FIA VM-22 PBR Concept Testing

Financial Modeling Results

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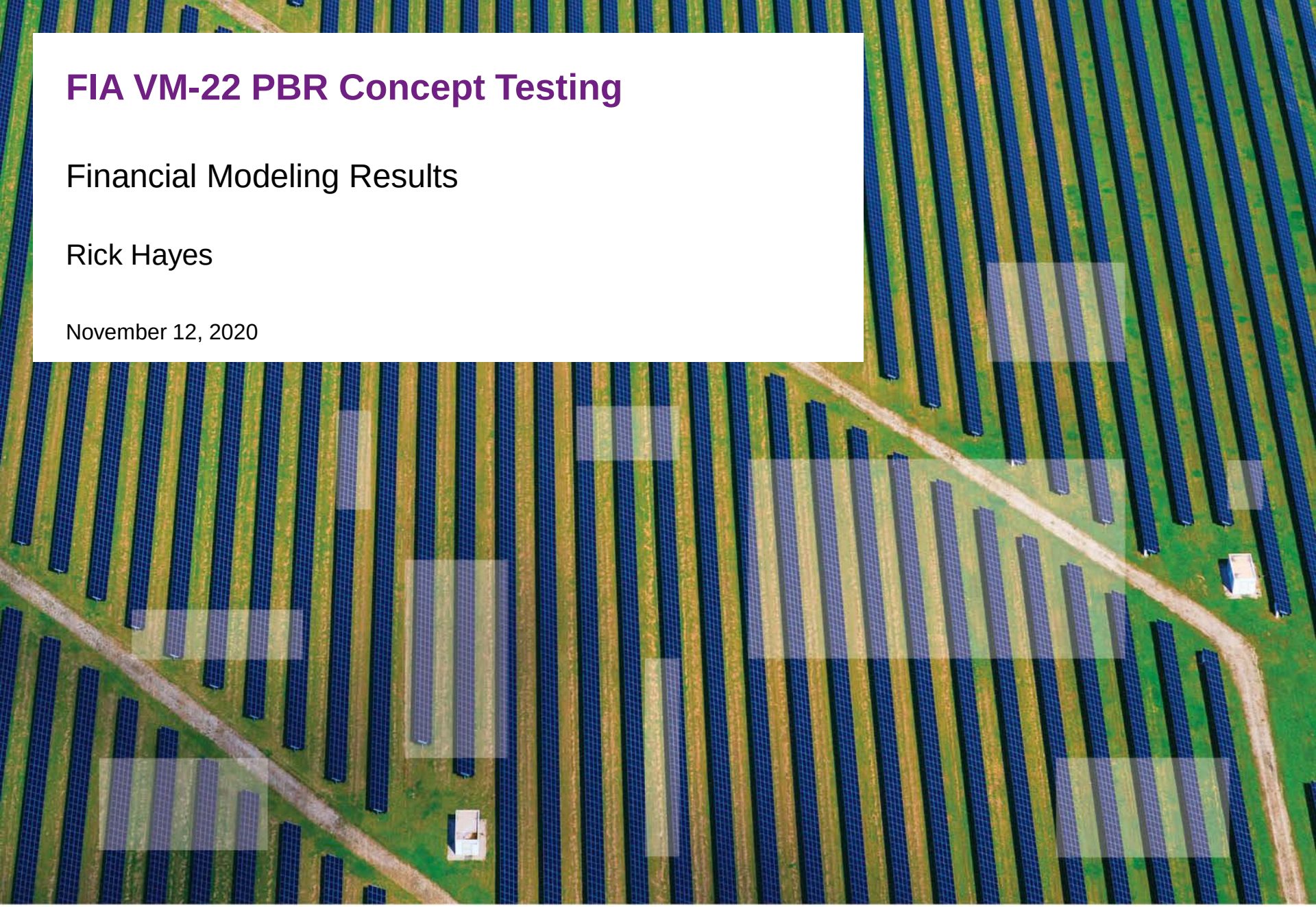

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Disclaimer

- This material has been prepared for general educational purposes only and does not purport to be and is not a substitute for specific professional advice. While the matters identified are believed to be generally correct, before any specific action is taken, specific advice on the circumstances in question should be obtained.

Modeling Summary

Modeling Summary

- Willis Towers Watson supported the Annuity Reserves Work Group (“ARWG”) by modeling a generic Fixed Indexed Annuity (“FIA”) with Guaranteed Living Withdrawal Benefit (“GLWB”) to calculate initial and projected reserves based on the current U.S. statutory reserve framework and the yet to be finalized VM-22 PBR framework, over a limited set of deterministic scenarios and sensitivities.
- The modeled FIA product and rider design is not intended to be globally representative of the indexed annuity market and will not perfectly align with any one annuity writer’s own product or modeling practices. This is intended to be a reasonable representation of a product where the design and features fall within the range of typical industry averages. The goal is to provide a starting point for industry participants to gauge the impact of the proposed VM-22 PBR framework on a generic product and hopefully be able to draw parallels to their own portfolio of annuities as a result.
- Two groups of new business FIA policies (with and without GLWBs) were simplistically priced using a deterministic scenario to ensure a reasonable profitability level. Non-GLWB policies had an IRR of 9.4% whereas GLWB policies had an IRR of 10.0%.
- We then compared the proposed projected annual VM-22 PBR reserves to the equivalent AG33 amount over 30 years.
  - Base product VM-22 PBR reserves never exceed the AG33 value at any point in time even when margins are applied
  - GLWB VM-22 PBR reserves demonstrated a different projected pattern than the base policies
    - The use of margins did have an impact on VM-22 PBR reserves with GLWBs
    - A shift away from a worst-case policyholder benefit election standpoint and dynamic reserve discounting had an impact on the shape of projected reserves
    - Aggregation also plays a role where a profitable policy may offset the impact of a richer WB policy
  - The GLWB VM-22 PBR results were sensitivity tested to show the impact of increased implied volatility, a decrease to the interest rate environment and alternative reinvestment strategies within the reserve calculation. We also looked at the impact of a decrease and increase to target spreads.
- An Exclusion Test analysis was performed at issue and 10 years along the projected horizon. The analysis was based on the 16 VM-20 stochastic exclusion testing scenarios

Product Design and Assumptions

Product and Assumption Selection

Base Product and Index Crediting

- The product being modeled is an indexed annuity with and without a GLWB rider
- Prior to performing the VM-22 PBR framework analysis, a deterministic pricing exercise, under the current statutory reserve framework was performed on the new business mix in order to ensure a reasonable statutory IRR when compared to the current industry norm.
- Base product design
  - Surrender charge schedule: 7-year schedule linearly grading from 8% to 2%, and then zero
  - Free partial withdrawals: 10% of fund value
- Index crediting
  - Index crediting method: 1-year S&P 500 point-to-point
    - Minimum cap rate of 1%
  - Cap rates are solved for dynamically within the model based on the Black-Scholes closed form solution and the specified target spread. The option budget is defined as the portfolio earned rate less the target spread.
  - Fund allocation: entirely allocated to the S&P 500 crediting bucket

Product and Assumption Selection

GLWB Rider

- GLWB rider
  - 10-year rollup with 7% compound interest
  - 110 bps rider fee as a percent of the guaranteed benefit base
  - Maximum Annual Withdrawal Percentage (MAW %)

Age at First Withdrawal	MAW %
55	3.5%
60	4.0%
65	4.5%
70	5.0%

  - GLWB Utilization

Wait Period	Issue Age 55	Issue Age 65	Issue Age 75
0	5%	15%	60%
5	15%	30%	30%
10	75%	50%	5%
Never Use	5%	5%	5%

Product and Assumption Selection

Actuarial Assumptions

- Mortality: 2012 IAM Period Table with projection scale G2
- Non-GLWB free partial withdrawal utilization: 20% in year 1 grading to 40% in year 20+
- Base lapse rates (*GLWB never use cohorts assume a base product lapse rate)

Policy Year	Base Product*	GLWB
1	1.0%	0.50%
2	2.0%	1.00%
3	2.5%	1.25%
4	3.0%	1.50%
5	3.0%	1.50%
6	3.0%	1.50%
7	3.0%	1.50%
8	35.0%	5.00%
9+	10.0%	2.50%

Product and Assumption Selection

Actuarial Assumptions

- Dynamic lapse function for in-the-money GLWBs ranges by level of ITM
  - ITM based on PV of benefits using a fixed discount rate
- Interest-sensitive dynamic lapse function
  - Two-sided function which compares the option budget to the 7-year treasury rate (competitor rate proxy)

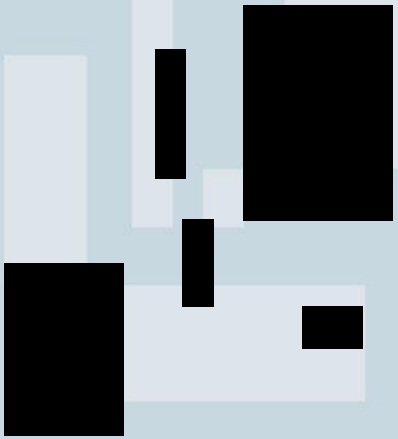
Product and Assumption Selection

Expenses & Policyholder distribution

- Expenses
  - Commissions: 7% of premium
  - Maintenance expense: $35 per policy
  - Acquisition expense: 1% of premium

- Policyholder distribution
  - Issue age distribution: 25% age 55, 50% age 65 and 25% age 75
  - Gender distribution: 55% male, 45% female
  - Average premium of $100,000

Economic Assumptions



Economic Assumptions

Equity and Interest Rate Scenarios

- Outer loop interest rates follow the U.S. Treasury forward curve developed from the 09/30/2019 date spot rates
- Outer loop equity returns assume a constant 6.5% total return per annum, inclusive of a 2% annual dividend yield
- Outer loop equity volatility

Implied Volatility by Moneyness		
90%	**ATM**	**110%**
17%	15%	13%

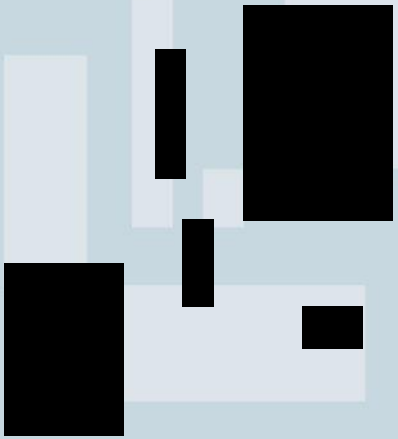
- Inflation of 2% per annum

Economic Assumptions

Credit Spreads & Defaults

- Initial credit spreads are based on valuation date market data and are specific to the rating and maturity
- Ultimate credit spreads are graded to over 2 years, where the ultimate values are based on a historical view
- Defaults are specific to the rating class of the asset, but held constant throughout the projection

Corporate Assumptions



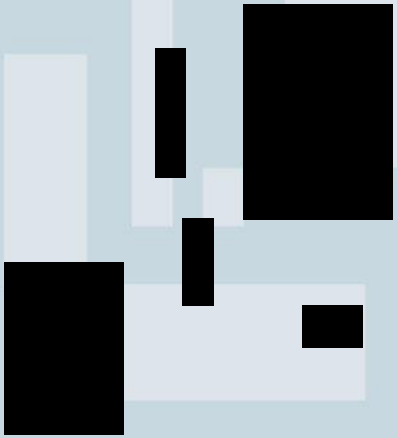
Corporate Assumptions

- The following reinvestment strategy is assumed for the baseline outer and inner loop projections

Initial and Reinvestment Strategy – Corporate Bonds				
	Maturity			
Rating	**5**	**7**	**10**	**20**
A	15%	15%	10%	10%
BBB	15%	15%	10%	10%

