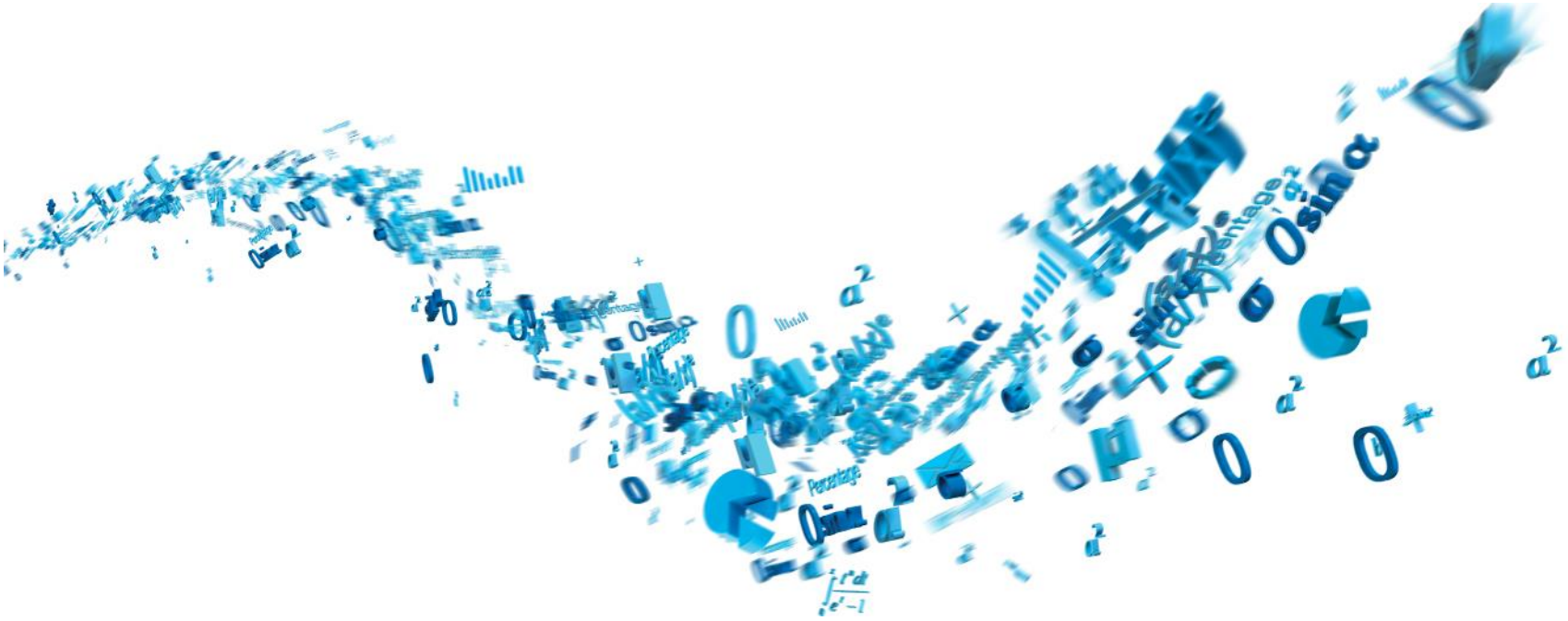


Thrift Savings Plan – Board Presentation
Lifecycle Fund Asset Allocation

September 17, 2018

Agenda Slide

Executive Summary

Scope of Study

The FRTIB hired Aon to complete the 2018 annual L-Funds glide path asset allocation study.

Retirement Adequacy

The desired outcome is to create a series of L Funds such that an "average participant" in those L Funds, in combination with the FERS defined benefit plan and Social Security, will be projected to have sufficient assets to maintain a reasonable standard of living throughout retirement.

Glide Path

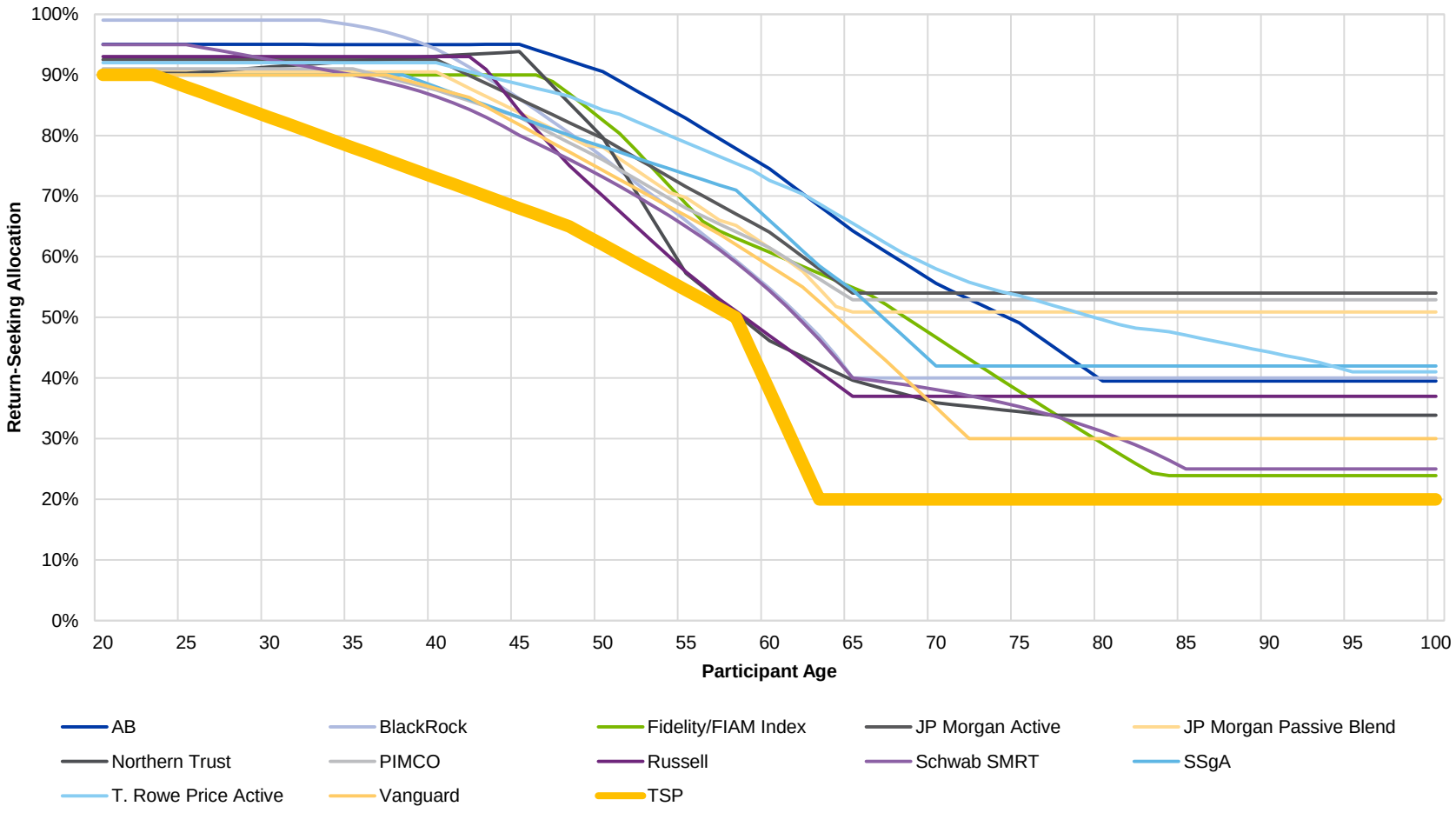
TSP's participant demographics suggest it is reasonable to increase the L Funds' glide path equity level. Aon recommends phasing into any equity allocation increases over time systematically to improve long-term risk-reward outcomes for participants. Aon suggests that Transitional A is the optimal implementation.

