OLIVER WYMAN

CRSB RETIREMENT PROGRAM FINANCIAL FEASIBILITY ANALYSIS
RESULTS

NOVEMBER 4, 2015

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Context and agenda

Context

- The Connecticut legislature has charged the Connecticut Retirement Securities Board (CRSB) with exploring the establishment of a retirement program for employed individuals who are currently not covered by a workplace retirement plan
- Mercer and Oliver Wyman are assisting the CRSB with developing the program structure and assessing its financial feasibility to recommend to the state legislature
- This document provides our findings with respect to the financial feasibility of the strawman program based on the following
  - Mercer strawman program description
  - BC Center for Retirement research on employee opt-out and contribution rates
  - Preliminary discussions with 3rd party service providers
  - Oliver Wyman secondary research and financial modelling
- The findings represent our best professional view based on the available information regarding the potential program design, likely expected employee participation and market proxies for administrative program expenses
- We encourage the CSRB to adjust the strawman program expense structure as details of the program are further refined and additional information becomes available

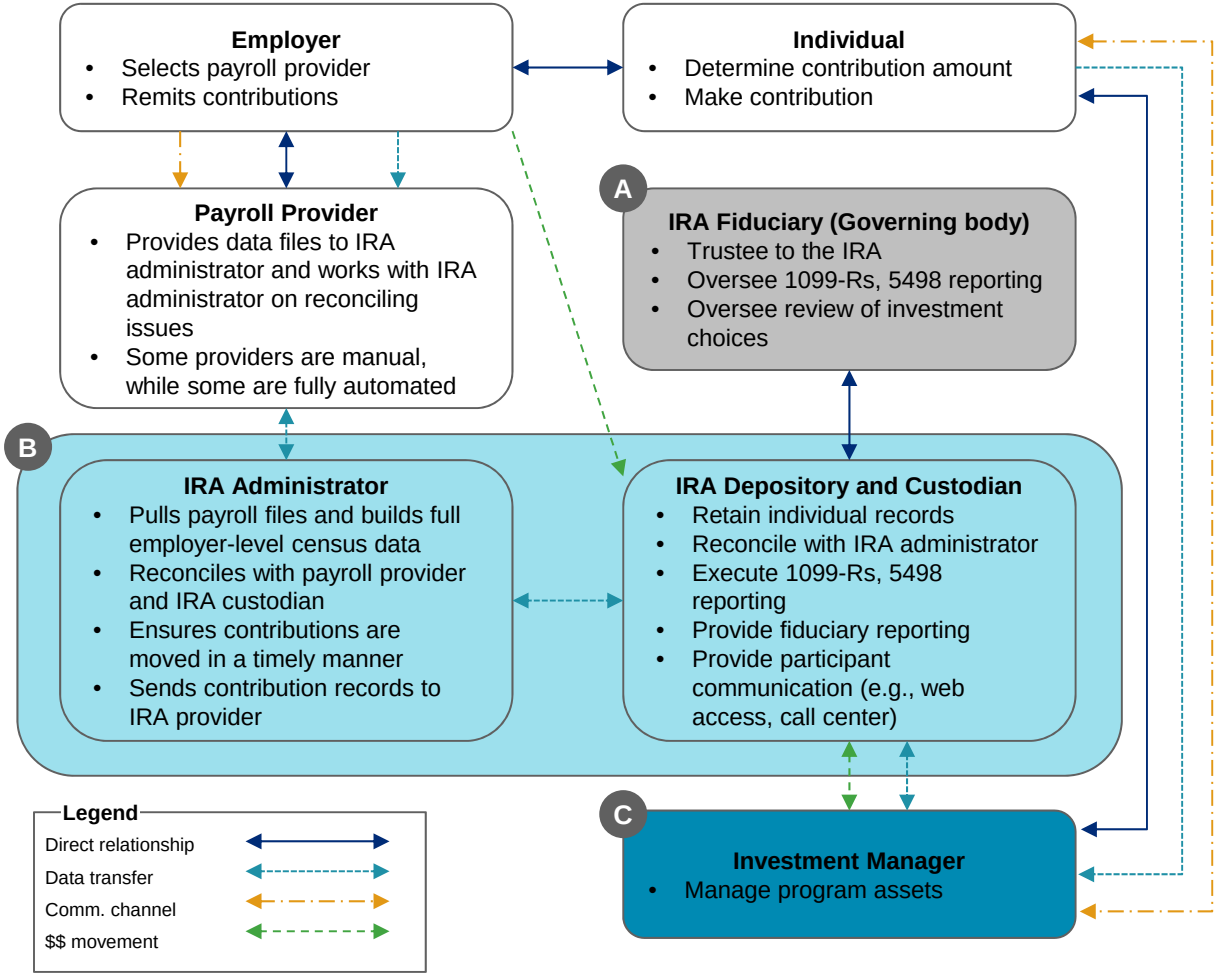
Agenda

1. Summary findings
2. Financial feasibility analysis approach
3. Base scenario
4. Bear scenario
5. Break-even analysis
6. Key takeaways

Next steps

- We will incorporate feedback from this discussion and issue a final report

Our financial feasibility analysis is based on the retirement program strawman developed by Mercer in concert with the CSRB



Key roles in model scope[1]

A IRA Fiduciary (Governing body)

- Program governance board will perform certain functions including program set-up and implementation, contracting for services with 3rd parties and ongoing monitoring and reporting, management of program expenses

B IRA Admin and Depository / Custodian

- IRA administrator / recordkeeper will provide a combination of services similar to those provided in direct and employer sponsored 529 plans, and 401(k) administration

C Investment manager

- Investment manager provides a suitable range of low cost, passive target date funds for different age segments

1. The strawman roles are based on the model observed in the analogous 529 direct program market for low cost providers and discussions with a limited set of providers. There may be other configurations and third party providers in the market that could provide a combination of IRA admin / recordkeeping and investment management services

We used a three-part test to assess financial feasibility of the strawman retirement program

Criteria for assessing program feasibility	Meets feasibility condition	Summary findings / comments
Self-funding *Program fees can cover the upfront investment and ongoing administration costs the state incurs*	✓	• The state must cover start-up costs (estimated to be $1-2MM) to establish a governance board, and pay for legal and contracting fees and other administrative costs, and for ongoing expenses (estimated at $500K per year) within a reasonable time period • Service providers indicate the willingness to cover upfront costs associated with their capability build-out, so the state will not be liable for those additional costs • In our base case projection, the program will generate sufficient fees to reimburse the state's initial outlay within 5 years and cover ongoing expenses by the second year
Attractive to service providers *Fees generated by program provide a fair economic return to service providers*	✓	• Potential service providers have indicated a desire to participate in supporting the strawman program • While not a large list, there are several providers that have existing capabilities that can be leveraged to support the program (e.g. employer and participant communications, fulfilment and on-boarding, call center and website support, record keeping, custody and investment management) • Compared to 529 plans, the program economics appear comparable if not superior by Year 2 (i.e. viable 529 plans exist with fewer assets than we project in the base case), and very favorable thereafter, and hence be attractive to providers that currently serve that market
Attractive to participants *Services can be provided at a reasonable fee*	✓	• We expect total program fees can remain below 1%, and potentially start as low as 50 bp, and will therefore be sufficiently attractive to program participants • Additionally, Mercer is performing an income replacement analysis to assess the benefits of program participation at an individual level

Our analysis indicates the program is expected to be viable under a range of scenarios and assumptions for the key financial drivers

Overview of approach for assessing financial feasibility

1

Determine minimum viability threshold

- Defined as the lowest level of program assets that can support program administration expenses and provide an attractive return to third party service providers

