorandum presents recommendations to the Supplemental Retirement Board of Trustees ("SRP Board") with respect to the North Carolina 403(b) Program Custom Portfolios. The recommendations will be presented and discussed at the November 12, 2015, meeting of the Investment Subcommittee of the SRP Board.

### Background

In October 2015, the SRP Board took up certain recommendations from Mercer Consulting ("Mercer") related to investment fund changes and mappings within the North Carolina 403(b) Program ("403(b) Program"). The Mercer consulting contract for the 403(b) Program has concluded. Going forward, investment staff of the Department of State Treasurer will provide investment oversight for the 403(b) Program and make periodic recommendations for the SRP Board's consideration related to investment policy and implementation matters.

Mercer's October 2015 recommended investment fund changes included terminating the Wells Fargo Target Date Funds and adding TIAA-CREF's Custom Portfolios feature. The SRP Board has expressed a desire to direct TIAA-CREF to adopt Custom Portfolios' structures that closely match the "Model Allocations" of the GoalMaker portfolios utilized in the North Carolina 401(k) and 457 Plans ("NC 401(k) / NC 457"). However, the Mercer recommendations were not intended to address how to structure the 403(b) Custom Portfolios to meet the SRP Board's objective. **The balance of this memorandum provides analysis to support a SRP Board direction for TIAA-CREF to use the tables in Appendix 3 for the Custom Portfolios.**

### Analysis and Recommendations

Appendix 1 contains the authorized NC 401(k) and NC 457 Model Allocations ("NC 401(k) / NC 457 Model Allocations"). Immediately below, Table 1 compares the 403(b) Program fund offerings to the NC 401(k) / NC 457 Model Allocations categories. Table 2 compares benchmarks for the categories and funds for the two plans. Note that two categories are dropped from Tables 1 and 2 because they receive no allocations in any of the Model Allocations:

1. Small / Mid Cap Index
2. International Index

**Table 1: NC 401(k) / NC 457 Model Allocations Categories and Comparable 403(b) Program Funds**

NC 401(k) / NC 457 Model Allocations Categories	Comparable NC 403(b) Fund
Large Cap Value	Vanguard Windsor II
Large Cap Index	Vanguard 500 Index
Large Cap Growth	T. Rowe Price Blue Chip Growth
Small / Mid Cap Value	<i>No SMID Value Fund (DFA Small Cap Core)</i>
Small / Mid Cap Growth	<i>No SMID Growth Fund (DFA Small Cap Core)</i>
Global	<i>No Global Equity Fund</i>
International	MFS Institutional International Equity
Fixed Income	J.P. Morgan Core Bond
Fixed Income Index	Vanguard Total Bond Market Index
Stable Value	TIAA Stable Value
Inflation Sensitive	PIMCO Inflation Responsive Multi-Asset

**Table 2: NC 401(k) / NC 457 and 403(b) Program Funds Benchmarks**

NC 401(k) / NC 457 Model Allocations Categories	Applicable NC 401(k) / NC 457 Fund Benchmarks	Applicable NC 403(b) Program Fund Benchmarks
Large Cap Value	Russell 1000 Value	Russell 1000 Value
Large Cap Index	S&P 500	S&P 500
Large Cap Growth	Russell 1000 Growth	Russell 1000 Growth
Small / Mid Cap Value	Russell 2500 Value	<i>No SMID Value Fund (Core: Russell 2000)</i>
Small / Mid Cap Growth	Russell 2500 Growth	<i>No SMID Growth Fund (Core: Russell 2000)</i>
Global	MSCI ACWI	<i>No Global Equity Fund</i>
International	MSCI ACWI ex US	<i>MSCI EAFE</i>
Fixed Income	Barclays Capital U.S. Aggregate	Barclays Capital U.S. Aggregate
Fixed Income Index	Barclays Capital U.S. Aggregate	Barclays Capital U.S. Aggregate
Stable Value	ML 91 Day T-Bill +1%	ML 91 Day T-Bill +1%
Inflation Sensitive	45% Barclays Capital U.S. TIPS Index; 20% DJ-UBS Commodity TR Index; 10% Dow Jones U.S. Select REIT Index; 10% JPM Emerging Local Market ELMI Plus Index; 10% DJ-UBS Gold TR Index.	45% Barclays Capital U.S. TIPS Index; 20% DJ-UBS Commodity TR Index; 10% Dow Jones U.S. Select REIT Index; 10% JPM Emerging Local Market ELMI Plus Index; 10% DJ-UBS Gold TR Index.