Investment Structure

Aon's analysis suggests increasing the proportion of equities allocated to the I Fund (non-US) from 30% to 35% could improve the risk-reward outcome for participants.

Agenda Tracker

Current L Funds Compared to a Glide Path Universe



Plan-Specific Factors that Affect the Appropriate Level of Risk

Factor	Description
Existence of a defined benefit plan	A defined benefit plan is a low risk retirement vehicle, so having one can allow more risk to be taken in the DC plan to balance the portfolio. Plan sponsors should also consider the generosity of the plan and the likelihood that participants will be in it for a large portion of their careers.
Employee stock ownership plan	If participants have significant assets in employee stock purchase plans, they would have a lower tolerance for risk in the target date funds.
Income predictability	Participants with higher income predictability (e.g. minimal variable compensation, low risk of layoffs) may be able to take more risk in the target date funds because they have less risk in their "human capital." This factor will likely be associated with industry and job role—e.g. jobs in government and education may have higher income predictability.
Population longevity	Groups with higher longevity can tolerate more risk at each age. To keep it simple and low cost, we would focus on gender distributions and blue/white collar.
Typical retirement ages	Earlier than average retirement ages imply a higher risk portfolio at the retirement date because it is associated with a younger age. This is usually immaterial except in extreme cases (e.g. firefighters who retire before age 50).
Market views	Plan sponsors with bullish long-term market outlooks will likely tolerate more risk. Most plan sponsors want to be close to market consensus for this category, but some investment managers building target date fund products have more extreme views.
Level of risk aversion	A higher or lower level of risk aversion within the population might influence the preferred level of risk in the glide path. Most plan sponsors want to be close to market consensus for this category, but some investment managers building target date fund products have more extreme views.
Level of risk in current target date fund	The level of risk in the current target date fund might influence the desired level of risk in a custom target date fund, to the extent that the plan sponsor wants to maintain a similar level of risk.

Agenda Tracker

Modeled TSP Glide Paths

Changes Modeled	Model Inputs
No Change	Current Glide Path
Equity Structure	Increase non-US equity to 35% of total equity
Parallel Equity Increase	Increase total equity by 5% and increase Non-US equity from 30% to 35% of total equity
Steepen Glide Path Slope	Steepen slope (increase total equity): 2050 +10%, 2040 +12%, 2030 +5%, 2020 and Income unchanged and increase Non-US equity from 30% to 35% of total equity
Transitional "To"	***A*: Increase total equity: 99% until age 35, 60% at age 58, 30% at age 63 and increase Non-US equity from 30% to 35% of total equity**
Transitional "Through"	*B:* Increase total equity: 99% until age 35, 60% at age 58, 40% at age 63, steadily reduce equity for 9 years beyond first withdrawal and increase Non-US equity from 30% to 35% of total equity
Transitional "Through"	*C:* Increase total equity: 99% until age 35, 65% at age 58, 40% at age 63, steadily reduce equity for 9 years beyond first withdrawal and increase Non-US equity from 30% to 35% of total equity
2018 to 2033 Implementation	**Freeze total equity allocations for L 2030, L 2040, L 2050 until transitional glide path A, B, or C intercepts with L 2060 and increase Non-US equity from 30% to 35% of total equity**

Yellow boxes: Current 2018 implementation considerations

Red box: Future-State considerations

*Aon modeled several other alternatives shown in the appendix
** The DOL requires a QDIA be a mix of stocks and bonds, therefore an equity cap of 99% and floor of 1% is required to maintain a safe harbor status

Why a transitional Glide Path Implementation

- Employer populations can change over time, either by:
  - what benefits an employer offers different segments of the population, or
  - due to expansion through the inclusion of new/different job types