2

Model base case financials

- Assess if/when the program achieves the minimum viability threshold

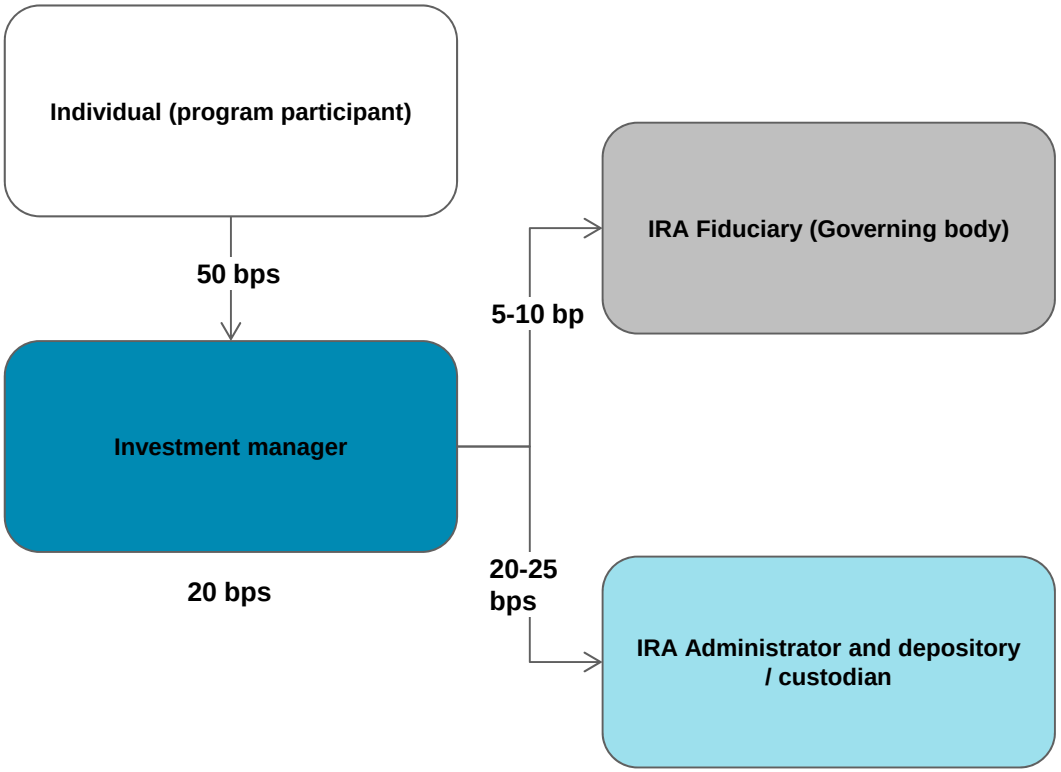
3

Model downside scenario financials

- Analyze bear scenarios using worst-case assumptions to determine if/when the program achieves the minimum viability threshold

We assume an investment wrap account structure with a single asset-based fee to pay for investment management, recordkeeping and administration

Illustrative program fee framework[1,2]



Comments

- The investment wrap account structure is a common vehicle used in 529 plans which face similar self-funding requirements
- In our base case, we have assumed the program will have a 50 bp all-in fee, which reflects the average of the 25 state 529 plans that do not have an account fee
- In this structure, 50 bp is deducted from plan assets on an annualized basis
- The investment manager rebates the governing body 5-10 bp (representing a typical 529 plan arrangement) and the IRA admin and depository / custodian receives 20-25 bp

1. Illustrative based on full fee payment to the investment manager who rebates other service provider and governing body
2. Appropriate accounting and structuring agreements to define payment flows, responsibilities and levels of protections still need to be established

Financial feasibility criteria: Self-funding

We estimate the program will need $1 BN in steady-state assets to be viable assuming $500K- $1 MM in ongoing admin expenses and a 5-10 bp fee

Ongoing expense assumption

- We have assumed ongoing expenses of $500K-1MM[1] per year to cover costs related to the state's program administration
  - 2-5 full time employees
  - Overhead, e.g., office space and supplies
  - 3rd party consultants, e.g., legal counsel

State rebate assumption

- 3RD party service providers for 529 direct plans typically rebate states 3-10 bp for program administrative expenses, with the average rebate ~5bp
- The CT program may require a higher or lower level of support than the average 529 plan

Minimum assets for program viability

- Assuming a 5 bp rebate and $500K in expenses would result in a $1BN minimum asset threshold
- Similarly, assuming a 10 bp rebate and $1MM in expenses would result in $1BN minimum asset threshold

Estimated minimum asset threshold

$1BN

The minimum asset threshold may ultimately be higher or lower depending upon the actual administrative costs and chosen fee level

1. We assume that enforcement of employer participation sits outside of the program

Financial feasibility criteria: Attractive to service providers

At $1BN, the program is expected to be attractive to 3rd party providers, assuming an overall program fee of 50 bp

There are examples of viable 529 programs with $1 BN in assets and similar fees

- We have assumed total program fees of 50 bps per year based on the average fee for state sponsored direct 529 plans without a per account fee
- At $1BN in assets, this implies 5MM per year to be split among the IM, IRA admin. and the state
- Five state 529 plans generate total fees ~$5MM per year or less (this represents 20% of plans in our sample population[1]) indicating the threshold would likely provide viable economics to a service provider

State	Assets	Avg fees (bps)	Fees per year
South Carolina	1,955,613,828	14	2,737,859
Oklahoma	683,232,331	55	3,757,778
Delaware	505,031,256	79	3,989,747
Georgia	1,506,628,047	32	4,821,210
Minnesota	1,097,194,549	47	5,156,814

The critical time period for achieving minimum viability varies for each stakeholder

- The State will want to be able to re-pay set-up costs and cover ongoing administrative expenses as soon as possible
- The typical contract term is 5-7 years. It will be critical for the IRA administrator / record keeper to achieve sufficient economics within this time frame or it may seek to renegotiate a higher fee
- Given limited support requirements from investment manager s, they are not likely to have as rigid a timeframe to achieve the minimum asset threshold; however, assets should be meaningful to garner sufficient attention and servicing

Role	Fee	Min $ fees criteria	Time criteria
Governing body (state)	5 -10 bps	$500K - $1MM	As soon as possible
IRA admin. and depository / custodian	20-25 bps	$2-2.5MM	Years 5-7
Investment manager	20 bps	$2MM	No set time criteria

The minimum asset threshold could be made lower through a higher initial fee structure (e.g. <100 bp) and still likely remain attractive to participants

1. Sample population includes state 529 plans with no per account fees;
Source: Morningstar

Our approach to modelling the financial feasibility of the strawman program is guided by three principles

Focus on key drivers

- Model the most important drivers that can be parameterized using available information

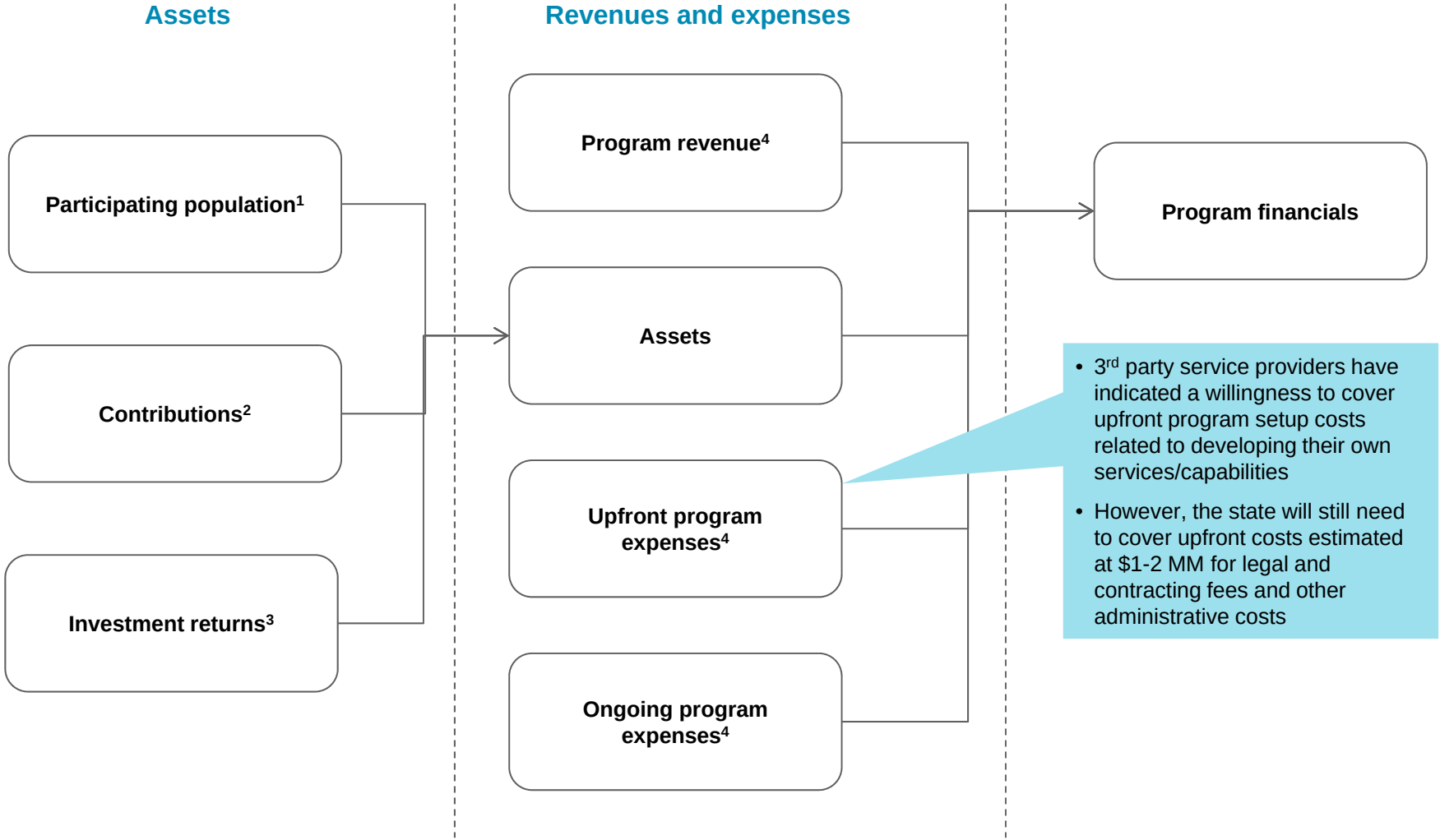
Use conservative assumptions

- Focus on downside risk to asset levels and program fees, as opposed to potential upside

