# Standard Projection—Prescribed Assumptions and Implementation

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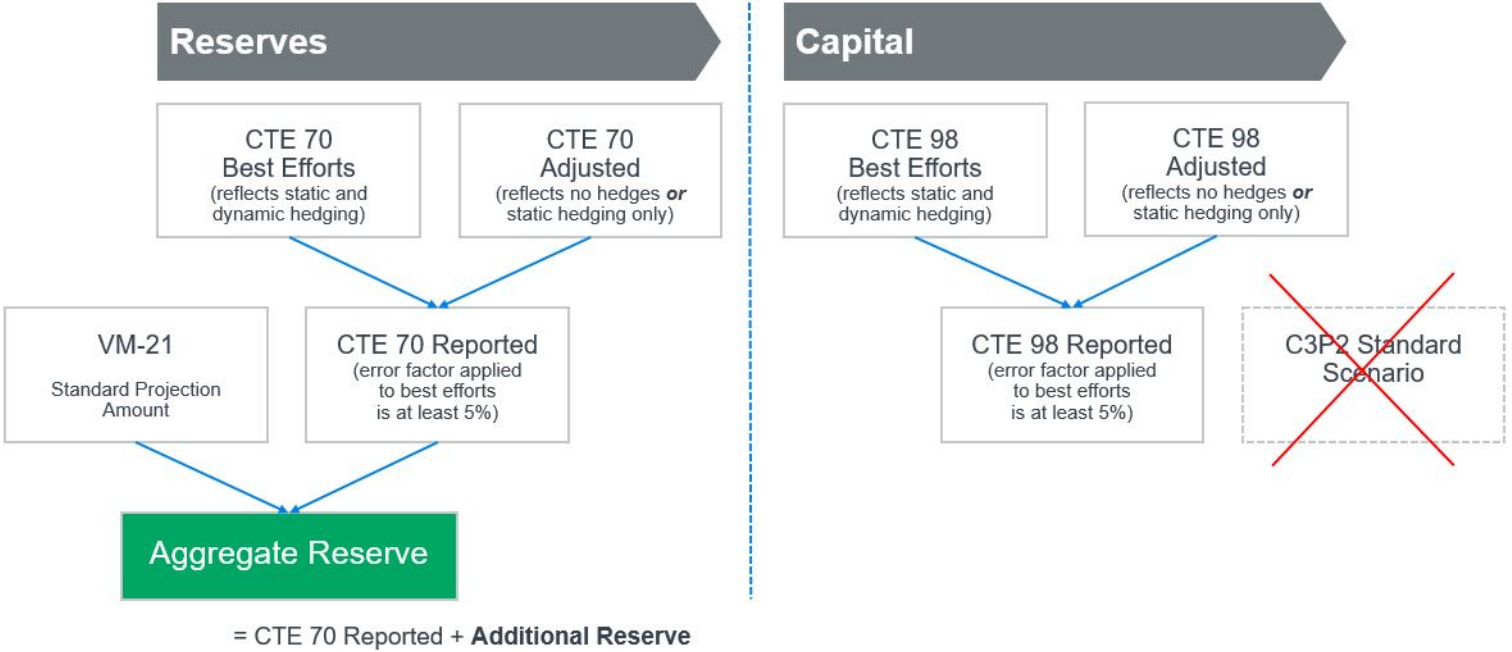
# VM-21 Statutory Framework—Overview