- Asset sales are performed on a pro-rata basis
- Hedging is modeled to offset policyholder equity indexed credits via the purchase and sale of equity options. An ineffectiveness assumption of 2% is used for the outer loop. That is, the option payoff is reduced by 2% and considered an implicit expense.
  - Hedging does not apply to the GLWB rider benefit

Current Reserve & Capital Assumptions



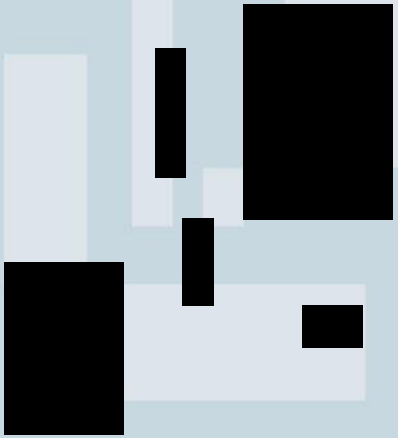
Current Statutory, Tax & Capital Assumptions

- For the purpose of assuring a reasonable product and rider profitability, we calculated the statutory IRR (9.4% and 10.0% with and without GLWB, respectively) along the deterministic outer loop scenario with the following statutory reserve, tax reserve and capital assumptions
- AG33 Valuation Assumptions
  - Mortality: 2012 IAM Period Table
  - Mortality improvement: Scale G2 with base year 2012
  - CARVM GLWB exercise points: annually for years 0 through 30
  - Valuation interest rates

Statutory Valuation Interest Rates		
Type A	Type B	Type C
4.00%	3.75%	3.75%

- Tax reserves are modeled as 92.81% of statutory reserves, floored at cash value
- Corporate tax rate of 21%
- Required capital was modeled with the following assumptions
  - Target surplus set at 400% for NAIC CAL RBC
  - RBC C1 factor of 0.9%
  - RBC C3 factor of 1.0%
  - RBC C4 factor of 2.0%

VM-22 PBR Calculation Methodology



VM-22 PBR Calculation Methodology

General Description

- For the purposes of this analysis, the VM-22 PBR reserve was modeled with the following considerations:
  - Initial assets are set to the prior period's investment portfolio value
  - The asset portfolio which had accumulated to a given point in time along the outer loop scenario is maintained, including index hedge assets, and new assets are purchased in line with the specified reinvestment strategy
    - Credit spreads will use the then-current outer loop assumption for 4 years and then grade to the VM-21 values in years 5 through 7
  - All product features and dynamic policyholder behavior is reflected along each path
  - Accumulated deficiencies, if any, are calculated in aggregate and tracked over time while assuming no working reserve
    - Since the working reserve is zero, the initial deficiency is the negative of the starting assets. The deficiency is rolled forward with profits each month where profits are the sum of (1) the liability cash flow, plus (2) interest and investment income
  - Deficiencies are discounted using the Net Asset Earned Rate (NAER) of additional assets. The discount NAER is determined by projecting an initial unit of cash based on the defined reinvestment strategy, without liability cash flows, for each reserve interest rate scenario.
  - The Greatest Present Value of Accumulated Deficiencies (GPVAD) is then calculated for each scenario
  - The scenario amount is then calculated as starting assets + GPVAD
  - The VM-22 PBR reserve is then calculated as the Conditional Tail Expectation (CTE) 70 of scenario amounts, floored at the aggregate cash surrender value

VM-22 PBR Calculation Methodology

Margins

- In order to reflect a prudent assumption set for reserve calculation purposes, the following margins were applied to the outer loop assumption set
  - Mortality
    - 90% for policies with a GLWB and 110% for those without
  - Dynamic Lapses
    - 200% dynamic lapse multiplier (baseline assumed 150%)
    - 90% base lapse rate for policies with a GLWB (110% for those without)
  - Expenses
    - 105% of baseline assumption
  - Hedge Effectiveness
    - 95% hedge effectiveness is assumed for the index crediting hedge, i.e., a 5% implied expense on option payoffs
  - GLWB Utilization
    - The never use cohort is reduced from 5% to 2.5% with the difference redistributed to the 10-year wait period cohort for issue ages 55 & 65 and to the 5-year wait period cohort for issue age 75
    - 10% of the 5-year wait period cohort is redistributed to the 10-year wait period cohort for issue ages 55 & 65
    - 5% of the 5-year wait period cohort is redistributed to the 10-year wait period cohort for issue age 75

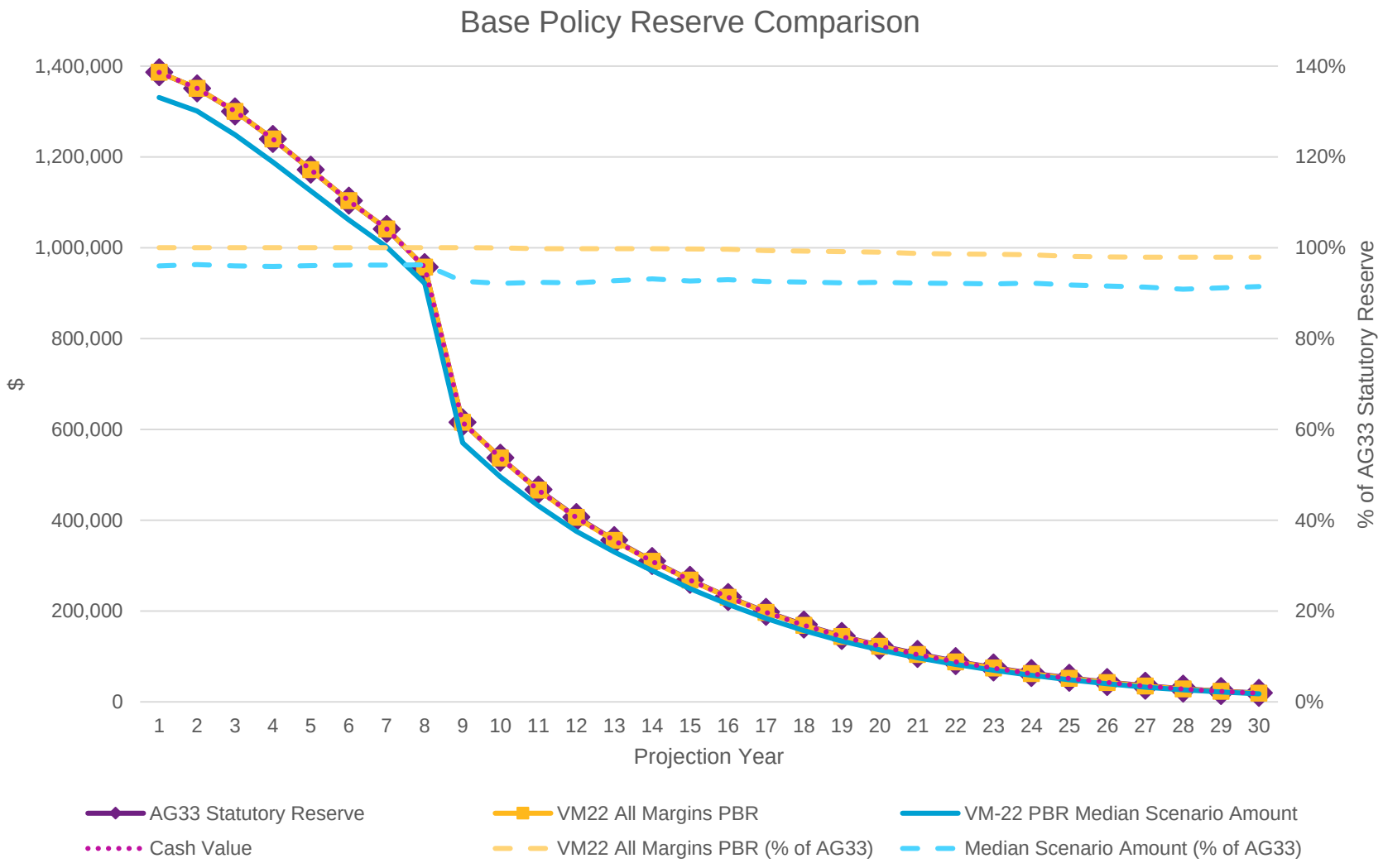
Projected Reserve Results

Baseline Reserve Comparison

Base Product Summary

- As illustrated on the following slide, the base product (no WB rider) reserve under VM-22 PBR never exceeds the AG33 value at any point in time even when using margins.
  - This is expected given the shift from a worst-case AG33 framework where the reserve is based on each policy's greatest present value of benefits regardless of the likelihood the policyholder will choose that given path.
  - VM-22 PBR is an aggregate approach where even when margins are applied to assumptions, the reserve does not exceed the aggregate cash value
  - VM-22 PBR does however introduce an interest sensitivity aspect where the scenario specific discount rate is dependent on the AIRG path and chosen reinvestment strategy. In a low interest rate environment, more extreme than what was considered for this exercise, this could potentially reduce the excess amount which AG33 produces over VM-22 PBR for a base product.