Perform sensitivity analysis

- Use sensitivity analysis of key assumptions to stress test model outcomes to account for different potential scenarios

The model calculates assets, program revenues and program expenses under a range of different scenarios



Sources: 1. US Census Bureau for base population and covered vs. uncovered population, BC Center for Retirement Research for opt-out rates; 2. Based on BC Center for Retirement Research survey; 3. Mercer capital markets analysis; 4. Estimated based on state 529 plan market analysis and 3rd party service provider discussions

Projections are based on assigning assumptions for each of the key model drivers to 9 distinct cohorts and rolling those forward through time

Cohort designation process

- Each group of participants is assigned to a cohort based on their age and income segment
- The bounds of the income segments (low, mid, high) are dependant on the age of the participant
- Below is the output of the cohort designation process:

Assumptions for key drivers by cohort

- The mapping of groups to a cohort is important because many model assumptions are only available at the cohort level or higher, and are thus applied at the cohort level
- Below are the assumptions for key drivers as applied in the base scenario model:

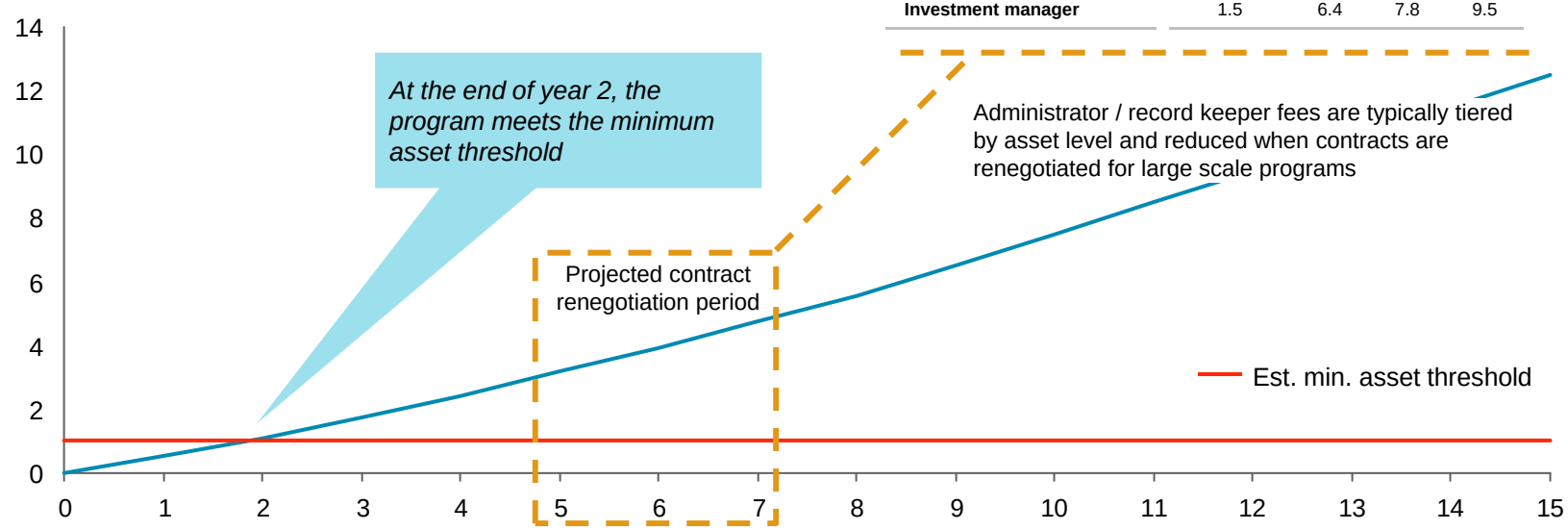
Cohort	Income level	Career level	Age min	Age max	Salary min ($thousands)	Salary max ($thousands)
Cohort 1	Low	25	18	30	13	20
Cohort 2	Low	40	30	50	14	29
Cohort 3	Low	55	50	65	15	36
Cohort 4	Mid	25	18	30	20	25
Cohort 5	Mid	40	30	50	29	50
Cohort 6	Mid	55	50	65	36	61
Cohort 7	High	25	18	30	25	138
Cohort 8	High	40	30	50	50	328
Cohort 9	High	55	50	65	61	319

Starting population (thousands)	Post-tax mean salary ($ thousands)	Opt out rates	Leakage	Contribution rate	Investment vehicle	Annual investment return
18	15	20%	1.5%	6.0%	Target date 25	6.4%
37	18	27%	1.5%	6.0%	Target date 40	6.3%
17	21	25%	1.5%	6.0%	Target date 55	5.3%
22	20	23%	1.5%	6.0%	Target date 25	6.4%
33	32	20%	1.5%	6.0%	Target date 40	6.3%
20	39	23%	1.5%	6.0%	Target date 55	5.3%
31	37	16%	1.5%	6.0%	Target date 25	6.4%
49	63	21%	1.5%	6.0%	Target date 40	6.3%
20	79	24%	1.5%	6.0%	Target date 55	5.3%

In the base scenario, program assets are estimated to meet the minimum asset threshold by the end of the second year

Base scenario assets (Target date fund)
$BN, by year (1-15)

	Fees by year ($MM)			
Role	**Min criteria**	**5**	**6**	**7**
Governing body	0.5	1.6	2.0	2.4
IRA admin. and dep. / cust.	3.0	8.0	9.8	11.9
Investment manager	1.5	6.4	7.8	9.5



Assets ($BN)	0.5	1.1	1.8	2.4	3.2	3.9	4.8	5.6	6.5	7.5	8.5	9.5	10.3	11.5	12.5
Accounts (K)	246	252	257	261	266	268	271	271	274	278	281	280	279	280	281
Per account ($K)	2	4	7	9	12	15	18	21	24	27	30	34	37	41	45

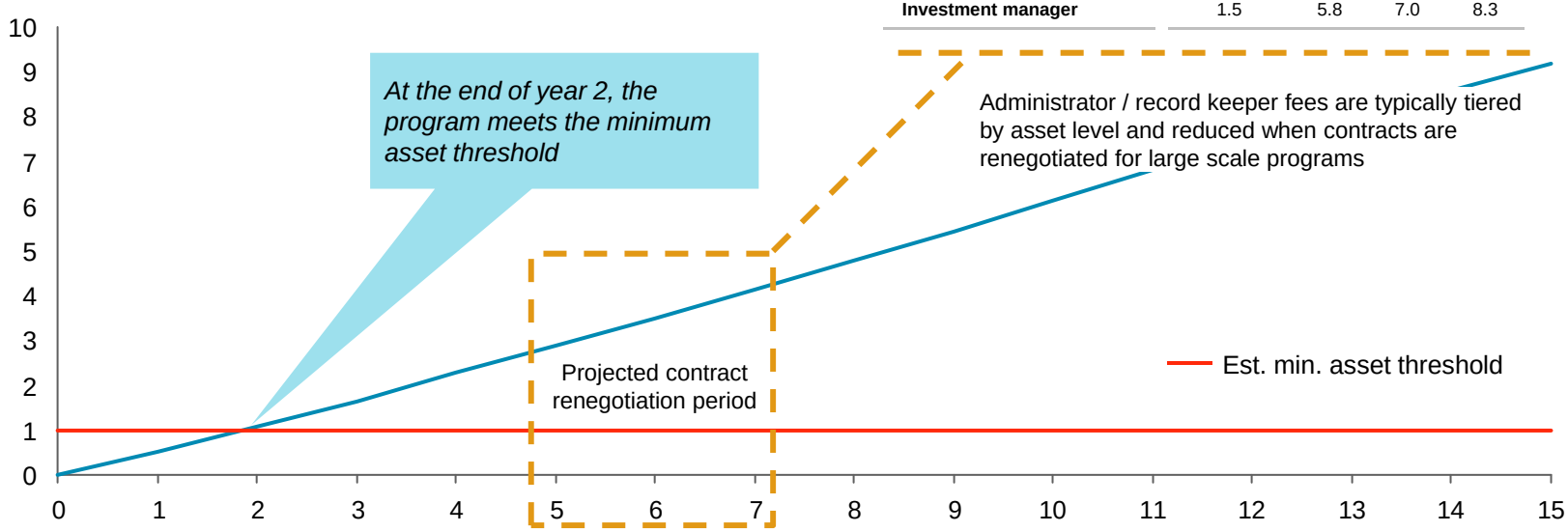
The program is also likely to be viable under a range of inputs for the key assumptions (see Appendix for sensitivity testing results)