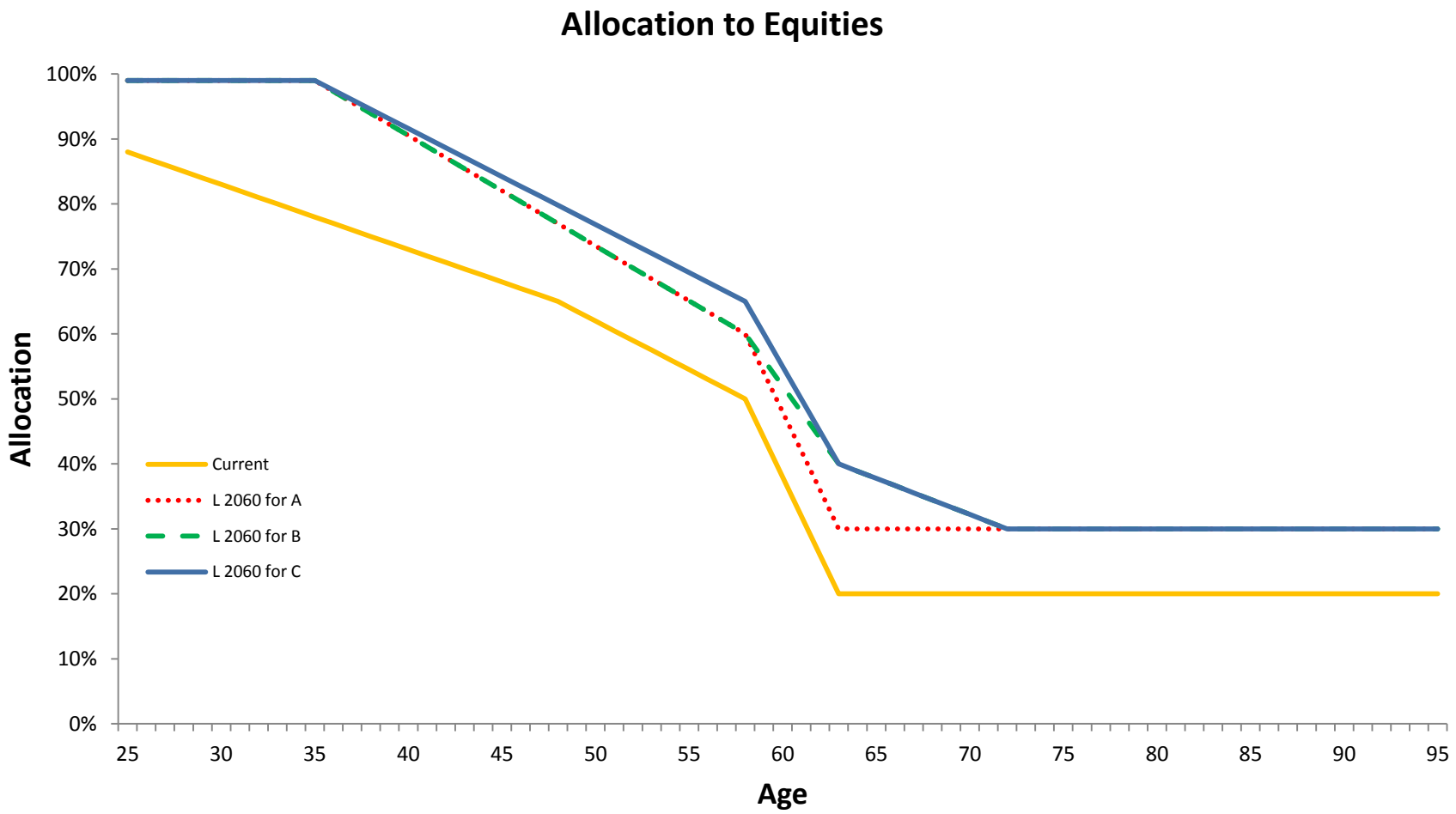
- Over the next few years the TSP will expand its eligible participant population.

- Glide paths offer **Vintages** which are portfolios designed for specific segments of the population that normally follow a predetermined repeatable path

- **Transitional glide paths** are a way to phase into a change in glide path shape. These changes can come in many forms, including:
  - Introducing new vintages over time (e.g. 5-year increments or new additions on the end)
  - Changing risk across the glide path