Base Policy Reserve Comparison

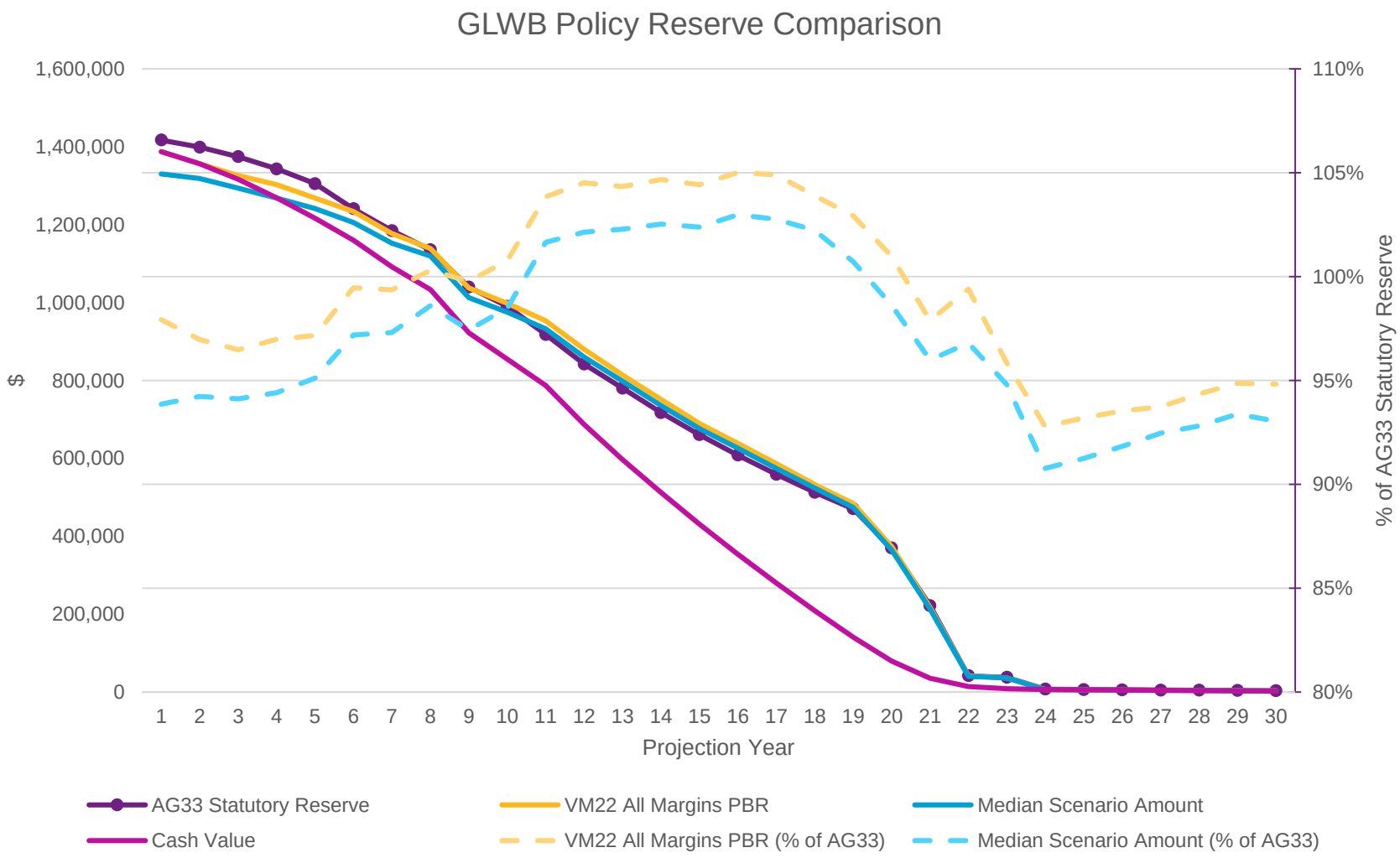


Baseline Reserve Comparison

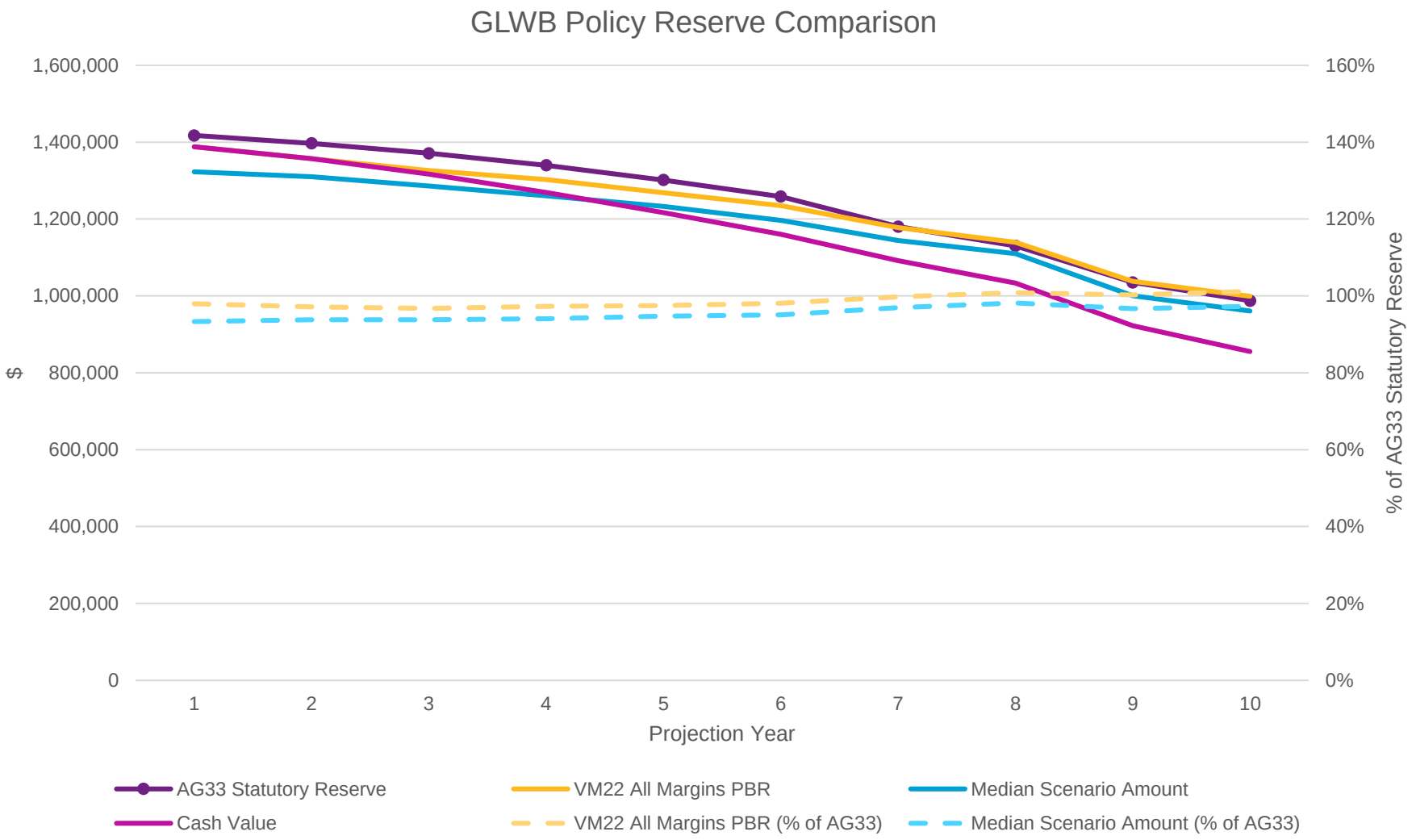
GLWB Summary

- As illustrated on the following slide, the use of margins had an impact on projected GLWB reserve amounts.
  - We isolated each margin impact, but when combined the effect was slightly magnified at times
  - This is not intended to act as guidance for setting margins under a VM-22 PBR framework, but simply reflected the view of the ARWG modeling sub-group in terms of a reasonable starting point
- As is the case with the base product reserve comparison, the GLWB reserves are also impacted by the shift away from a worst-case policyholder benefit election standpoint (now reflecting a cohorted wait-period approach)
- Aggregation also plays a role where a profitable policy may offset the impact of a richer WB policy
- The economic environment impacts the VM-22 PBR value as reserves now reflect investment income via our modeled ALM functionality and additional asset NAER for discounting. Lower portfolio yields could impact profitability in a low rate environment, where minimum cap rates are hit, while the same environment will push discount rates lower thus increasing the present value of a WB claim / deficiency.
  - This effect is not as strong in the early years of the projection where the AG33 worst-case GLWB election path still causes a higher reserve, but as the majority of policyholders elect withdrawals along the outer loop and both reserve frameworks reflect the same withdrawal timing, the stochastic rates in VM-22 can be more impactful than the fixed values used in AG33.
  - Once the never-use cohort policyholders are all that remain in years 25+ of the projection, the worst case AG33 framework again overtakes VM-22 which still has a never-use component in reserve calculations
- Due to reserve balance differences between the two frameworks, we also see a slight difference in outer loop portfolio yields which drives dynamic policyholder behavior pattern and index crediting differences, so WB claim timing will also be slightly impacted in this comparison