Under a money market investment assumption, program assets are expected to meet the minimum asset threshold by the end of the second year

Base scenario assets (Money Market)

$BN, by year (1-15)

	Fees by year ($MM)			
Role	**Min criteria**	**5**	**6**	**7**
Governing body	0.5	1.5	1.8	2.1
IRA admin. and dep. / cust.	3.0	7.3	8.8	10.4
Investment manager	1.5	5.8	7.0	8.3



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Accounts (K)	246	252	257	261	266	268	271	271	274	278	281	280	279	280	281
Per account ($K)	2	4	6	9	11	13	15	18	20	22	24	27	29	31	33

We also tested the financial feasibility of the strawman program based on several 'bear' scenarios

Bear scenario approach

- The base scenario represents our view on the most likely path forward for the strawman program
- We also considered adverse scenarios to assess the program's financial feasibility under a composite of distressed assumptions
- In the bear scenarios, we apply multiple stresses to the program several ways
  - Certain stresses are applied for a single period, e.g., market shock
  - Other stresses are applied throughout the projection time horizon to individual assumptions for the model key drivers, e.g. lower participation due to an increased unemployment rate

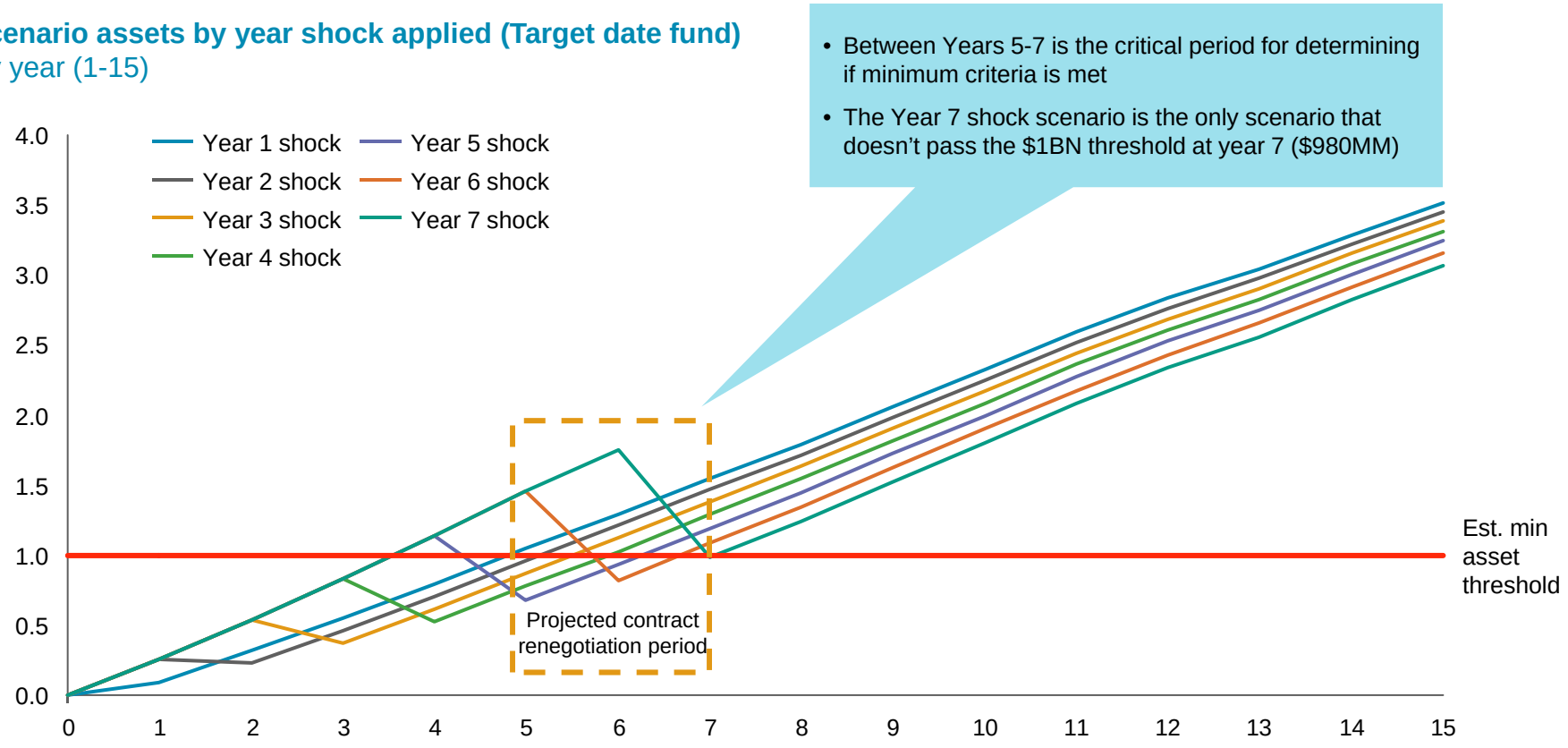
Bear scenario assumptions

- Employer non-participation rate is 48% based on BC Center for Retirement Research employer survey[1]
- Returns based on the 5th percentile of cumulative returns according to Mercer returns modelling (<3% annualized returns)
- Leakage rate doubles from 1.5% to 3% for the duration of the projection time horizon
- Increase in unemployment to the highest yearly rate since 1976 (9.3%) for the duration of the 15-year projection reduces program participation
- Application of a shock in a given year (we run 7 separate scenarios, each time applying the market shock to a different year for Years 1-7)
  - A significant market correction similar to that of the 2008 financial crisis, after which point returns revert to 5th percentile annualized cumulative return for the duration of the period
  - Upon market correction, 20% of the population exits the program, removes balances and does not re-enroll in the program
  - Contribution rates across the entire population decline by 50% (from 6% to 3%) in the year of the shock

[1] Note: Employer non-participation was not used in the base scenario due to lack of meaningful survey results according to the BC Center for Retirement Research

In some bear scenarios, program assets fall below the minimum threshold between years 5-7, but in all bear scenarios assets eventually recover

Bear scenario assets by year shock applied (Target date fund)
$BN, by year (1-15)



- Between Years 5-7 is the critical period for determining if minimum criteria is met
- The Year 7 shock scenario is the only scenario that doesn't pass the $1BN threshold at year 7 ($980MM)

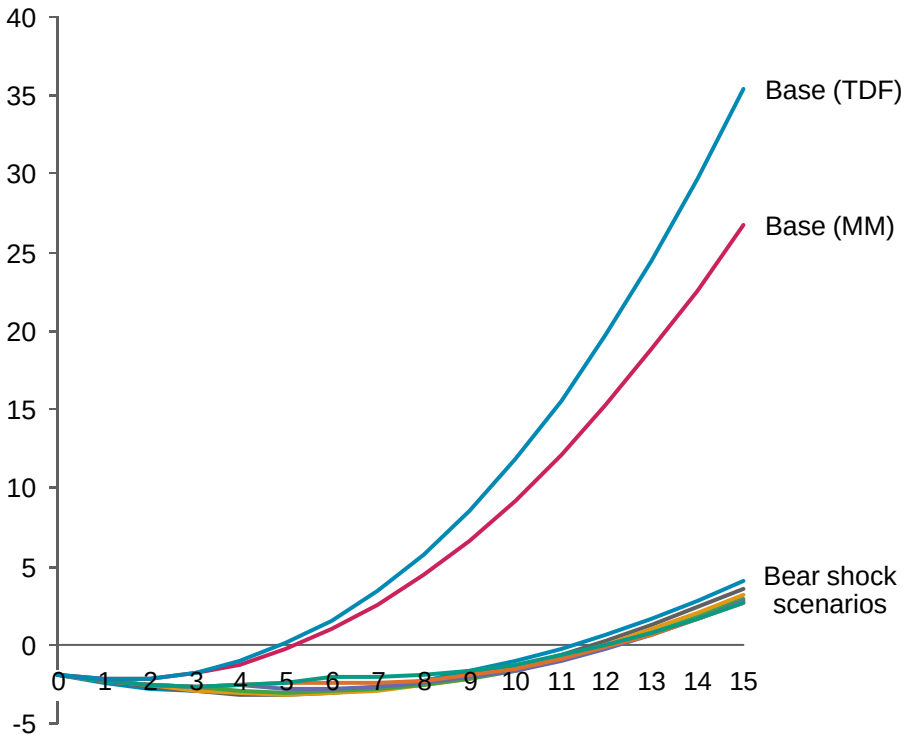
There are mitigating actions that the state can take in order to help prevent a drop in assets below the $1BN threshold