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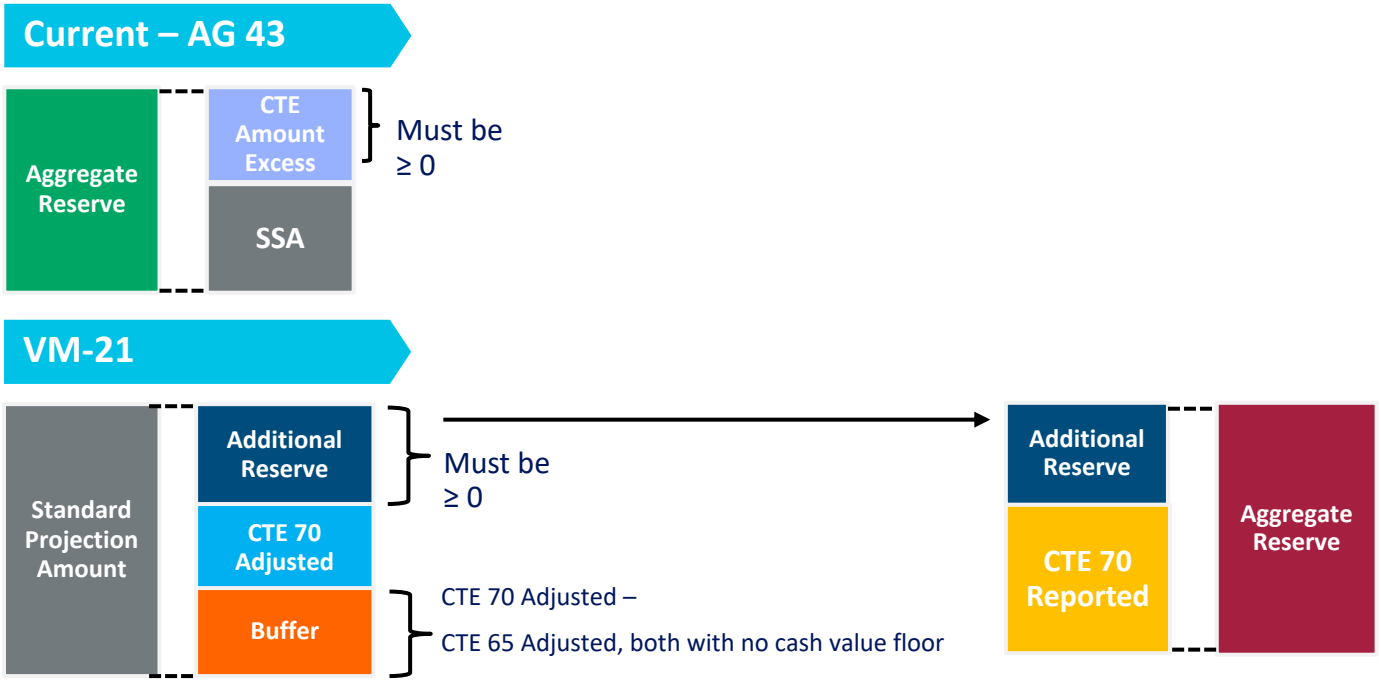
# Comparison of Statutory Frameworks—Reserves

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# VM-21 Statutory Framework—Overview

## Standard Projection Amount

**GPV of Accumulated Asset Deficiencies**

- Scenario Reserve = Starting Assets plus GPV of accumulated asset deficiencies; i.e., not accumulated net revenue (as under the existing AG 43 Standard Scenario), with a cash surrender value floor
- Companies can choose EITHER:
  - Company Specific Market Path: Calculate the Standard Projection using a set approach involving modeling company and prescribed assumptions over a panel of standardized market paths – "CSMP"
  - CTE with Prescribed Assumptions: Calculate the Standard Projection using a CTE 70 (Adjusted) approach but with prescribed assumptions – "CTEPA"

**Starting Assets**

- Prescribed policy behavior assumptions are aligned with current industry experience
- Provision for periodic refresh of prescribed behavioral assumptions based on industry-wide experience studies
- Same approach as the CTE 70 (Adjusted) calculation, unless otherwise stated

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# Standard Scenario Changes

- AG 43 Standard Scenario referred to as the "Standard Projection" (No C3P2 Standard Scenario)
- Use the Standard Projection to derive the "Additional Reserve"

## Current AG 43 Standard Scenario

- SSR = Max(CSV, BAR + PV(-ANR)) for each contract (no aggregation)
  - BAR = Basic Adjusted Reserve (pseudo-AG 33)
  - ANR = Accumulated Net Revenue (Accumulated prescribed margins less claims)
- Single drop/recovery market path (by asset class)
- Discounting uses issue year specific statutory valuation rates (Plan Type A with guaranteed duration > 10 years and ≤ 20 years)
- Only guaranteed revenue sharing is reflected in the margins

## VM-21 Standard Projection

- Now aligned with CTEA 70 (Adjusted)
  - GPVAD calculation
  - All base contract and rider cash flows are reflected (a prescribed expense floor is applied)
  - Aggregation permitted
  - No dynamic hedging
  - NAER discounting methodology under new VM-21 framework
- Companies can choose one of two calculation options:
  - Company Specific Market Path Approach
  - CTE with Prescribed Assumptions



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# Standard Projection Amount - Approach

**Standard Projection Amount**

Can choose either option BUT a company may not change the method used from one valuation date to the next without regulator approval