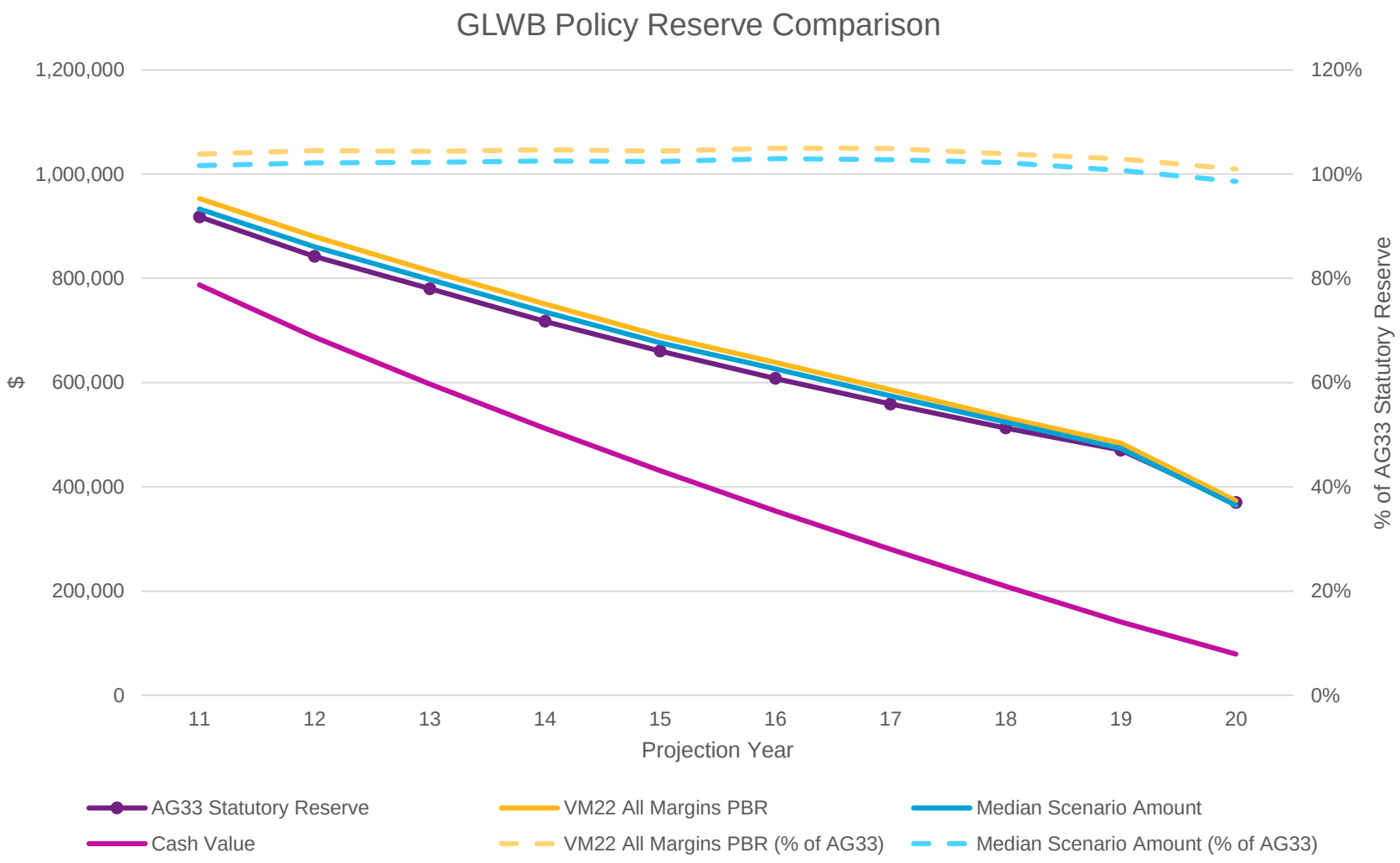
GLWB Reserve Comparison



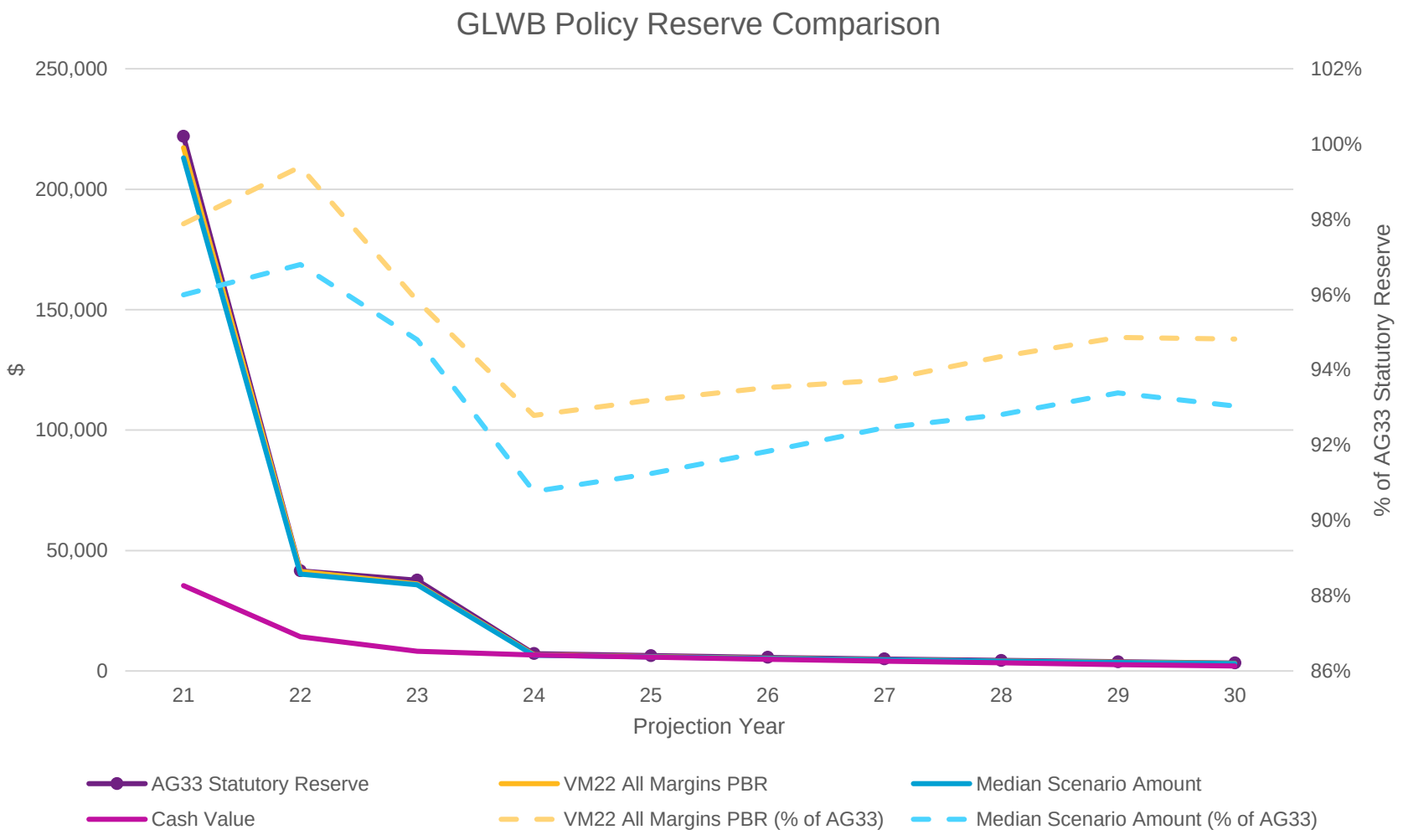
GLWB Reserve Comparison Chart (Years 1-10)



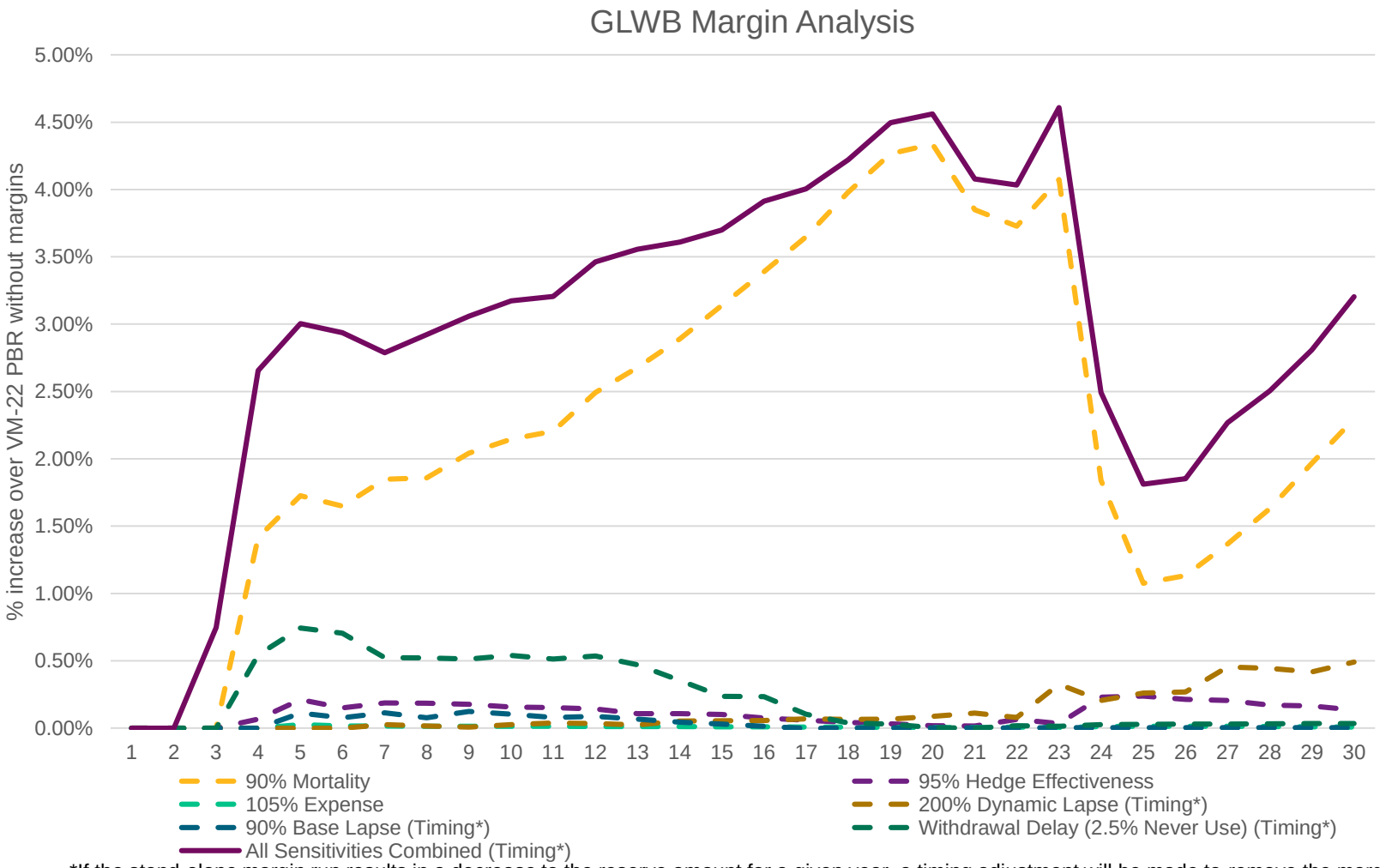
GLWB Reserve Comparison Chart (Years 11-20)



GLWB Reserve Comparison Chart (Years 21-30)



GLWB Reserve Assumption Margin Impact on Projected Reserves



*If the stand-alone margin run results in a decrease to the reserve amount for a given year, a timing adjustment will be made to remove the margin in that year

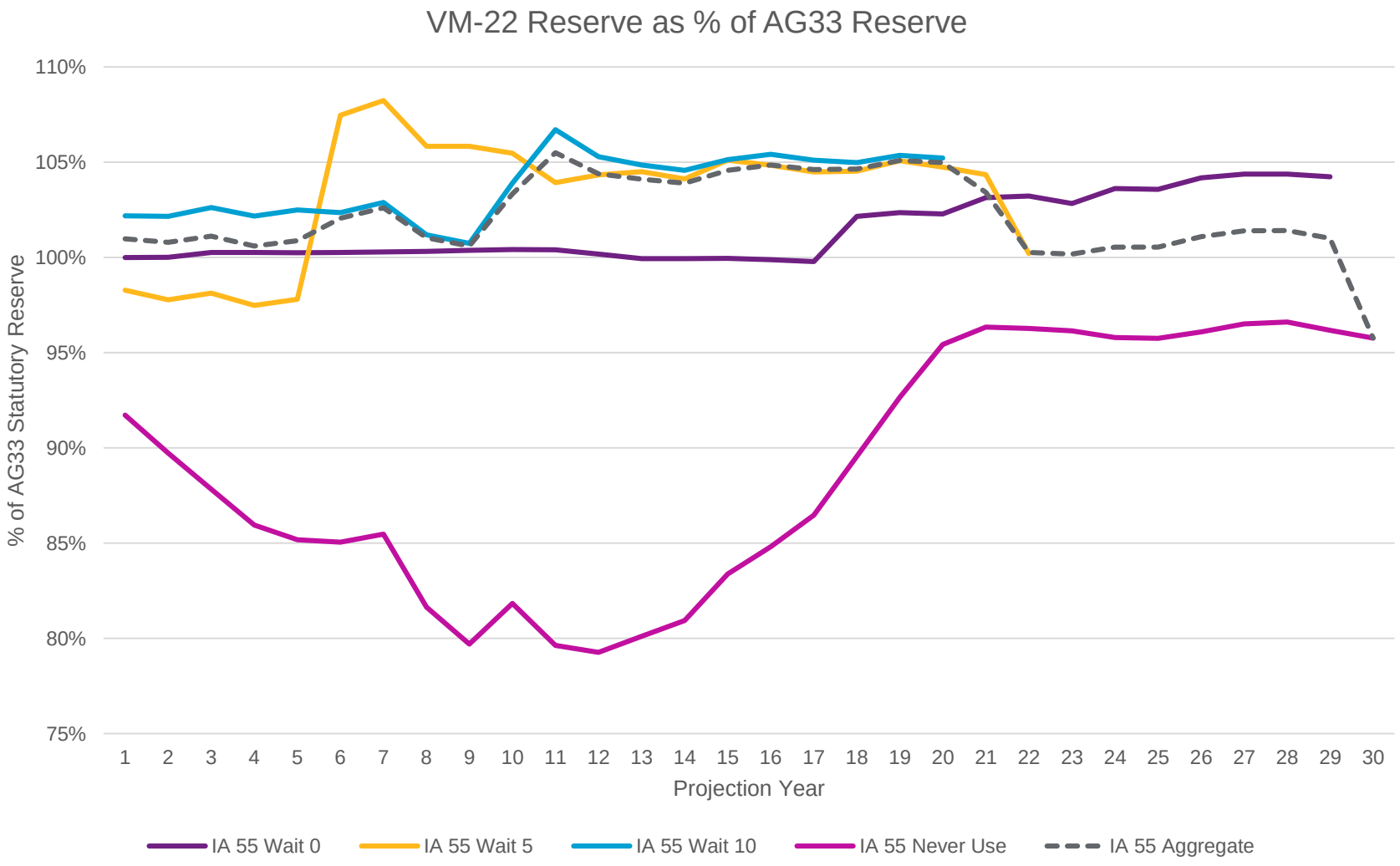
Projected Reserve Single Cell Results

Single Cell Analysis

Issue Age 55

- We compared the single cell GLWB results between AG33 and VM-22 PBR which ignores the aspect of aggregation. During this comparison, we maintained the same margins as previously described which includes the reallocation of GLWB election cohorts
- Issue Age 55 Comparison Details
  - Wait 0
    - Both frameworks produced reserves which are held at cash value, due to low WB benefit when electing early, until it approaches fund exhaustion close to year 20. At this point the PV of claims exceeds fund value and there's an excess. VM-22 reaches this point a quarter earlier than AG33 due to lower reserve discount rate
  - Wait 5
    - AG33 exceeds VM-22 by ~3% until the end of the 5th year when the withdrawals are elected. VM-22 then has a higher reserve associated to index crediting and discounting in a low interest rate environment.
    - AG33 has a steep drop in reserves once the election occurs as it had been holding the wait-10 period's reserve amount until then.
    - The slight reallocation to an optimal wait period (10 years) doesn't play a significant role for the VM-22 reserve calculations
  - Wait 10
    - AG33 and VM-22 both exceed cash value initially and throughout the projection, with VM-22 exceeding AG33 – partly attributed to the lower discount rates in today’s interest rate environment
  - Never use
    - AG-33 exceeds VM-22 by 10% initially, increasing to 20% once the benefit is at its peak around year 10 and then grades to be equal once the benefit is reduced to zero around year 21.
    - The partial reallocation to an optimal wait period (or immediate withdrawals later in the projection) for VM-22 reserve calculations doesn't have an effect