A number of mitigating actions are available to the State, however, to increase the financial health of the program

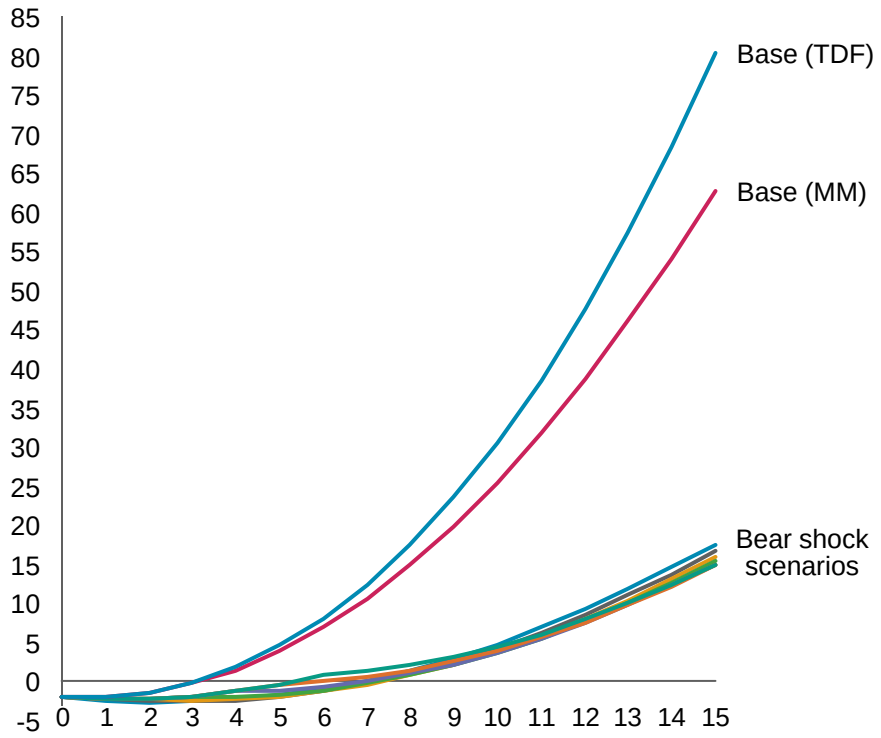
Mitigating action	Description	Impact
Employee educational program	• Marketing related to ensuring awareness around the benefits of participating in the program • Continued outreach to those who have chosen to opt-out of the program at anytime during their employment and have not yet re-enrolled	• Decrease in opt-out rate
Employer educational program	• Marketing related to ensuring employer awareness around – The benefits to their employees of participating – The low cost and effort associated with complying with program requirements – The penalties associated with non-compliance	• Increase employer participation
Increase fines associated with non-compliance	• Increase fines to employers associated with non-compliance with program requirements in order to reduce non-participation	• Increase employer participation
Increase program fees	• Increase bp fees charged to participants in order to increase the total fees to – Ensure fees collected by 3rd party service providers allow for attractive economics – Ensure the rebate collected by the state is enough to cover program's administrative expenses	• Decrease minimum asset viability threshold

We estimate the payback period for the state is likely to range from ~3 years to ~12 years depending on the state rebate and model scenario

Cumulative cash flows (5bps rebate)
$MM, by year (1-15)



Cumulative cash flows (10 bps rebate)
$MM, by year (1-15)



Both scenarios assume $1.5MM upfront investment and $500K admin expenses per year

Key takeaways

- The program is expected to be viable in the base scenario and will meet the criteria associated with self funding, and attractiveness to service providers and participants
- The program is expected to exceed the minimum asset threshold by Year 7 in all but one of the extremely conservative bear scenarios we analyzed; however, even in a case where the minimum asset threshold is not met, mitigating actions can be taken improve the likelihood of program viability, including
  - Employee education
  - Employer education and increased fines for non-participation to drive increased compliance
  - Adjustments to program fee levels to reduce the minimum viability threshold
- Actual basis point program fees, and the split of that fee among the service providers and the state, will be dictated by negotiations with third party service providers as well as a more detailed view of the State's expected upfront and ongoing expenses as program details are further developed -- We nevertheless expect that this fee will likely to remain below 1% once the detailed program is finalized
  - Given the wide range of potential outcomes in the break even analysis, it will be important for the state to consider their desired payback period when structuring the ultimate fee split
- Further, our sensitivity analysis (see Appendix) indicates the key drivers that have the largest impact on the financial feasibility of the program are employee participation and contribution rate
  - Steps should be taken to encourage participation at the outset of the program as well as participation among those who have already opted out (e.g., through periodic outreach and education)
  - We recommend the default contribution rate should be set to a minimum of 6% to ensure positive impact to participants and to provide a buffer around assets to ensure the program can meet minimum requirements across a range of potential scenarios

Appendix 1 | Model methodology

The objective of the feasibility analysis is to assess the viability of the strawman retirement program across three key criteria

Key criteria

Can the program be self-sustaining?	• What do you have to believe about program participation, savings rates, investment returns, assets and expenses to cover costs at a reasonable fee level? • How long will it take to achieve break-even status, how much investment is required and how could the program be financed
Is the program compelling to 3rd party service providers?	• Is the strawman program attractive to potential service providers? What kind of fee arrangements are achievable? • Do potential service providers have the necessary capabilities to support the program?

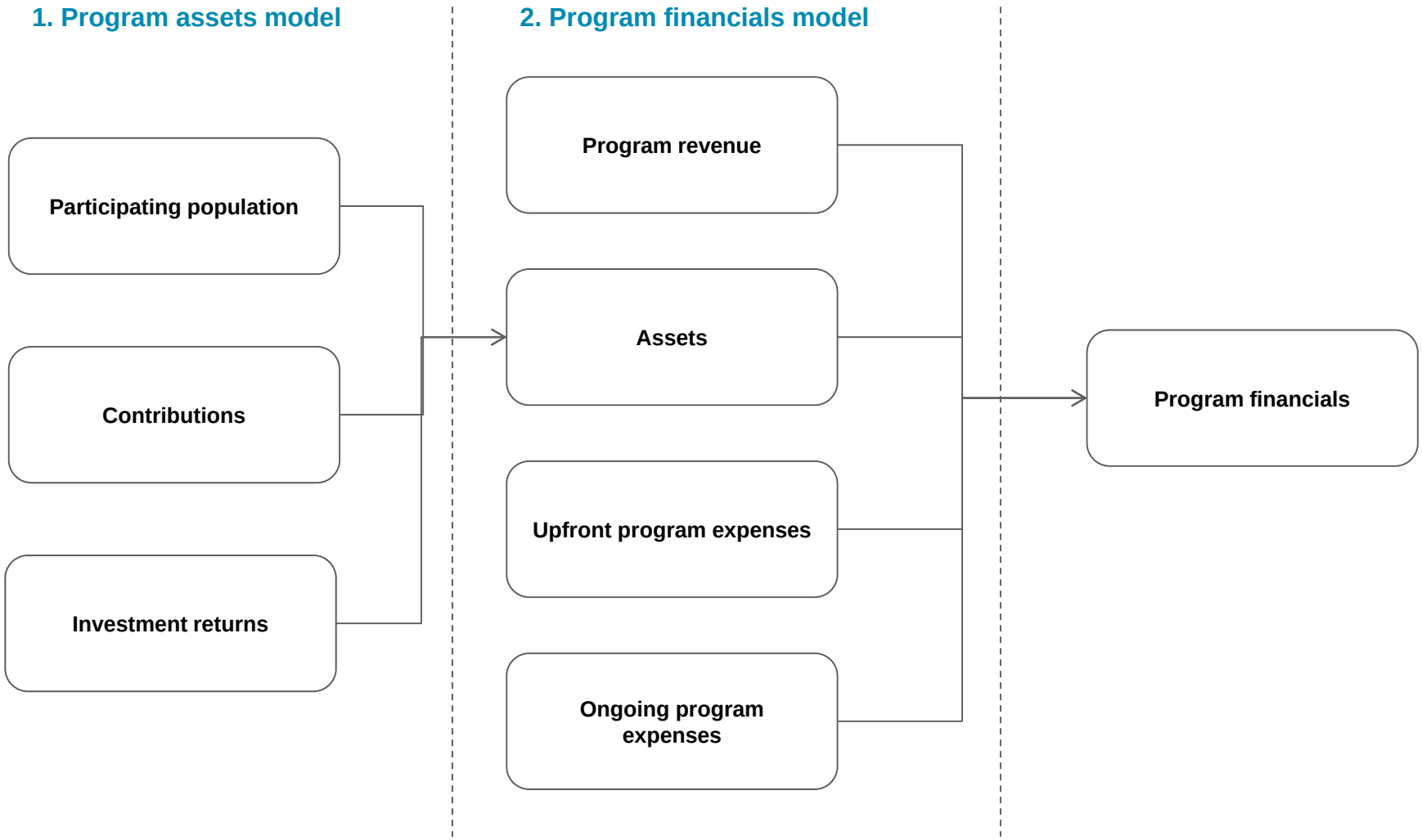
To be covered in income replacement analysis

Does the program provide meaningful benefits to participants?	• What amount of assets are program participants expected to build? • What kind of income replacement ratio can program participants expect to achieve? • How do expected asset levels and income replacement ratios differ across different cohorts of the Connecticut population with regard to age and income?