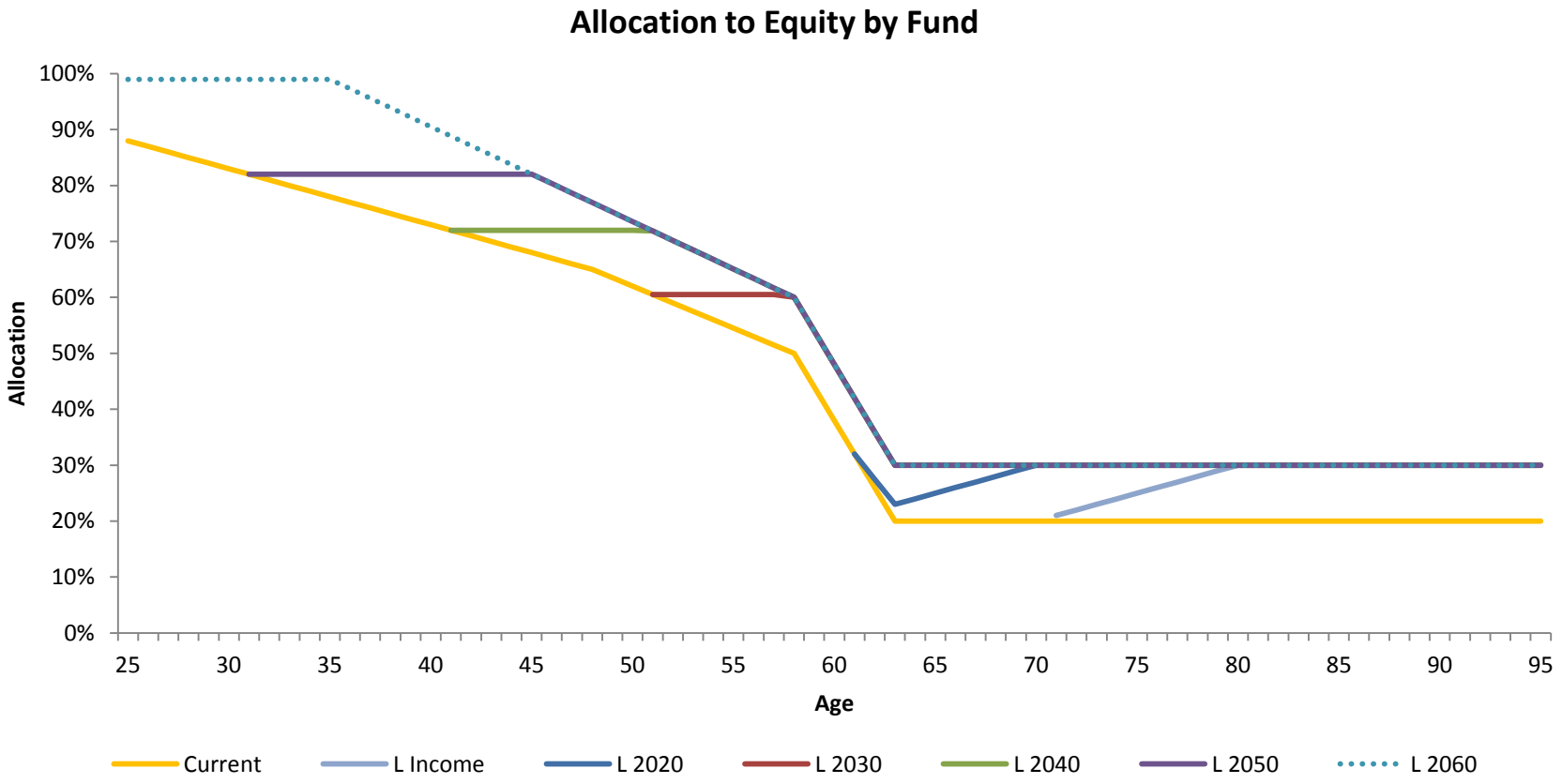
- The goal of transitional glide paths is to **systematically change a glide path's risk posture over time while minimizing short-term impacts on participants**

Comparison of Transitional Glide Paths Future State After Full Phase-in (L 2060 Vintage Example)



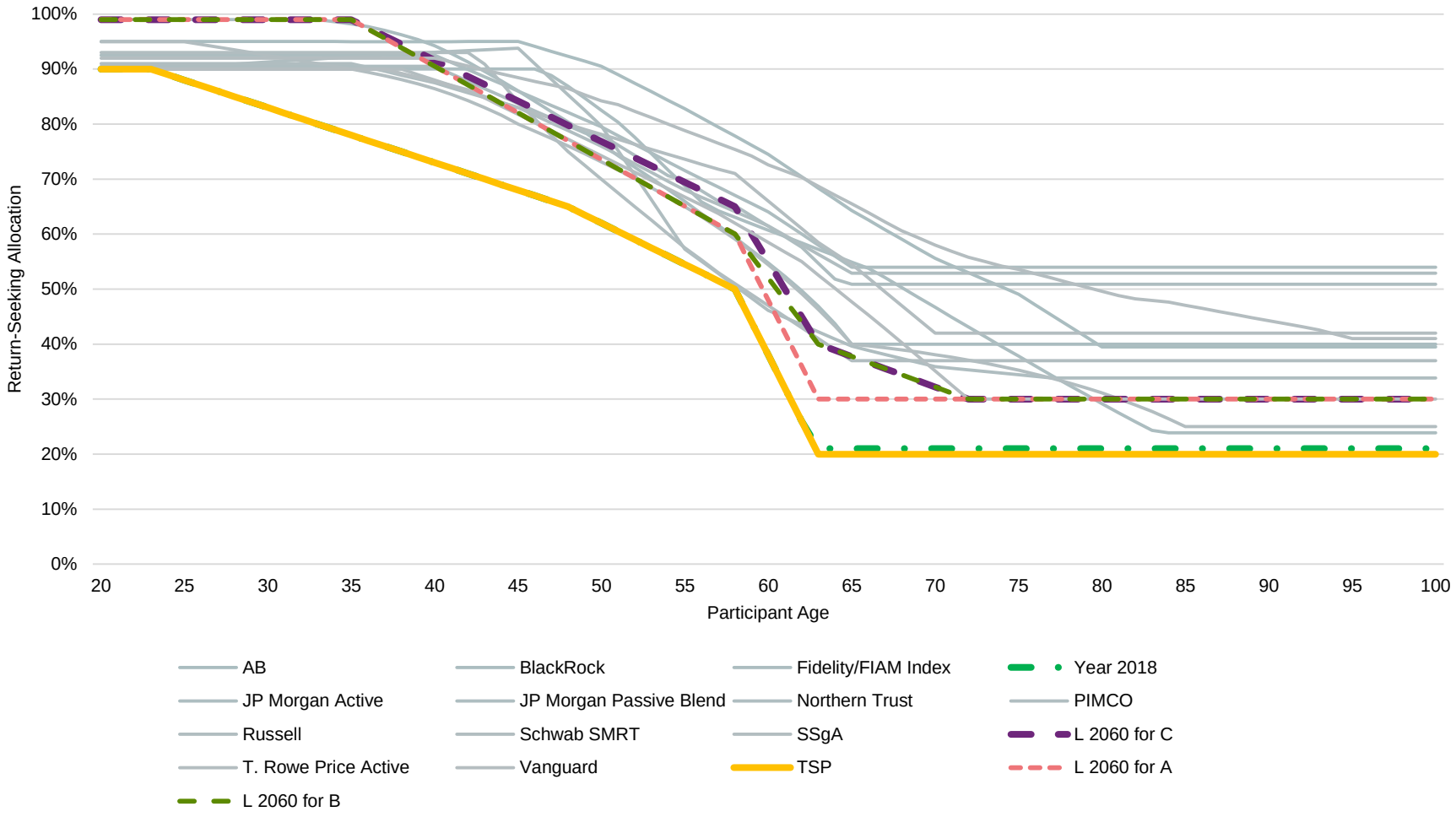
- The glide paths modeled phase into these future state by freezing total equity allocation until intercepting L 2060