Issue Age 55 Comparison by Wait Period Cohort

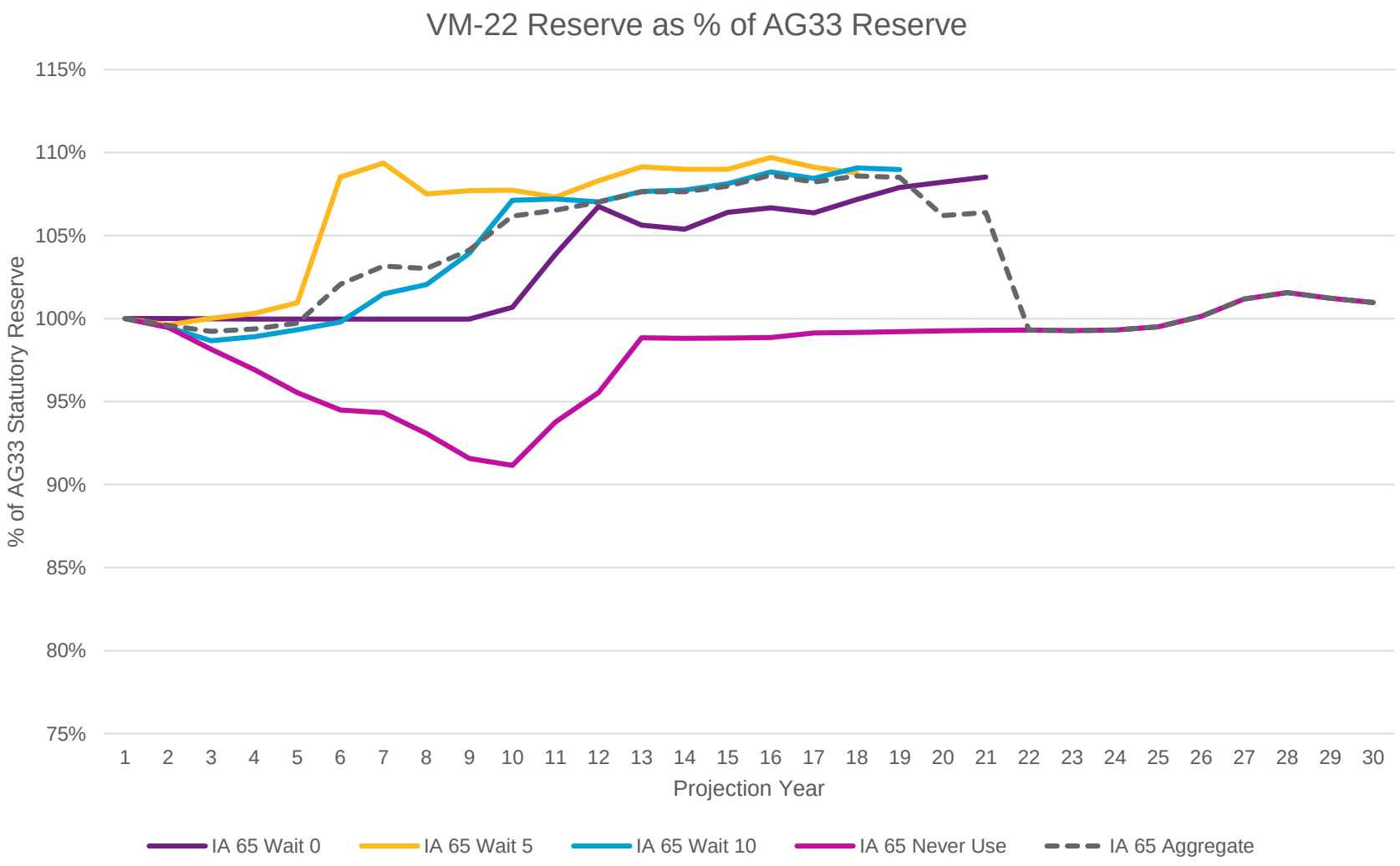


Single Cell Analysis

Issue Age 65

- Issue Age 65 Comparison Details
- Wait 0
  - Similar pattern to age 55, but due to higher MAWA the reserve in excess of cash value occurs faster in year 11
- Wait 5
  - Reserves are held at cash value until year 2 at which point both AG33 & VM-22 exceed cash value.
  - At this issue age, it appears as though the higher MAWA for a wait 10 does not exceed the value of the lower MAWA for wait 5, given survivorship.
  - VM-22 is holding a higher reserve due to the discount rate / yield environment
- Wait 10
  - Reserves are held at cash value until year 2 where both AG33 & VM-22 exceed cash value. At this issue age, it appears as though the higher MAWA for a wait 10 does not exceed the value of the lower MAWA for wait 5 given survival, so the AG33 exceeds VM-22 until closer to the actual 10-year wait period at which point VM-22 wins out with lower discount rates
- Never use
  - VM-22 is always equal to cash value. AG33 exceeds VM-22 by a marginal amount at first and then grows to an 8% differential around year 9 and then grades to be equal around year 13
  - The partial reallocation to an optimal wait period (or immediate withdrawals later in the projection) for VM-22 reserve calculations doesn't have an effect