The model is based on 5 broad drivers, each with certain key components that help drive model results

Drivers	Key components	Description	Sources
Participating population	Base population	• Current population of uncovered privately employed employees in Connecticut	• US Census Bureau • Bureau of Labor Statistics
	Population growth	• Growth of population over projection time horizon	• NA – assumed flat
	Opt-out rate	• The portion of the population that does not participate in the program	• BC Center for Retirement Research
Contribution amount	Base contribution rate	• Percentage of gross income each participant contributes to their account	• Based on BC Center for Retirement Research
	Contribution haircut	• Buffer to account for employees in the participating population that are not contributing to their account	• OW analysis • Bureau of Labor Statistics
	Mean income	• Average post-tax income of population segment	• Mercer Consulting • US Census Bureau
Net returns	Market returns	• Returns of the funds that have been invested in the program	• Mercer Consulting
	Leakage	• Outflows of cash from the program for reasons including cash out, early withdrawal	• BC Center for Retirement Research
Ongoing expenses	Asset based expenses	• Asset based expenses for IRA administration, IRA depository and custodian, IRA fiduciary and Investment Management	• OW research on 529 plans • Interviews with potential 3rd party servicer providers
	Per participant based expenses	• Per participant based expenses for IRA administration, IRA depository and custodian, IRA fiduciary and Investment Management	• OW research on 529 plans • Interviews with potential 3rd party servicer providers
Upfront expenses		• Initial costs for program initiation including infrastructure build (e.g., central database, website), marketing collateral, legal fees	• Interviews with potential 3rd party servicer providers

The model framework is built around the key drivers; the initial step is calculating assets, which is the key input into program financials



Assets are modelled at the individual participant level for each age group and multiplied by the appropriate participating population to calculate total assets

$$\boldsymbol{Total\ AuM_t} = \sum_{age=18}^{65} \left[\left(Ind.AuM_{t-1,\,age,\,income\ segment} + Ind.Contributions_{t,\,age,\,income\ segment} + Ind.Net\ returns_{t,age,\,income\ segment} \right) \times Participating\ population_{t,age,income\ segment} \right]$$

Component modelling steps

Component	Key steps
Participating population	• Identify the total population of privately employed workers in the state of Connecticut between the ages of 18-65 • Segment the population by current age (starting age) and by income segment, i.e., low, mid, high, and exclude covered workers • Apply appropriate opt-out rates (based on age and income segment) to the total uncovered population to arrive at the t=0 participating population for each age and income segment
Contributions	• Map age and income segment to appropriate contribution rate • Apply contribution rate assumption to mean income for each age and income segment to arrive at individual contribution amount • Multiply individual contribution amount by associated participating population
Investment return and balance calculation	• Map age and income segment to appropriate net return rate • Apply appropriate net return assumption to previous period's balance and to ½ the current period's contribution amount to arrive to return amount • Add return amount and contribution amount to previous period's assets

Illustrative

To account for migration in and out of the participating population, the model segments the total population by yearly starting age

Cohort mapping

Age	18-30	30-50	50-65
Low Income	Cohort 1	Cohort 2	Cohort 3
Mid Income	Cohort 4	Cohort 5	Cohort 6
High Income	Cohort 7	Cohort 8	Cohort 9

- Most key drivers for assets are applied at the cohort level of granularity including:
  - Opt-out rates
  - Returns
  - Mean income

Cohort evolution for 'Low' income segment

Starting age	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1
5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1
7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1
8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
10	NA	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
11	NA	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
12	NA	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
13	NA	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
14	NA	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
15	NA	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1
16	NA	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 2
17	NA	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 2	Cohort 2
18	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 2	Cohort 2	Cohort 2
19	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 2	Cohort 2	Cohort 2	Cohort 2
20	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 1	Cohort 2	Cohort 2	Cohort 2	Cohort 2	Cohort 2
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
50	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3
51	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3
52	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA
53	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA
54	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA
55	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA
56	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA
57	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA
58	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA
59	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA
60	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA	NA
61	Cohort 3	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
62	Cohort 3	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
63	Cohort 3	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
64	Cohort 3	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
65	Cohort 3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

- To allow for the capture of the inflow of underage workers (<18) to and outflow of retiring workers (>65) from the participating population, we model assets for each starting age individually
- For example, in year 1, the 17 year old is not included in model results; however, in year 2 the 17 year old becomes 18 and is included in the projection
- Similarly, in year 1, the 65 year old is included in model results; however, in year 2 the 65 year old becomes 66 and is no longer included in the projection
- Further, the cohort mapping for each starting age evolves, for example
  - Low income, starting age 20 is mapped to Cohort 1 for years 1-10
  - However, in year 11, that starting age / income group turns 30 and is subsequently mapped to Cohort 2

Included in model results

Not included in model results

Illustrative

At t=0, the population is modelled at the yearly age level of granularity based on privately employed population and opt out rates

Illustrative example for starting age group = 22 years old, income segment = low

$$\textbf{Participating population}_{t=0,\,age,\,income\ segment} = CT\ Privately\ employed\ population \times Allocation\ of\ uncovered\ workers_{t=0,\,age,\,income\ segment} \times (1 - Opt\ out\ rate_{t=0,\,age,\,income\ segment})$$

Population
1,215,128

	Income segment		
Age	Low	Mid	High
18	0.2%	0.1%	0.0%
19	0.1%	0.1%	0.1%
20	0.0%	0.2%	0.0%
21	0.0%	0.2%	0.0%
22	0.2%	0.4%	0.3%
23	0.3%	0.0%	0.4%
…	…	…	…
64	0.0%	0.1%	0.0%
65	0.0%	0.0%	0.0%

Cohort mapping

	Income segment		
Age	Low	Mid	High
18	Cohort 1	Cohort 2	Cohort 3
19	Cohort 1	Cohort 2	Cohort 3
20	Cohort 1	Cohort 2	Cohort 3
21	Cohort 1	Cohort 2	Cohort 3
22	Cohort 1	Cohort 2	Cohort 3
23	Cohort 1	Cohort 2	Cohort 3
…	…	…	…
64	Cohort 7	Cohort 8	Cohort 9
65	Cohort 7	Cohort 8	Cohort 9

Cohort	Age min	Age max	Salary min	Salary max	Mean income	Opt out rates	Cont. rate	Return
Cohort 1	18	30	13,000	20,000	15,284	20%	6%	6.4%
Cohort 2	30	50	14,000	29,000	18,328	27%	6%	6.3%
Cohort 3	50	65	15,000	36,000	21,441	25%	6%	6.4%
Cohort 4	18	30	20,000	25,000	19,585	23%	6%	6.4%
Cohort 5	30	50	29,000	50,000	32,146	20%	6%	6.3%
Cohort 6	50	65	36,000	61,000	39,140	23%	6%	6.4%
Cohort 7	18	30	25,000	138,000	36,752	16%	6%	6.4%
Cohort 8	30	50	50,000	328,000	63,489	21%	6%	6.3%
Cohort 9	50	65	61,000	319,000	79,070	24%	6%	6.4%

Opt-out rates by age, income segment

	Income segment		
Age	Low	Mid	High
18	20.1%	23.2%	16.1%
19	20.1%	23.2%	16.1%
20	20.1%	23.2%	16.1%
21	20.1%	23.2%	16.1%
22	20.1%	23.2%	16.1%
23	20.1%	23.2%	16.1%
…	…	…	…
64	25.1%	23.2%	23.8%
65	25.1%	23.2%	23.8%

$$\textbf{Participating population}_{t=0,\,age,\,income\ segment} =$$

	Income segment		
Age	Low	Mid	High
22	1,780	3,422	2,803

The population of each starting age and income group is projected to remain flat throughout the course of the projections

Illustrative

Contribution amount is based on the participating population, mean income and contribution rates

Illustrative example for starting age group = 22 years old, income segment = low

$$\textbf{Contribution amount}_{t,\,age,\,income\ segment} = Participating\ pop._{t,\,age,\,income\ segment} \times Mean\ income_{t,\,age,\,income\ segment} \times Net\ contribution\ rate_{t,\,age,\,income\ segment})$$