Transitional A: “To” Glide Path



Overall: Increase total equity: 99% until age 35, 60% at age 58, 30% at age 63, and Increase Non-US equity from 30% to 35% of total equity

Transitional L Fund Glide Paths Compared to Market Universe



Agenda Tracker

Expected Returns and Risks (10-Year)

- We used our 10-year capital market assumptions as of 2/28/2018 to calculate expected return and volatility for TSP core funds.

	Geometric Return	Standard Deviation	Geometric Return (Previous Study)	Standard Deviation (Previous Study)
C Fund: Large Cap Equity	6.2%	17.0%	6.1%	18.1%
S Fund: Small Cap Equity	6.3%	23.0%	6.5%	22.1%
I Fund: International Equity (Dev & EM)	7.7%	20.5%	7.1%	20.3%
F Fund: Core Fixed Income	3.3%	4.0%	3.5%	5.3%
G Fund: Government Yield	3.0%	1.0%	3.5%	1.2%
Inflation	2.3%	1.5%	2.2%	

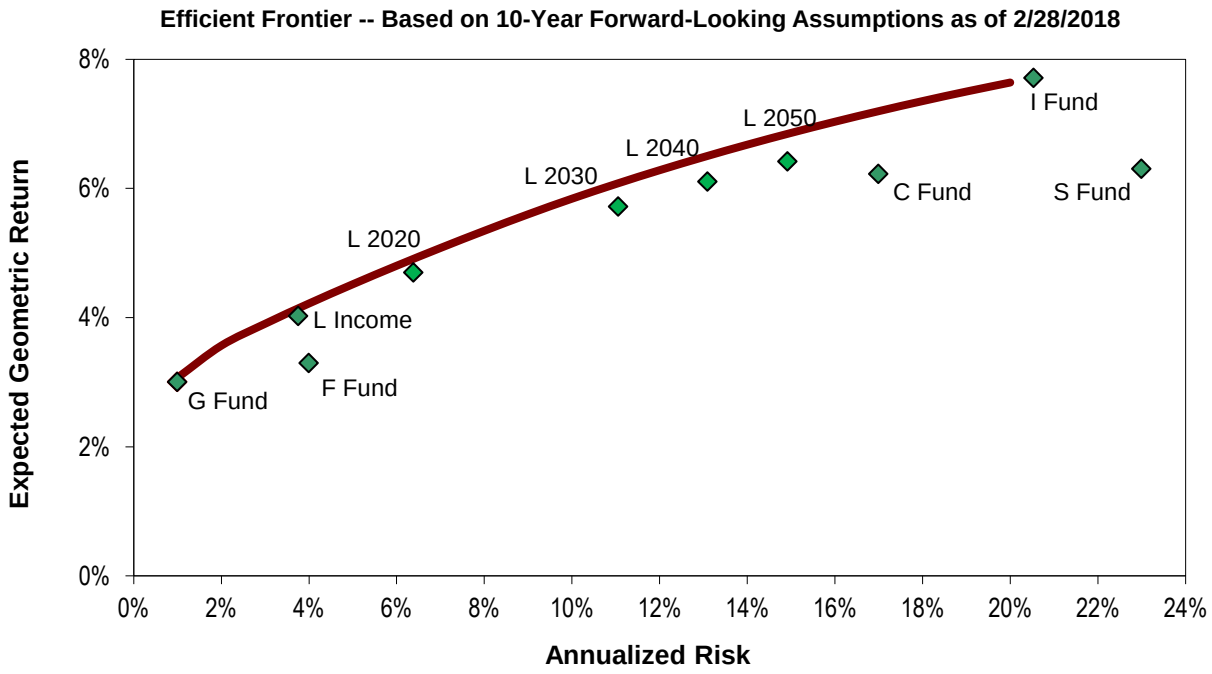
- We modeled the I Fund using 75% International Developed Equity and 25% Emerging Market Equity Allocation to approximate the MSCI ACWI ex-US index. In the previous study, the fund allocation was 100% International Developed Equity.
- For G Fund modeling, we used our projections for yields on 9 year duration Treasuries. Currently the duration on all outstanding Treasury bonds with 4 or more years to maturity is approximately 9 years.
- Our models project a higher expected return for the F fund (3.3%) than the G fund (3.0%), but with higher volatility. While underlying Treasury bonds for the G Fund have a higher duration than the F fund (9 years vs. 6 years), the U.S. Aggregate index is composed of 55% of corporate and securitized bonds that often have higher yields than a basket of U.S. Treasuries with 4 or more years to maturity.

Correlation Assumptions (10-Year)

- Based upon our 10-year capital market assumptions as of 2/28/2018.