Issue Age 65 Comparison by Wait Period Cohort

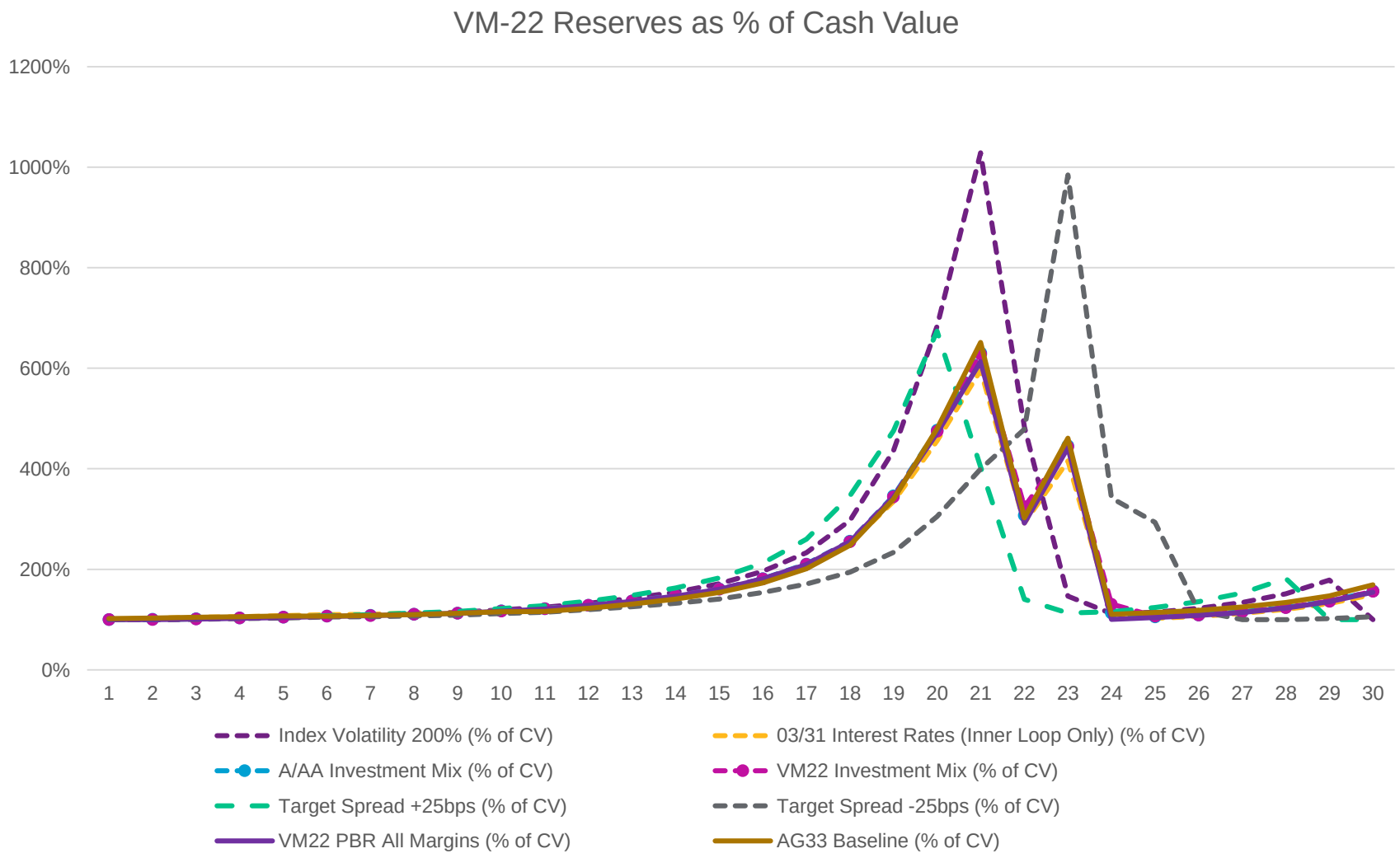


Projected Reserve Sensitivity Results

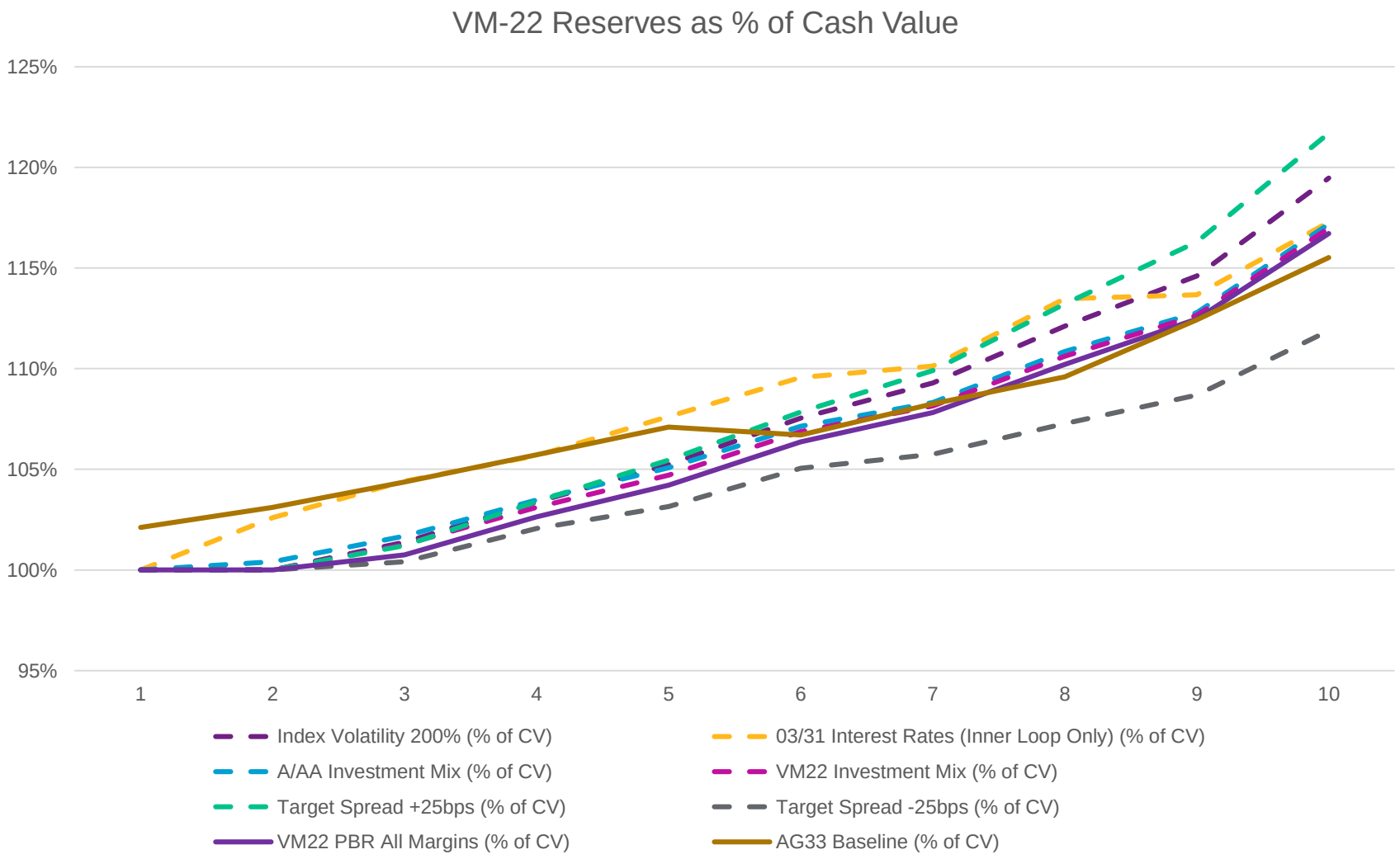
Sensitivity Analysis

- We performed a small set of sensitivities to highlight the impact of certain assumptions. The assumptions which were assessed are as follows:
  - Doubling the static implied volatility surface
  - Using the U.S. Treasury forward curve developed from March 31st, 2020 spot rates as opposed to those as of September 30th, 2019
    - Here we replaced the reserve scenario sets with those produced by the AIRG along the 03/31/2020 forward curve while maintaining the same outer loop scenario as the baseline. This isolated the impact of lower rates on the reserve calculation only. This demonstrates the potential impact of a market shock to the VM-22 reserves which would not flow through the AG33 framework due to the static nature of discounting.
  - Replacing the reserve calculation reinvestment strategy with a 50% Aa / 50% A mix
  - Replacing the reserve calculation reinvestment strategy with a VM-22 portfolio mix (5% Treasury, 15% AA, 40% A, 40% BBB)
  - Increasing and decreasing the constant target spread by 25 basis points

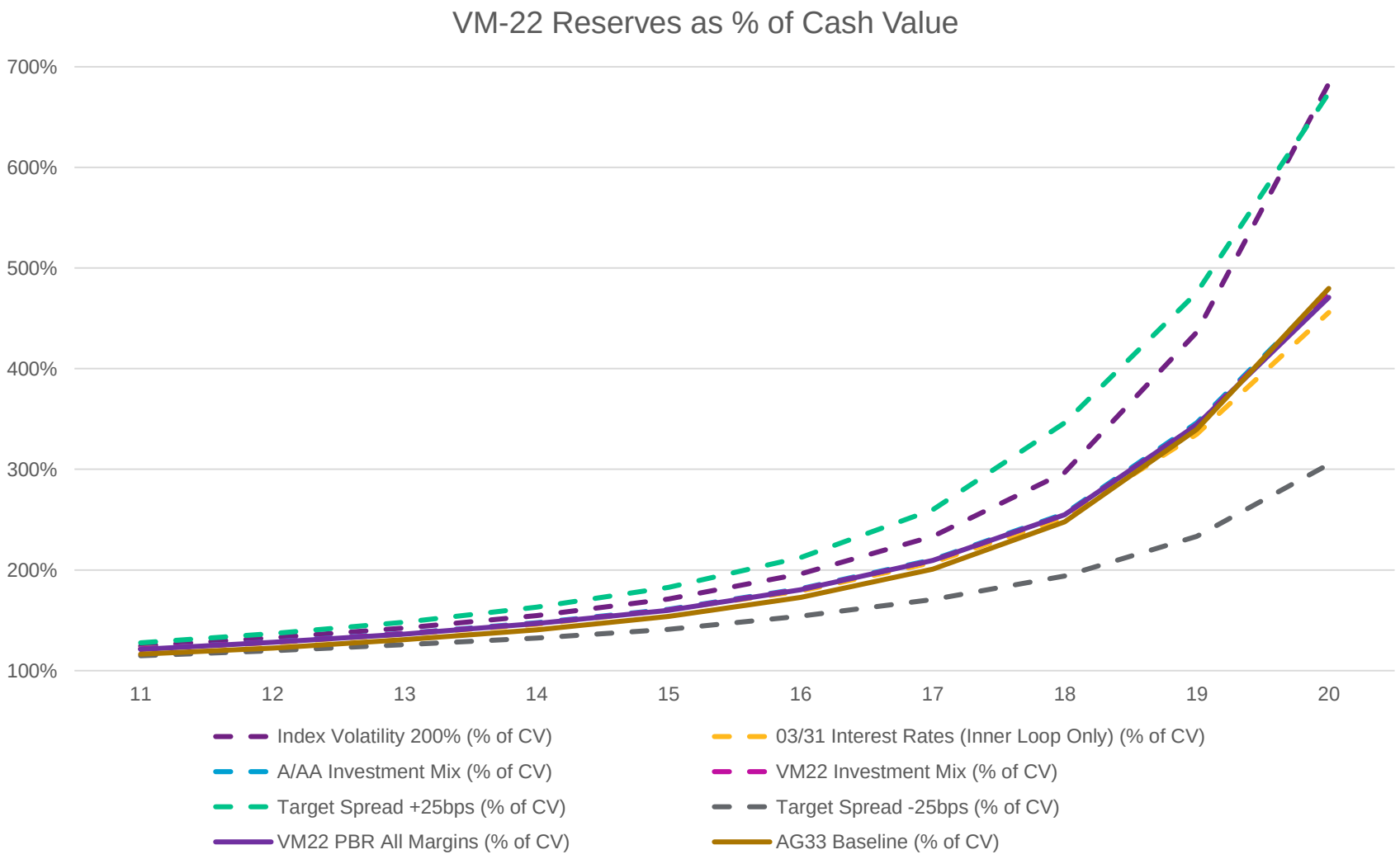
VM-22 PBR Reserve as % of Cash Value



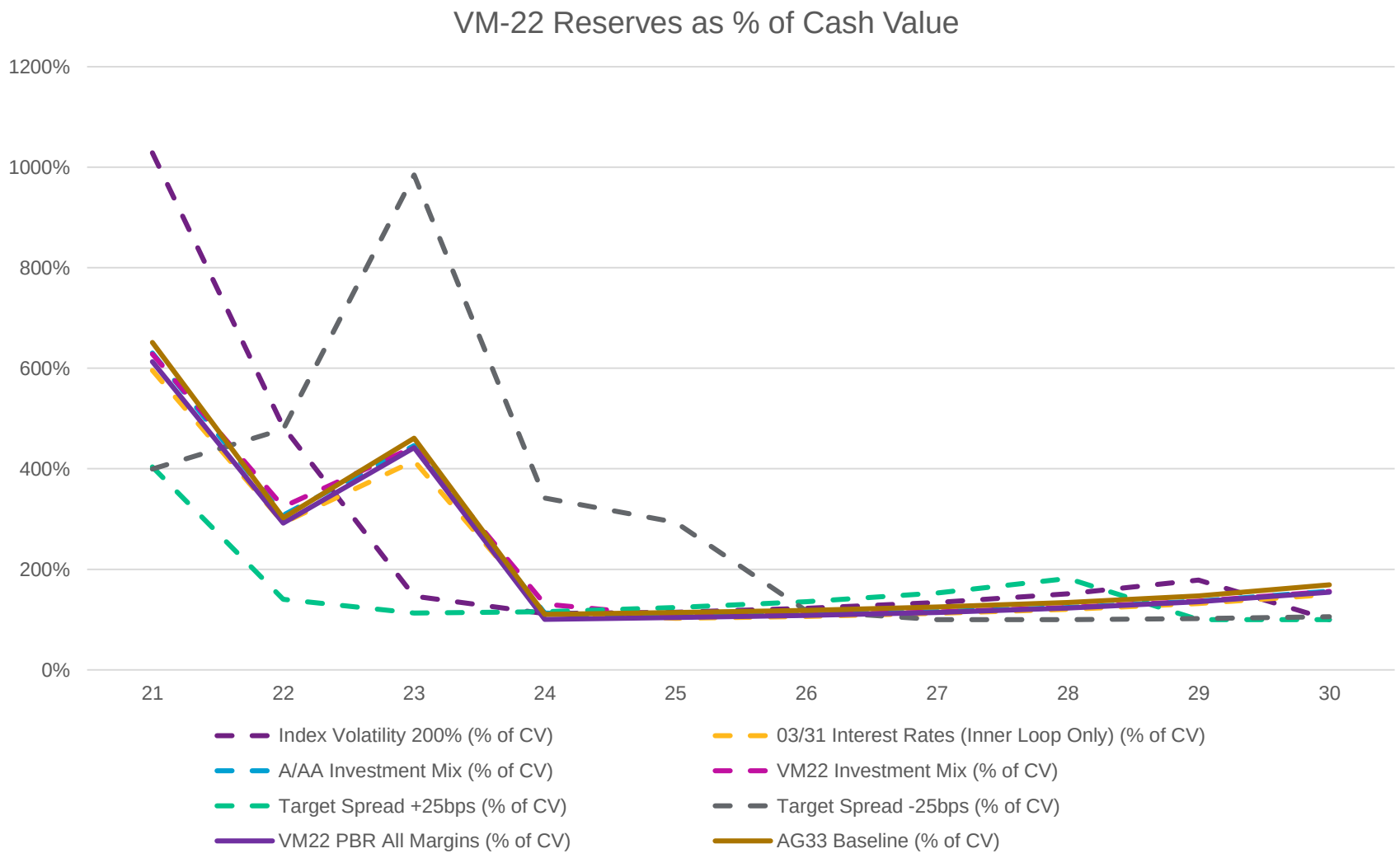
VM-22 PBR Reserve as % of Cash Value (Years 1-10)



VM-22 PBR Reserve as % of Cash Value (Years 11-20)



VM-22 PBR Reserve as % of Cash Value (Years 21-30)