There are three differences in the NC 401(k) / NC 457 Plans and 403(b) Programs that potentially impact how the TIAA-CREF Custom Portfolios should be implemented:

1. The 403(b) Program has a Small Cap Core fund rather than the Small / Mid Cap Value Fund and Small / Mid Cap Growth Fund found in the SRP. The benchmark coverage is also somewhat different; Russell 2500 versus Russell 2000.

2. The International Fund benchmarks are somewhat different; MSCI ACWI ex US versus MSCI EAFE.
3. The 403(b) Program has no Global Equity fund.

**Recommendation 1.** Map the combined NC 401(k) / NC 457 Model Allocation for the Small / Mid Cap Value Fund and Small / Mid Cap Growth Fund to the DFA Small Cap Core Fund.

1. The NC 401(k) / NC 457 Model Allocations (see Appendix 1) always incorporate an equivalent allocation to Small / Mid Cap Value and Small / Mid Cap Growth. Since the DFA Small Cap Core Fund will contain a blend of value and growth exposures over time this approach will provide a reasonable approximation of the style exposures in the NC 401(k) / NC 457 Model Allocations for Small / Mid Cap.
2. Differences between the Small / Mid Cap and Small Cap benchmarks and investment manager processes will cause some dispersion in returns over time. However, we have compared an equal-weighted blend of the actual returns for the NC 401(k) Small / Mid Cap Value Fund and NC 401(k) Small / Mid Cap Growth Fund to the actual returns of the DFA Small Cap Core Fund for the period October 2010 to June 2015. The DFA Small Cap Core Fund returns explain about 96% of the variation in the equal-weighted Small / Mid Cap blend returns; the two return series have a correlation of 97.5% and annualized tracking error of 3.51%. See also Chart 2A in Appendix 2 for a graphical goodness of fit comparison. We believe this analysis supports Recommendation 1.

**Recommendation 2.** Map the NC 401(k) / NC 457 Model Allocation for the International Fund to the MFS Institutional International Equity Fund.

1. Differences in the International Funds' benchmarks and investment manager processes between the Plans and Program will cause some dispersion in returns over time. For instance, the NC 401(k) / NC 457 benchmark includes weights to emerging markets and Canada that are not included in the NC 403(b) benchmark. However, the MFS Institutional International Equity Fund routinely includes investments in companies domiciled or doing material business in the emerging markets and Canada.
2. We compared the actual returns for the NC 401(k) International Fund to the actual returns of the MFS Institutional International Equity Fund for the period October 2010 to June 2015. The MFS Institutional International Equity Fund returns explain about 95% of the variation in the NC 401(k) International Equity Fund returns; the two return series have a correlation of 97.3% and annualized tracking error of 3.51%. See also Chart 2B in Appendix 2 for a graphical goodness of fit comparison. We believe this analysis supports Recommendation 2.

**Recommendation 3.** Map the NC 401(k) / NC 457 Model Allocation for the Global Fund with approximate MSCI ACWI index weights to the Vanguard Windsor II Fund, T. Rowe Price Blue Chip Growth Fund, and MFS Institutional International Equity Fund. Review the allocations on an annual basis.

1. We conducted extensive statistical analysis of the actual returns for the NC 401(k) Global Fund compared to the actual returns of the Vanguard Windsor II Fund, T. Rowe Price Blue Chip Growth Fund, and MFS Institutional International Equity Fund for the period December 2010 to June 2015. The best-fit multivariate regression explained 96% of the variation of the Global Fund returns by allocating 34.9% to Vanguard Windsor II Fund, 25.5% to T. Rowe Price Blue Chip Growth Fund, and 39.6% to MFS Institutional

International Equity Fund. However, we have several concerns with using these historic estimates for the purpose at hand:

- a. There is a risk of “over-fitting” which means the historical period may be well explained by a statistical model, but forward-looking applications of the statistical model can be less robust. The risk of over-fitting increases if the economic and financial environment changes materially going forward compared to the estimation period.
  - b. In recent years Global Equity managers as a group have produced strong returns by taking advantage of unsynchronized economic recoveries and disparate returns across the U.S. and foreign stock markets. Each NC 401(k) / NC 457 Global Equity investment manager has had material active country allocations over the period analyzed. At times, particularly since 2013, they have over-weighted the U.S. market relative to emerging markets and Continental European markets (i.e., when comparing their allocations to the MSCI ACWI benchmark).
  - c. For context, the regression suggests about a 60% weight to the U.S. market and 40% weight to Non-U.S. markets, while MSCI ACWI currently has about a 53% weight to the U.S. market and 47% weight to Non-U.S. markets.
  - d. The regression weights also tilt toward the Vanguard Windsor II Fund and tilt away from the T. Rowe Price Blue Chip Growth Fund. Intuitively, we would expect to equal weight U.S. Value and U.S. Growth exposures over time to ensure an unbiased blend of style exposures for the U.S. market component of the “Global Fund” in the NC 403(b) Program.
3. We believe that the mapping weights should reflect the index market weights to the U.S. market (i.e., 53%) and the Non-U.S. markets (i.e., 47%) and equal weighting to Value and Growth sectors within the U.S. The weights would then be (50% times 53%) for Vanguard Windsor II Fund; (50% times 53%) for T. Rowe Price Blue Chip Growth Fund; and 47% for MFS Institutional International Equity Fund. Using this approach creates a historical series of simulated “Global Fund” returns that explain about 97% of the variation in the NC 401(k) Global Fund returns; the two return series have a correlation of 98.3% and annualized tracking of 2.37%. See also Chart 2C in Appendix 2 for a graphical goodness of fit comparison. We believe this analysis supports Recommendation 3.

Appendix 3 contains the consolidated recommended Model Allocations for the NC 403(b) Program encompassing all of the foregoing analysis and Recommendations 1-3 above. **We recommend that the SRP Board use the tables in Appendix 3 to direct TIAA-CREF for the implementation of the Custom Portfolios.**

Please contact Mary Buonfiglio should there be any additional information Board members would like to receive before the November 12, 2015, meeting.

## Appendix 1: Supplemental Retirement Plans Authorized Model Allocations

The SRP Board has authorized a set of asset allocation models (“Model Allocations”) to be offered to participants of the Supplemental Retirement Plans. These models were designed to be sensitive to:

1. **Risk Tolerance.** Participants are able to select their risk tolerance from one of three levels Conservative, Moderate, and Aggressive.
2. **Investment Horizon.** For each of the three levels of Risk Tolerance, four investment horizon models have been selected. These investment horizon models become more conservative, with higher allocations to bonds and stable value investments, as the horizon becomes shorter. Each investment horizon model is designed to be consistent with the participants’ retirement date.

The Model Allocations are implemented by:

1. Utilizing the investment Options offered to the participants by the Supplemental Retirement Plans.
2. The Plans’ recordkeeper automatically allocates any participant contributions and distributions across the Options in each Model Allocation, in order to maintain the targeted allocation (described below). The recordkeeper rebalances the allocation across the Options back to the target allocation on a quarterly basis or more frequently if necessary due to market movements.

### Conservative Model Allocation

The objective of the Conservative Model Allocation is to achieve long-term growth in excess of inflation with a minimal risk of capital loss over a full market cycle.

Conservative	C01	C02	C03	C04
	0-5 Yrs	6-10 Yrs	11-15 Yrs	16+ Yrs
Large Cap Value	1%	2%	3%	3%
Large Cap Index	4%	4%	7%	8%
Large Cap Growth	1%	2%	3%	3%
Small / Mid Cap Value	2%	3%	5%	7%
Small / Mid Cap Index	0%	0%	0%	0%
Small / Mid Cap Growth	2%	3%	5%	7%
Global	6%	10%	15%	23%
International	3%	5%	7%	11%
International Index	0%	0%	0%	0%
Fixed Income	16%	14%	12%	10%
Fixed Income Index	17%	14%	13%	10%
Stable Value	40%	35%	22%	10%
Inflation Sensitive	8%	8%	8%	8%

### Moderate Model Allocation

The objective of the Moderate Model Allocation is moderate growth of principal with limited downside risk over a market cycle.

Moderate	M01	M02	M03	M04
	0-5 Yrs	6-10 Yrs	11-15 Yrs	16+ Yrs
Large Cap Value	2%	3%	4%	5%
Large Cap Index	5%	7%	7%	10%
Large Cap Growth	2%	3%	4%	5%
Small / Mid Cap Value	4%	5%	7%	10%
Small / Mid Cap Index	0%	0%	0%	0%
Small / Mid Cap Growth	4%	5%	7%	10%
Global	11%	15%	19%	25%
International	6%	7%	9%	12%
International Index	0%	0%	0%	0%
Fixed Income	13%	12%	10%	4%
Fixed Income Index	13%	13%	10%	5%
Stable Value	31%	21%	14%	5%
Inflation Sensitive	9%	9%	9%	9%