	C Fund	S Fund	I Fund	F Fund	G Fund	Inflation
C Fund: Large Cap Equity	1.00	0.92	0.81	0.03	0.13	0.05
S Fund: Small Cap Equity		1.00	0.75	0.02	0.11	0.04
I Fund: International Equity (Dev & EM)			1.00	0.03	0.10	0.08
F Fund: Core Fixed Income				1.00	0.05	0.16
G Fund: Government Yield					1.00	0.56
Inflation						1.00

Efficient Frontier



L 2040 Fund Demographics

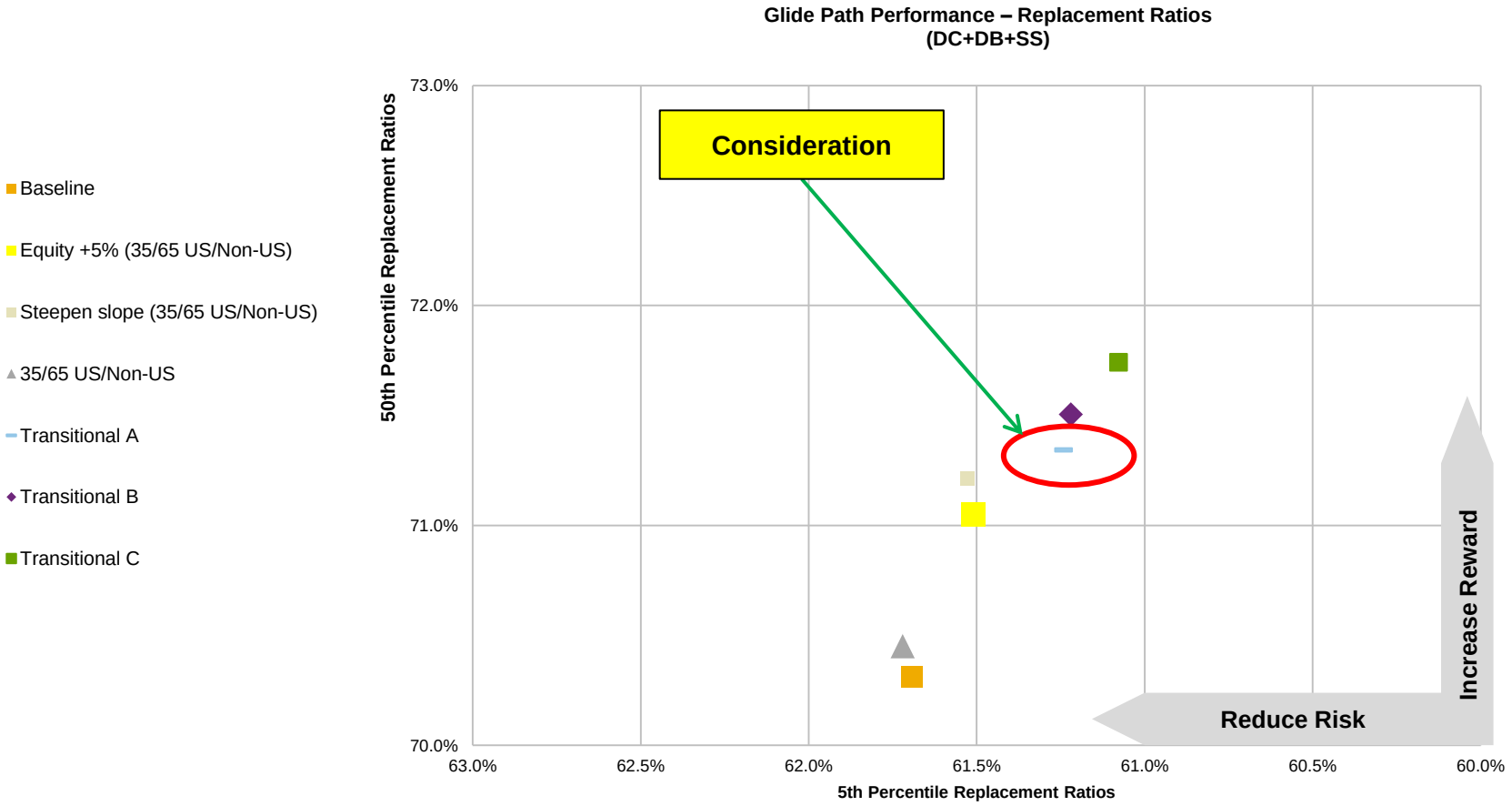
- Aon is using the L 2040 Fund along with average TSP participant data for simulation purposes within our analysis.

	2040		Prior Study
Age on July 1, 2018	41		Varies
Retirement Age	62		62
Age at First Withdrawal	63		62
Salary on July 1, 2018	$82,713		Varies
DC Balance on July 1, 2018	$109,553		Varies
Average Deferral Rates	**Employee**	**Employer**	**Employee smoothed[1] / raw**
< 26	-	-	n/a
26 - 35	-	-	5.5% / 6.2%
36 - 45	6.8%	5.0%	6.3% / 7.2%
46 - 55	7.9%	5.0%	7.1% / 8.2%
56 - 61	9.8%	5.0%	8.8% / 10.4%
62 +	0.0%	0.0%	

[1]The smoothed average deferral rates from the prior study are the three-year average of rates used for the model participants. The raw rates are the rates based on participant data from 2016.