Exclusion Testing Results

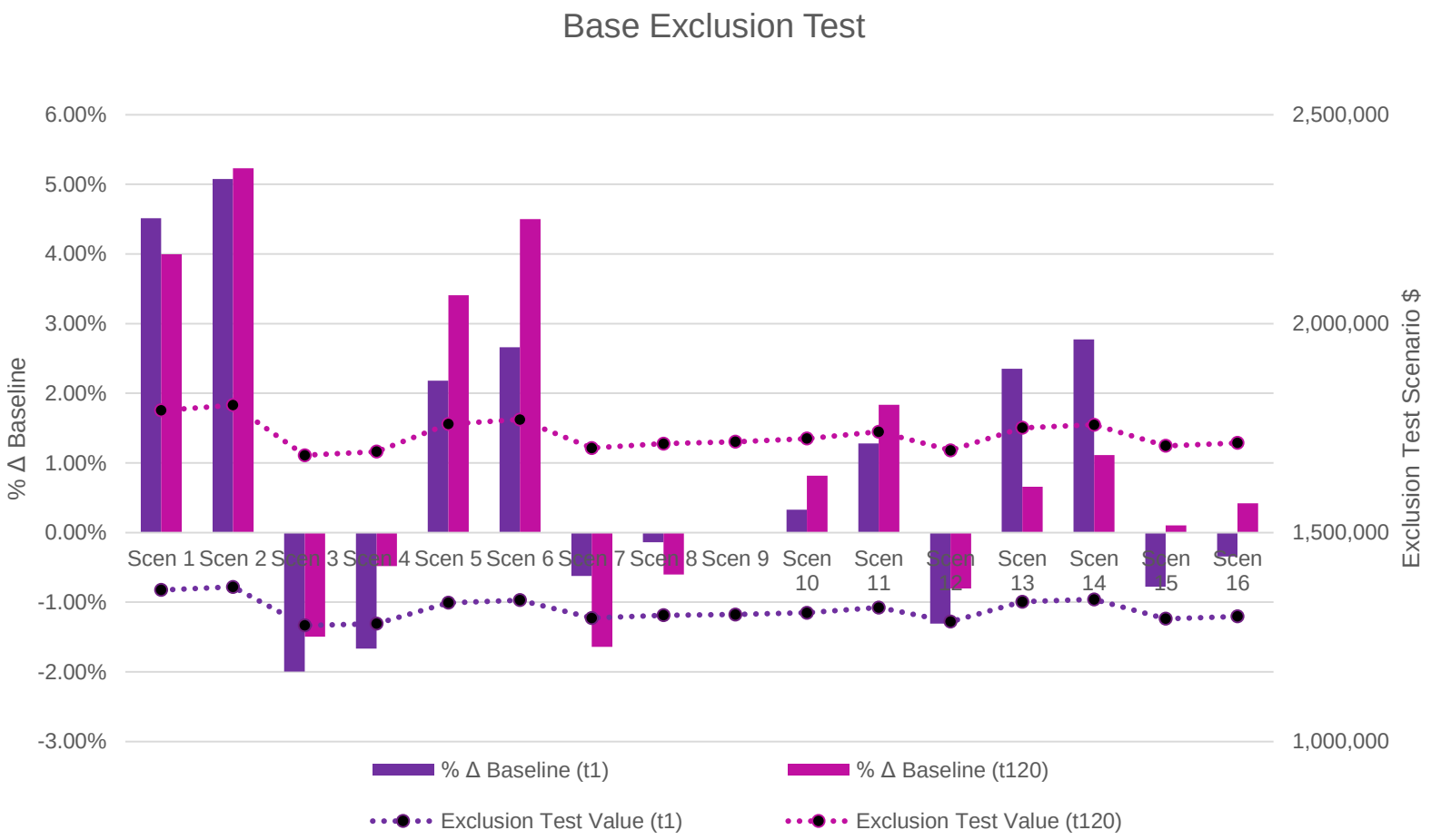
Exclusion Testing

- Exclusion testing was performed at issue and 10 year in the future for GLWB policies, base policies and an analogous FA product
  - The FA product was modeled as an FIA policy with all fund value in a fixed account with a 1% minimum crediting rate.
- Unfloored scenario amounts were calculated for each VM-20 stochastic exclusion test scenario, without margins
- The ratio to the baseline, scenario #9, was then calculated as a final metric
  - If the percentage of the max reserve over the baseline reserve exceeds a set threshold, it indicates material market risk and the group of policies fails the test
  - If below the threshold, the group of policies may use the AG33 or pre-PBR requirements
  - The ARWG has not yet proposed a threshold as it will likely wait until future field testing results are produced, but this analysis suggests somewhere around a 6% to 7% threshold

Exclusion Testing Scenario Descriptions

Scenario Descriptions	
Scenario 1 – Pop up, high equity	Interest rate shocks are selected to maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 90% level.
Scenario 2 – Pop up, low equity	Interest rate shocks are selected to maintain the cumulative shock at the 90% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 10% level.
Scenario 3 – Pop down, high equity	Interest rate shocks are selected to maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 90% level.
Scenario 4 – Pop down, low equity	Interest rate shocks are selected to maintain the cumulative shock at the 10% level (1.282 standard errors). Equity returns are selected to maintain the cumulative equity return at the 10% level.
Scenario 5 – Up/down, high equity	Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns are selected to maintain the cumulative equity return at the 90% level.
Scenario 6 – Up/down, low equity	Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns are selected to maintain the cumulative equity return at the 10% level.
Scenario 7 – Down/up, high equity	Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns are selected to maintain the cumulative equity return at the 90% level.
Scenario 8 – Down/up, low equity	Interest rate shocks are selected that, for each five-year period, are consistently in the same direction. The cumulative shock for each five-year period is at the 90% level during “up” periods and at the 10% level during “down” periods. Equity returns are selected to maintain the cumulative equity return at the 10% level.
Scenario 9 – Baseline scenario	All shocks are zero.
Scenario 10 – Inverted yield curves	There are no shocks to long-term rates and equities. There are shocks to the spread between short and long rates that are consistently in the same direction for each three-year period. The shocks for the first three-year period are in the direction of reducing the spread (usually causing an inverted yield curve). Shocks for each subsequent three-year period alternate in direction.
Scenario 11 – Volatile equity returns	There are no shocks to interest rates. There are shocks to equity returns that are consistently in the same direction for each two-year period and then switch directions.
Scenario 12 – Deterministic scenario for valuation	There are uniform downward shocks each month for 20 years, sufficient to get down to the one standard deviation point (84%) on the distribution of 20-year shocks. After 20 years, shocks are zero.
Scenario 13 – Delayed pop up, high equity	There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks— each 1.414 (square root of 2) times those in the first 10 years of Scenario 1. This gives the same 20-year cumulative shock as scenario 1, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 1. Equity returns are selected to maintain the cumulative equity return at the 90% level.
Scenario 14 – Delayed pop up, low equity	There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks— each 1.414 (square root of 2) times those in the first 10 years of Scenario 2. This gives the same 20-year cumulative shock as scenario 2, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 1. Equity returns are selected to maintain the cumulative equity return at the 10% level.
Scenario 15 – Delayed pop down, high equity	There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks— each 1.414 (square root of 2) times those in the first 10 years of Scenario 3. This gives the same 20-year cumulative shock as scenario 3, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 3. Equity returns are selected to maintain the cumulative equity return at the 90% level.
Scenario 16 – Delayed pop down, low equity	There are interest rate shocks that are zero for the first 10 years, followed by 10 years of shocks— each 1.414 (square root of 2) times those in the first 10 years of Scenario 4. This gives the same 20-year cumulative shock as scenario 4, but all the shock is concentrated in the second 10 years. After 20 years, the shock is the same as scenario 4. Equity returns are selected to maintain the cumulative equity return at the 10% level.

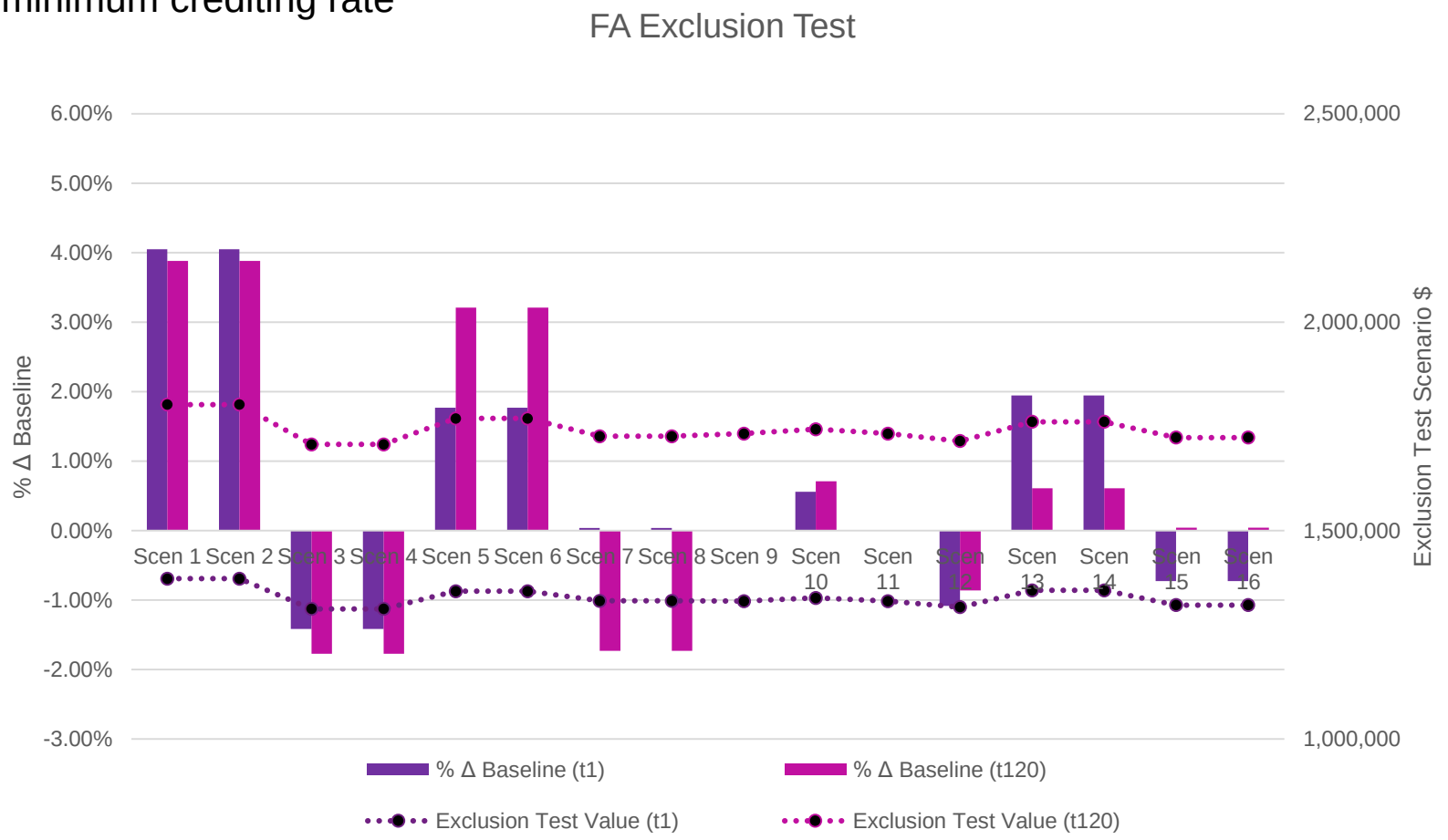
Base Policy Exclusion Testing



- At issue max ratio = 5.1%, 10-year max ratio = 5.2%. Please see slide 58 for additional details on the exclusion test scenarios.