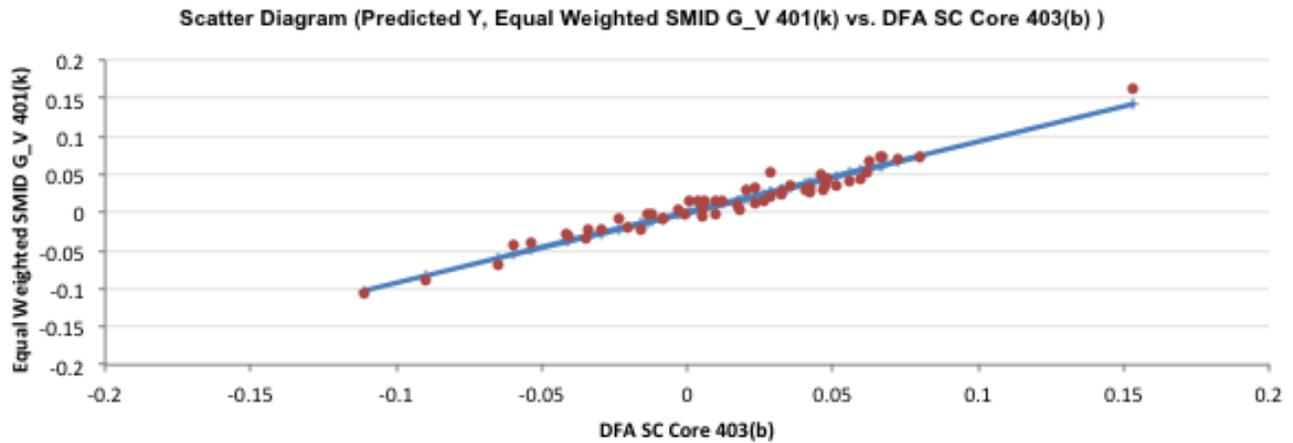
### Aggressive Model Allocation

The primary investment objective of the Aggressive Model Allocation is to maximize growth of principal over the long term with a reasonable level of overall volatility.

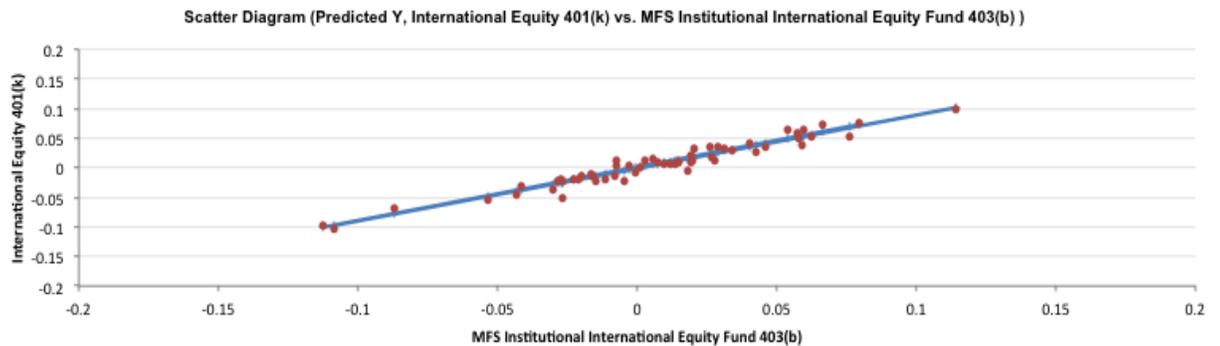
Aggressive	A01	A02	A03	A04
	0-5 Yrs	6-10 Yrs	11-15 Yrs	16+ Yrs
Large Cap Value	3%	4%	5%	6%
Large Cap Index	7%	7%	8%	11%
Large Cap Growth	3%	4%	5%	6%
Small / Mid Cap Value	6%	7%	9%	11%
Small / Mid Cap Index	0%	0%	0%	0%
Small / Mid Cap Growth	6%	7%	9%	11%
Global	16%	19%	24%	30%
International	8%	9%	12%	15%
International Index	0%	0%	0%	0%
Fixed Income	12%	10%	5%	0%
Fixed Income Index	12%	10%	6%	0%
Stable Value	17%	13%	7%	0%
Inflation Sensitive	10%	10%	10%	10%