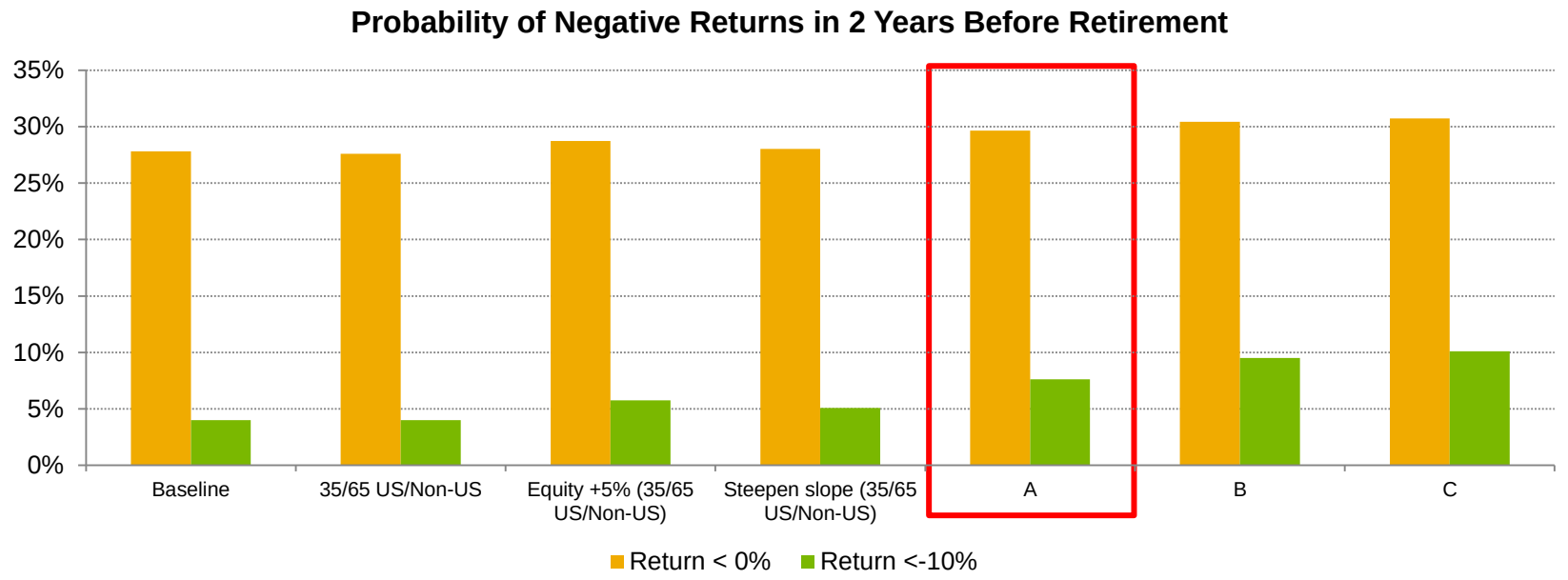
Glide Path Performance—Replacement Ratios
(L 2040 Model Participant with DC+DB+SS)

Pre-retirement metric of expected (50th percentile) replacement ratio balance, versus downside (5th percentile) replacement ratio, as a multiple of final pay



The glide paths with higher total equity allocations have better expected outcomes for participants, while also having higher risk.

Glide Path Performance—Short-Term Investment Risk
(L 2040 Model Participant)



Models	No Change	EQ Structure	Increase Total Equity		Transitional Glide Paths		
Changes	Baseline	Increase Non-US EQ	5%	Steepen Slope	A	B	C
Return < 0%	28%	28%	29%	28%	30%	30%	31%
Return <-10%	4%	4%	6%	5%	8%	10%	10%

The glide paths with higher total equity allocations near retirement have a higher risk of poor performance in the years leading up to retirement.

Results: 2040 Fund for the Transitional Glide Paths

Expected Account Balance Depletion Ages

Confidence	Baseline	Transitional A	Transitional B	Transitional C
95%	**75**	**75**	**75**	74
75%	80	**81**	**81**	**81**
50%	86	89	**90**	**90**

Probability of Depleting Assets by Age

Age	Baseline	Transitional A	Transitional B	Transitional C
Age 80	25%	21%	**20%**	**20%**
Age 90	62%	53%	51%	**50%**
Median LE	61%	51%	50%	**49%**

Real Account Balance at Withdrawal

Percentile	Baseline	Transitional A	Transitional B	Transitional C
5%	**$397,839**	$385,243	$384,366	$378,152
25%	$531,144	$538,994	**$541,613**	$540,757
50%	$656,700	$687,389	$691,352	**$698,417**
75%	$818,950	$892,144	$899,292	**$916,310**
95%	$1,165,276	$1,323,726	$1,344,489	**$1,383,215**

Results: 2040 Fund for the Transitional Glide Paths

Probability of Negative Returns in 2 Years Before Retirement

	Baseline	Transitional A	Transitional B	Transitional C
Return < 0%	28%	30%	30%	31%
Return <-10%	4%	8%	10%	10%

Replacement Ratio at Withdrawal (DC only)

Percentile	Baseline	Transitional A	Transitional B	Transitional C
5%	13%	13%	13%	13%
25%	18%	18%	18%	18%
50%	22%	23%	23%	23%
75%	27%	30%	30%	30%
95%	39%	44%	44%	46%

Replacement Ratio at Withdrawal (DC+DB+SS)

Percentile	Baseline	Transitional A	Transitional B	Transitional C
5%	62%	61%	61%	61%
25%	66%	66%	66%	66%
50%	70%	71%	72%	72%
75%	76%	78%	79%	79%
95%	87%	92%	93%	94%

Probability of Real Decline in Account Balance in the 2 Years Before Retirement

	Baseline	Transitional A	Transitional B	Transitional C
Probability	11%	11%	12%	12%