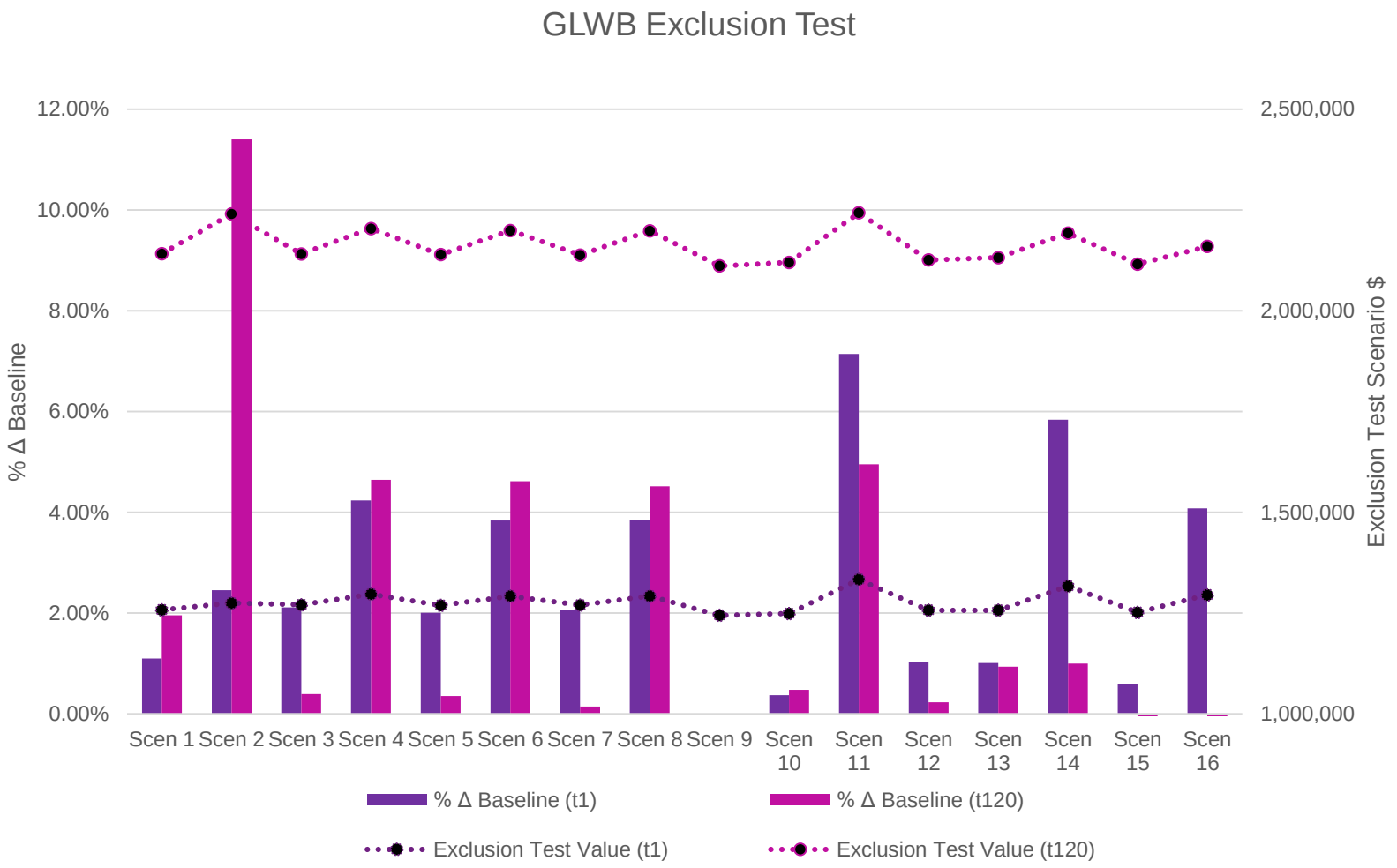
FA Exclusion Testing

The FA product was modeled as an FIA policy with all fund value in a fixed account with a 1% minimum crediting rate



- At issue max ratio = 4.1%, 10-year max ratio = 3.9%. Please see slide 58 for additional details on the exclusion test scenarios.

GLWB Exclusion Testing



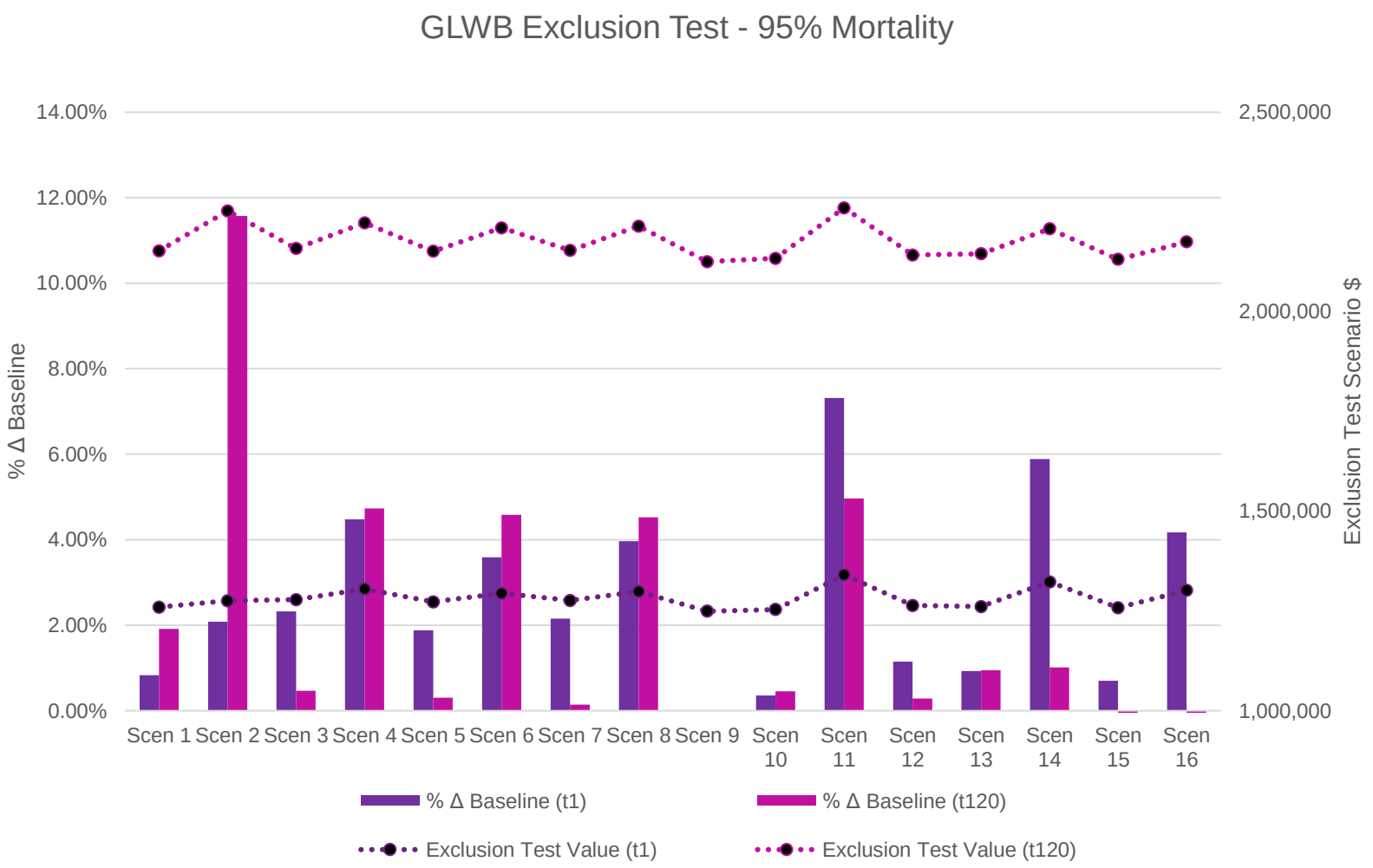
- At issue max ratio = 7.1%, 10-year max ratio = 11.4%. Please see slide 58 for additional details on the exclusion test scenarios.

Exclusion Testing

Additional GLWB Analysis

- We also performed the exclusion testing on the GLWB block with a 95% mortality assumption
- We calculated the ratios consistently with prior runs and then also calculated the ratios based on the unmargined GLWB baseline

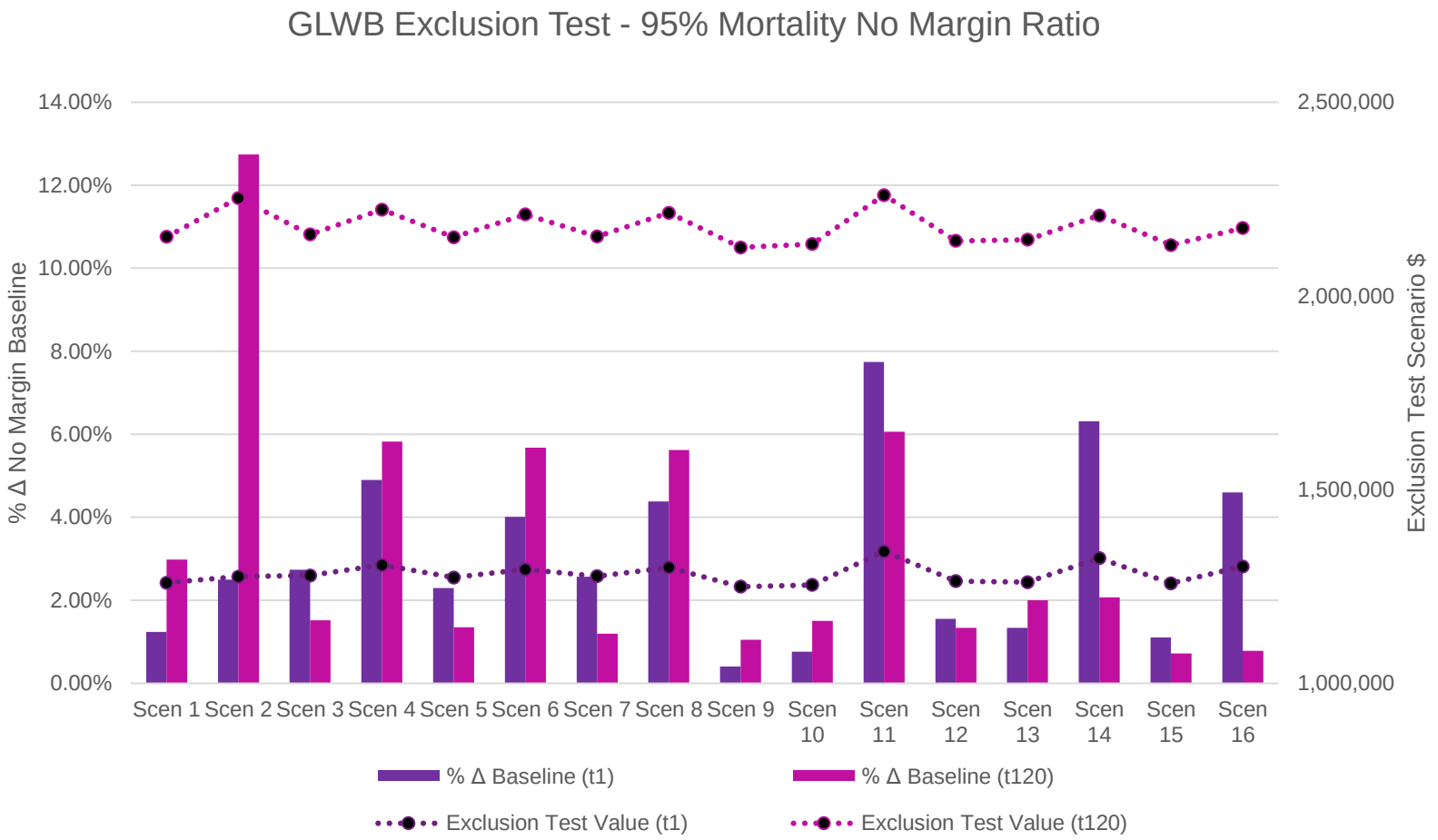
GLWB Exclusion Testing (95% Mortality)



- At issue max ratio = 7.3%, 10-year max ratio = 11.6%. Please see slide 58 for additional details on the exclusion test scenarios.

GLWB Exclusion Testing (95% Mortality With No Margin Ratio)

Ratio calculated as 95% mortality result divided by baseline with 100% mortality



- At issue max ratio = 7.7%, 10-year max ratio = 12.7%. Please see slide 58 for additional details on the exclusion test scenarios.
- The ratios here are calculated by dividing the results with 95% mortality by the baseline scenario using 100% mortality. The rationale is that this approach may be explored for developing the exclusion ratio test, where the numerator is based on a sensitivity to longevity, but the baseline scenario of the denominator is not.

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