## Appendix 2: Statistical Supplement

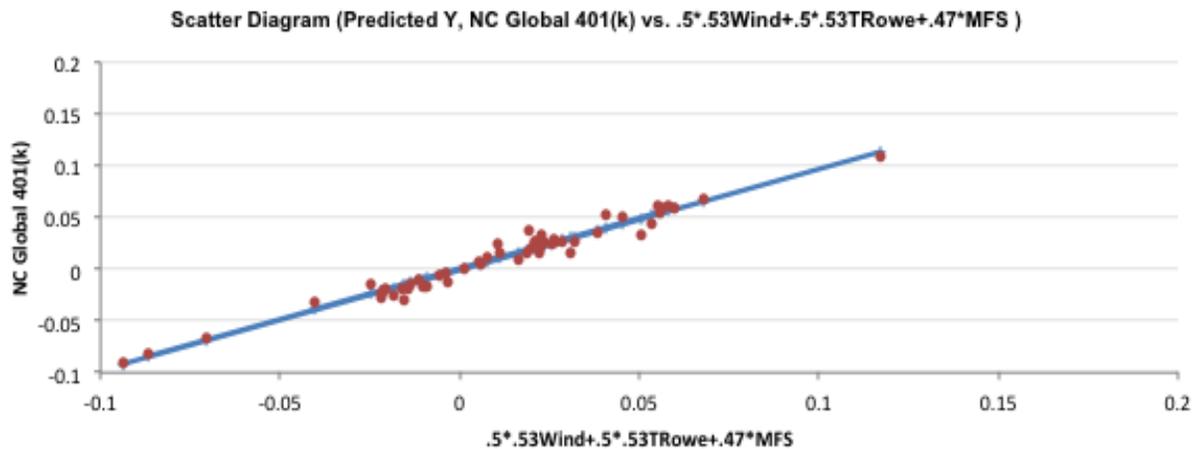
### Chart 2A: Predicted NC 401(k) SMID Monthly Returns for October 2010 to June 2015



### Chart 2B: Predicted NC 401(k) International Equity Monthly Returns for October 2010 to June 2015



### Chart 2C: Predicted NC 401(k) Global Equity Monthly Returns for December 2010 to June 2015



### Appendix 3: NC 403(b) Program Recommended Model Allocations

We recommend the SRP Board direct TIAA-CREF to use the following tables for the Custom Portfolios.

#### NC 403(b) Program Conservative Model Allocation

The objective of the Conservative Model Allocation is to achieve long-term growth in excess of inflation with a minimal risk of capital loss over a full market cycle.

Conservative	C01	C02	C03	C04
	0-5 Yrs	6-10 Yrs	11-15 Yrs	16+ Yrs
Vanguard Windsor II	3%	5%	7%	9%
Vanguard 500 Index	4%	4%	7%	8%
T. Rowe Price Blue Chip Growth	3%	5%	7%	9%
DFA Small Cap Core	4%	6%	10%	14%
Global				
MFS Institutional International Equity	6%	10%	14%	22%
J.P. Morgan Core Bond	16%	14%	12%	10%
Vanguard Total Bond Market Index	17%	14%	13%	10%
TIAA Stable Value	40%	35%	22%	10%
PIMCO Inflation Responsive Multi-Asset	8%	8%	8%	8%

#### NC 403(b) Program Moderate Model Allocation

The objective of the Moderate Model Allocation is moderate growth of principal with limited downside risk over a market cycle.

Moderate	M01	M02	M03	M04
	0-5 Yrs	6-10 Yrs	11-15 Yrs	16+ Yrs
Vanguard Windsor II	5%	7%	9%	12%
Vanguard 500 Index	5%	7%	7%	10%
T. Rowe Price Blue Chip Growth	5%	7%	9%	12%
DFA Small Cap Core	8%	10%	14%	20%
Global				
MFS Institutional International Equity	11%	14%	18%	24%
J.P. Morgan Core Bond	13%	12%	10%	4%
Vanguard Total Bond Market Index	13%	13%	10%	5%
TIAA Stable Value	31%	21%	14%	5%
PIMCO Inflation Responsive Multi-Asset	9%	9%	9%	9%

## NC 403(b) Program Aggressive Model Allocation

The primary investment objective of the Aggressive Model Allocation is to maximize growth of principal over the long term with a reasonable level of overall volatility.

Aggressive	A01	A02	A03	A04
	0-5 Yrs	6-10 Yrs	11-15 Yrs	16+ Yrs
Vanguard Windsor II	7%	9%	11%	14%
Vanguard 500 Index	7%	7%	8%	11%
T. Rowe Price Blue Chip Growth	7%	9%	11%	14%
DFA Small Cap Core	12%	14%	18%	22%
Global				
MFS Institutional International Equity	16%	18%	23%	29%
J.P. Morgan Core Bond	12%	10%	5%	0%
Vanguard Total Bond Market Index	12%	10%	6%	0%
TIAA Stable Value	17%	13%	7%	0%
PIMCO Inflation Responsive Multi-Asset	10%	10%	10%	10%