Agenda Tracker

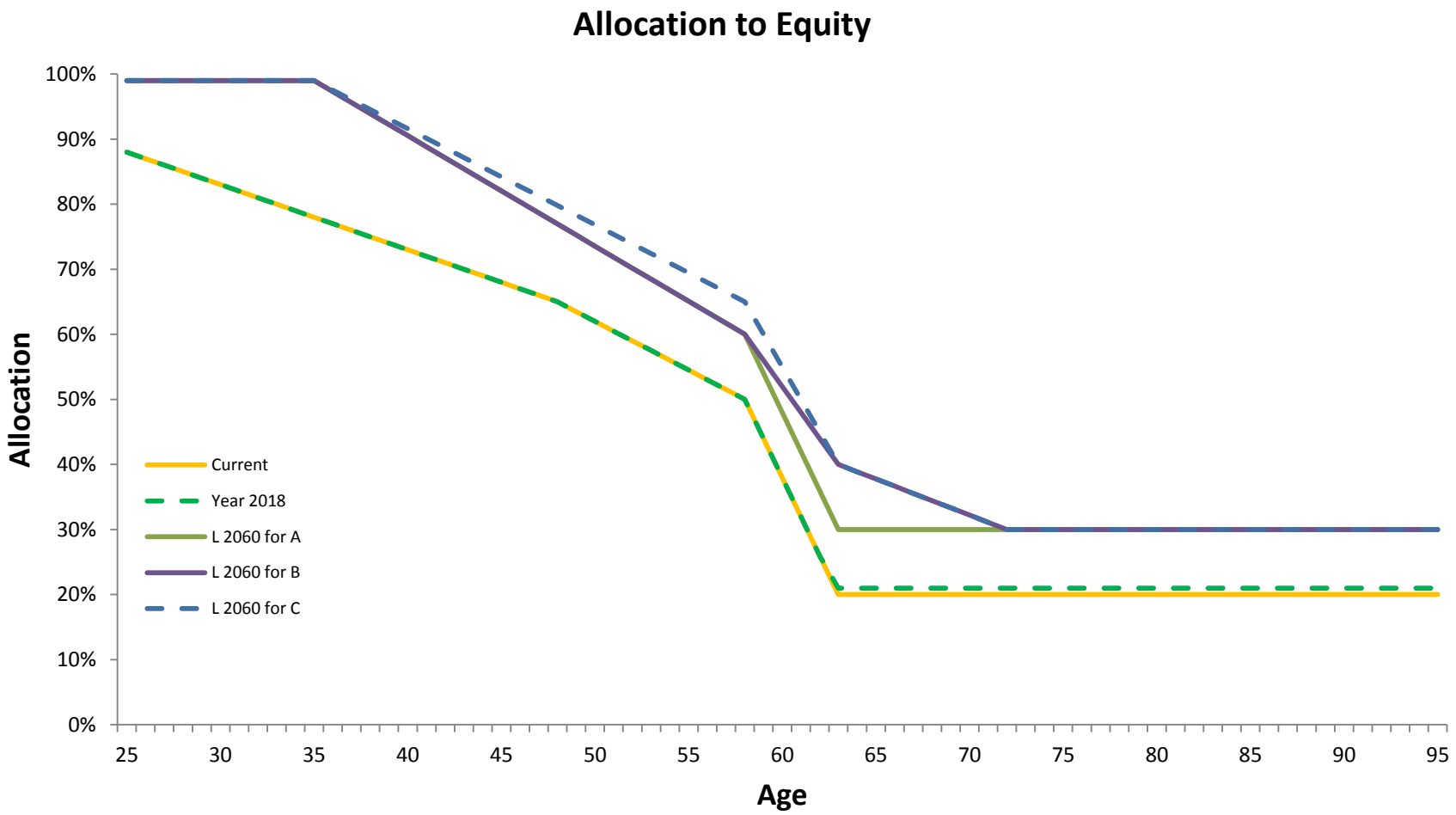
Phasing into Changes

- The Transitional glide paths reflect a phasing-in approach to equity allocations
  - Aon recommends this as preferable implementation over making large allocation changes at a single time

- Aon's suggested approach modeled freezes total equity allocations for L 2050, L 2040, L 2030 until intercepting Transitional A, B, or C L 2060. For L Income, the total equity allocation increases 1% a year over the next 10 years. L 2020 rolls into L Income in year 2020.
  - Faster or slower transitioning could be decided over time during the L Funds annual asset allocation process.

- Aon recommends that TSP continues to evaluate the pace of the transition over time during its normally scheduled L Fund asset allocation review process.
  - This would reduce the likelihood of annual decisions being subject to market timing or sentiment
  - It would mean that changes to the plan, though possible, would be subject to a higher hurdle of analysis, similar to how TSP has historically maintained the same glide path unless there was high conviction to make changes
  - Reasonable periods of transition could be anywhere from 4-15 years depending on the pacing schedule for each L Fund.

2018 L Fund Asset Allocation Considerations



Aon's 2018 L Fund Asset Allocation Recommendations

TSP Fund	C-Fund	S-Fund	I-Fund	F-Fund	G-Fund
L 2050					
Current	43.22%	14.18%	24.60%	6.65%	11.35%
Proposed	40.13%	13.17%	28.70%	6.65%	11.35%
Change	-3.09%	-1.01%	4.10%	0.00%	0.00%
L 2040					
Current	38.64%	11.76%	21.60%	7.15%	20.85%
Proposed	35.88%	10.92%	25.20%	7.15%	20.85%
Change	-2.76%	-0.84%	3.60%	0.00%	0.00%
L 2030					
Current	32.99%	9.36%	18.15%	6.81%	32.69%
Proposed	30.63%	8.69%	21.18%	6.81%	32.69%
Change	-2.36%	-0.67%	3.03%	0.00%	0.00%
L 2020					
Current	17.76%	4.64%	9.60%	6.40%	61.60%
Proposed	16.49%	4.31%	11.20%	6.40%	61.60%
Change	-1.27%	-0.33%	1.60%	0.00%	0.00%
L Income					
Current	11.20%	2.80%	6.00%	6.00%	74.00%
Proposed	10.92%	2.73%	7.35%	5.92%	73.08%
Change	-0.28%	-0.07%	1.35%	-0.08%	-0.92%

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Eric leads the firm's U.S. efforts in developing intellectual capital to improve its investment advice to institutional investors. He oversees the preparation of many of the firm's key white papers and innovations, including helping to implement many of them in client portfolios. Eric also leads AHIC's glide path construction efforts custom target date funds and develops much of its intellectual capital.

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Bill has over 15 years of investment management and operational procedures. He has seven defined contribution plan clients with combined assets over $700 billion representing over 60 million participant lives. Bill is also the head of AHIC's Qualified Default Investment Alternative (QDIA) research team and Custom DC Solutions team.