	Income segment		
Age	Low	Mid	High
18	1,780	855	0
19	890	855	934
20	0	1,711	0
21	0	1,711	0
22	1,780	3,422	2,803
23	2,670	0	3,738
…	…	…	…
64	0	855	0
65	0	0	0

Cohort mapping

	Income segment		
Age	Low	Mid	High
18	Cohort 1	Cohort 2	Cohort 3
19	Cohort 1	Cohort 2	Cohort 3
20	Cohort 1	Cohort 2	Cohort 3
21	Cohort 1	Cohort 2	Cohort 3
22	Cohort 1	Cohort 2	Cohort 3
23	Cohort 1	Cohort 2	Cohort 3
…	…	…	…
64	Cohort 7	Cohort 8	Cohort 9
65	Cohort 7	Cohort 8	Cohort 9

Cohort	Age min	Age max	Salary min	Salary max	Mean income	Opt out rates	Cont. rate	Return
Cohort 1	18	30	13,000	20,000	15,284	20%	6%	6.4%
Cohort 2	30	50	14,000	29,000	18,328	27%	6%	6.3%
Cohort 3	50	65	15,000	36,000	21,441	25%	6%	6.4%
Cohort 4	18	30	20,000	25,000	19,585	23%	6%	6.4%
Cohort 5	30	50	29,000	50,000	32,146	20%	6%	6.3%
Cohort 6	50	65	36,000	61,000	39,140	23%	6%	6.4%
Cohort 7	18	30	25,000	138,000	36,752	16%	6%	6.4%
Cohort 8	30	50	50,000	328,000	63,489	21%	6%	6.3%
Cohort 9	50	65	61,000	319,000	79,070	24%	6%	6.4%

Mean income by age, income segment

	Income segment		
Age	Low	Mid	High
18	15,284	19,585	36,752
19	15,284	19,585	36,752
20	15,284	19,585	36,752
21	15,284	19,585	36,752
22	15,284	19,585	36,752
23	15,284	19,585	36,752
…	…	…	…
64	21,441	39,140	79,070
65	21,441	39,140	79,070

Net contribution rate by age, income segment

	Income segment		
Age	Low	Mid	High
18	6.0%	6.0%	6.0%
19	6.0%	6.0%	6.0%
20	6.0%	6.0%	6.0%
21	6.0%	6.0%	6.0%
22	6.0%	6.0%	6.0%
23	6.0%	6.0%	6.0%
…	…	…	…
64	6.0%	6.0%	6.0%
65	6.0%	6.0%	6.0%

$$\textbf{Contribution amount}_{T=t,\,age,\,income\ segment} =$$

	Income segment		
Age	Low	Mid	High
22	1,863,826	4,803,729	7,973,949

Illustrative

Investment returns are based on previous period assets, contribution amount and investment return

Illustrative example for starting age group = 22 years old, income segment = low

$$\boldsymbol{Investment\ returns}_{t,\,age,\,income\ segment} = (AuM._{t-1,\,age,\,income\ segment} + 0.5 \times Contribution\ amount_{t,\,age,\,income\ segment}) \times (Net\ return\ rate_{t,\,age,\,income\ segment})$$

	Income segment		
Age	Low	Mid	High
18	2,781,509	1,712,929	0
19	1,390,754	1,712,929	3,511,550
20	0	3,425,857	0
21	0	3,425,857	0
22	2,781,509	6,851,714	10,534,649
23	4,172,263	0	14,046,198
…	…	…	…
64	0	4,048,414	0
65	0	0	0

	Income segment		
Age	Low	Mid	High
18	1,632,194	1,005,149	0
19	816,097	1,005,149	2,060,583
20	0	2,010,299	0
21	0	2,010,299	0
22	1,632,194	4,020,598	6,181,750
23	2,448,291	0	8,242,334
…	…	…	…
64	0	0	0
65	0	0	0

Cohort mapping

	Income segment		
Age	Low	Mid	High
18	Cohort 1	Cohort 2	Cohort 3
19	Cohort 1	Cohort 2	Cohort 3
20	Cohort 1	Cohort 2	Cohort 3
21	Cohort 1	Cohort 2	Cohort 3
22	Cohort 1	Cohort 2	Cohort 3
23	Cohort 1	Cohort 2	Cohort 3
…	…	…	…
64	Cohort 7	Cohort 8	Cohort 9
65	Cohort 7	Cohort 8	Cohort 9

Cohort	Age min	Age max	Salary min	Salary max	Mean income	Opt out rates	Cont. rate	Return
Cohort 1	18	30	13,000	20,000	15,284	20%	6%	6%
Cohort 2	30	50	14,000	29,000	18,328	27%	6%	6%
Cohort 3	50	65	15,000	36,000	21,441	25%	6%	5%
Cohort 4	18	30	20,000	25,000	19,585	23%	6%	6%
Cohort 5	30	50	29,000	50,000	32,146	20%	6%	6%
Cohort 6	50	65	36,000	61,000	39,140	23%	6%	5%
Cohort 7	18	30	25,000	138,000	36,752	16%	6%	6%
Cohort 8	30	50	50,000	328,000	63,489	21%	6%	6%
Cohort 9	50	65	61,000	319,000	79,070	24%	6%	5%

Net return rate by age, income segment

	Income segment		
Age	Low	Mid	High
18	6%	6%	6%
19	6%	6%	6%
20	6%	6%	6%
21	6%	6%	6%
22	6%	6%	6%
23	6%	6%	6%
…	…	…	…
64	5%	5%	5%
65	5%	5%	5%

$$\boldsymbol{Investment\ returns}_{t,\,age,\,income\ segment} =$$

	Income segment		
Age	Low	Mid	High
22	210,804	519,275	798,395

Key base scenario assumptions (1/2)

Drivers	Key components	Assumptions
Participating population	Base population	• Based on privately employed population of CT workers ages 18-65 • Haircut applied to account for workers > 65 and < 18 years of age • Haircut applied to account for employers with < 5 employees
	Population allocation	• Applied at the starting age and income segment level • Allocated based on US Census national survey of covered vs. uncovered workers
	Opt-out rate	• Applied to the current period only to get base participating population for each starting age • No employer non-participation rate
	Population projections	• For each starting age, growth is assumed to be flat • E.g., the population within the starting age group 22 stays flat over the 15 year projection horizon • Unemployment assumed to be flat throughout projection • Distribution of jobs across income segments for each starting age remains constant
Contribution amount	Base contribution rate	• Assumed to be 6% to align with BC Center for Retirement Research study • Contribution is applied to post-tax salary
	Contribution haircut	• Haircut applied based on BLS data on employee tenure by age • Assume 120 days out of workforce
	Mean income	• Mean income grows based on CPI (CPI projection from Mercer analysis) • Mean income is net of effective tax rate

Key base scenario assumptions (2/2)

Drivers	Key components	Assumptions
Net returns	Market returns	• Market returns based on stochastic modelling over 90 scenarios • Base case returns are applied as CAGR of 15 year cumulative return for the 50 percentile • Returns are applied to previous year's balance and ½ of the current year contribution (to account for returns on contributed funds)
	Leakage	• Assumed to be 1.5% per year based on 401(k) research study
	Fees	• Returns are net of fees charged to participants
Ongoing expenses	Asset based expenses	• 50 bps based on average state 529 plan fees and discussions with 3rd party service providers
	Per participant based expenses	• Assumed to be 0 based on indication that per account fees would not be acceptable in program strawman
Upfront expenses		• Upfront expenses associated with service provider capabilities assumed to be zero based on indication that service provider would incorporate upfront costs into fee charge and potentially rebate the state for expenses related to program specific administration • Upfront expenses related to governing body assumed to be $1.5MM in break even analysis based on $1-2MM range provided by 3rd party service provider

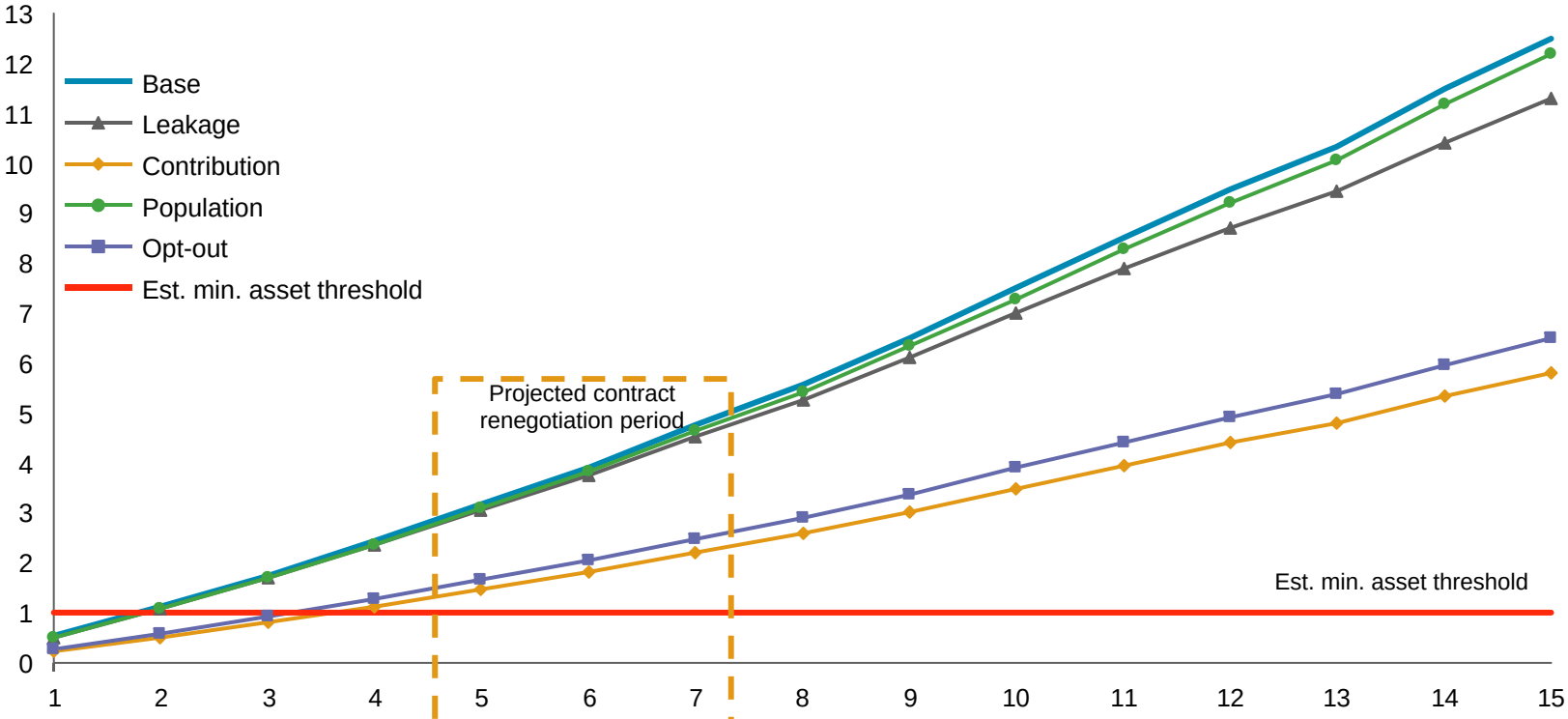
Appendix 2 | Sensitivity testing results

We applied several independent stresses to the base model to test the programs financial feasibility under different key assumptions

Key driver stressed	Stress description
Participating population	• Stressed based on maximum state unemployment since 1976 (9.3%) vs. base case rate of 6.3%
Opt out rate	• Stressed based on 48.3% employer opt-out rate cited in BC Center for Retirement Research employer survey
Contribution rate	• Stressed to 3% of after tax income vs. 6% in base case
Leakage	• Stressed to 3% vs. 1.5% in base case
Investment performance	• Stressed based on 5th percentile of cumulative annual returns at each time step vs. 50th percentile in the base case
	• Point in time shocks based on 2008 financial crisis vs. no shocks in the base case – Separate tests for shock at year 4, year 8, year 12

Program assets remain above the minimum threshold across each scenario and continue to increase over the course of the projection time horizon

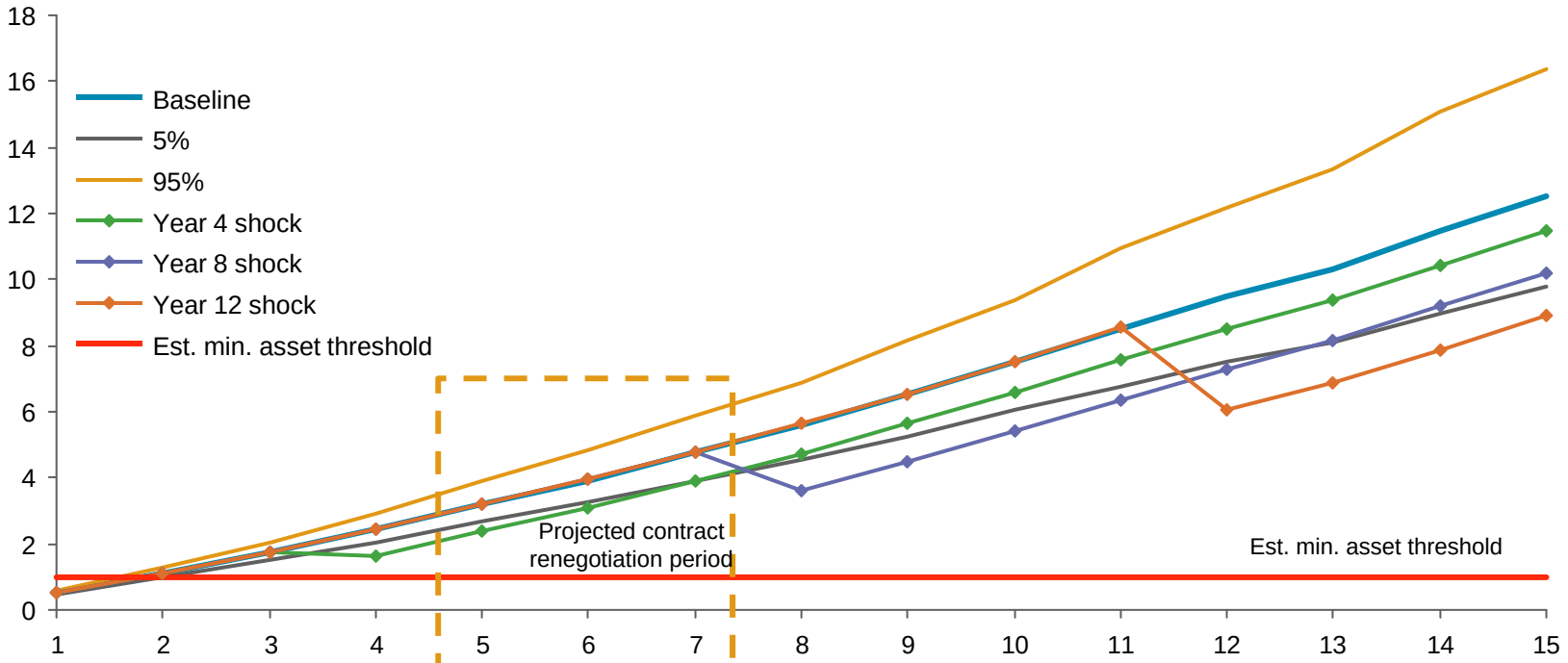
Assets by sensitivity test (Target date fund)
$BN, by year (1-15)



Base	1.1	1.8	2.4	3.2	**3.9**	**4.8**	**5.6**	6.5	7.5	8.5	9.5	10.3	11.5	12.5	12.5
Leakage	1.1	1.7	2.4	3.1	**3.8**	**4.5**	**5.3**	6.1	7.0	7.9	8.7	9.4	10.4	11.3	11.3
Contribution	0.5	0.8	1.1	1.5	**1.8**	**2.2**	**2.6**	3.0	3.5	4.0	4.4	4.8	5.3	5.8	6.3
Population	1.1	1.7	2.4	3.1	**3.8**	**4.6**	**5.4**	6.3	7.3	8.3	9.2	10.1	11.2	12.2	12.2
Opt-out	0.6	0.9	1.3	1.7	**2.0**	**2.5**	**2.9**	3.4	3.9	4.4	4.9	5.4	6.0	6.5	9.5

Program assets remain above the minimum threshold across each investment performance scenario at year 5 and beyond

Assets by investment performance scenario (Target date fund)
$BN, by year (1-15)



Baseline	0.5	1.1	1.8	2.4	3.2	3.9	4.8	5.6	6.5	7.5	8.5	9.5	10.3	11.5	12.5
5%	0.5	1.0	1.5	2.1	2.7	3.3	3.9	4.6	5.3	6.0	6.8	7.5	8.1	9.0	9.8
95%	0.6	1.3	2.1	2.9	3.9	4.8	5.9	6.9	8.1	9.4	10.9	12.2	13.3	15.1	16.4
Year 4 shock	0.5	1.1	1.8	1.6	2.4	3.1	3.9	4.7	5.6	6.6	7.6	8.5	9.4	10.4	11.5
Year 8 shock	0.5	1.1	1.8	2.5	3.2	4.0	4.8	3.6	4.5	5.4	6.4	7.3	8.2	9.2	10.2
Year 12 shock	0.5	1.1	1.8	2.5	3.2	4.0	4.8	5.6	6.5	7.5	8.5	6.0	6.9	7.9	8.9

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