## Option 1: Company Specific Market Path Approach ("CSMP")

- Must use seriatim in-force
- At least 40 standardized market paths
  - 8 equity paths: Year 1 varies from -25% to 10%, in 5% increments, with 3% in later years
  - 5 interest rate paths: Generated using varying starting curves and AIRG with no random variation
- Calculate Scenario Reserve for all standardized paths using company assumptions ("Company Standard Projection Set")
- Identify Path A in the Company Standard Projection Set that is "closest to" the CTE 70 (Adjusted)
- Undertake a prescriptive process to identify Path B
- Calculate the Scenario Reserve for Paths A and B using prescribed assumptions and use an interpolation scheme to derive the final result

## Option 2: CTE 70 with Prescribed Assumptions Approach ("CTEPA")

- Can use either seriatim in-force or a model office that is consistent with (no less granular than) the approach used in the CTE 70 (Adjusted) calculation
- Need to maintain consistency in the grouping method used from one valuation to the next



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# Prescribed Assumptions

- Mortality for cash flows
  - Follows the 2012 IAM Basic Mortality table
  - Projection Scale G2 mortality improvement relative to a base year of 2012 (applied indefinitely; i.e., no cap)
  - "Fx" mortality multipliers that vary by attained age and presence/absence of a VAGLB
- General comments on policyholder behavior assumptions
  - Refreshed prescribed policyholder behavior assumptions to align with industry experience
  - Applied on the basis of GMxB rider type and ITM
- ITM is based on the "GAPV" of the benefit relative to the account value
  - GAPV = Guarantee Actuarial Present Value, similar to Current Value concept under AG 43 Standard Scenario
  - Inner loop mortality improvement applies only through December 31, 2017 (unlike the outer loop)

*Guidance Note: Projecting mortality to a specific date rather than the valuation date … is a practical expedient to streamline calculations. This date should be considered an experience assumption to be periodically reviewed and updated as the Life Actuarial (A) Task Force reviews and updates the assumptions used in the Standard Projection*



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# Guarantee Actuarial Present Value

- Similar to existing Current Value approach
- Needed at each time step to support the ITM calculation for setting PHB assumptions
  - Variation of the GAPV is also needed for application of the Withdrawal Delay Cohort Method
- APV of the rider lump sum or benefit payments
- APV is gross of the amount paid out of the account value
- Assume earliest possible exercise (for a VAGLB). If the rider is already exercised, continued exercise is assumed
- 2012 IAM Basic Table, improved to December 31, 2017, using Projection Scale G2 improvement
- Discounting uses the 10-year U.S. Treasury rate on the valuation date
- Account value growth, if applicable, is assumed to be 0% net of all fees
  - No need to track account value in the inner loop calculation unless a benefit design need (e.g., MAWA% changes on account value depletion)
- If a market index or interest rate is needed to project the benefit base, then that index or interest rate is assumed to be remain constant in the inner loop calculation



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# Guarantee Actuarial Present Value

- For a GMDB, any contractual termination provisions are voided
- Hybrid GMIB
  - Dollar-for-dollar partial withdrawals up to a threshold and pro rata thereafter and guaranteed growth in the benefit base
  - Both an Annuitization GAPV and Withdrawal GAPV are calculated for ITM purposes
- Annuitization GAPV
  - Assumes benefit payments arising from GMIB annuitization
  - Payout rate is the guaranteed purchase rate specified in the contract
- Withdrawal GAPV
  - Assumes benefit payments from taking withdrawals
  - Payout rate is the MAWA% dollar-for-dollar threshold (commonly the rollup rate)
- For a GMWB, the GAPV is calculated assuming 100% of the MAWA is withdrawn



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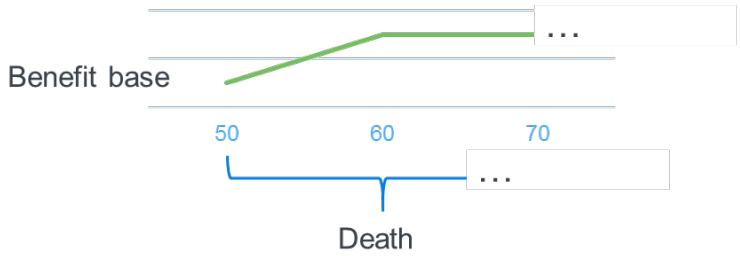
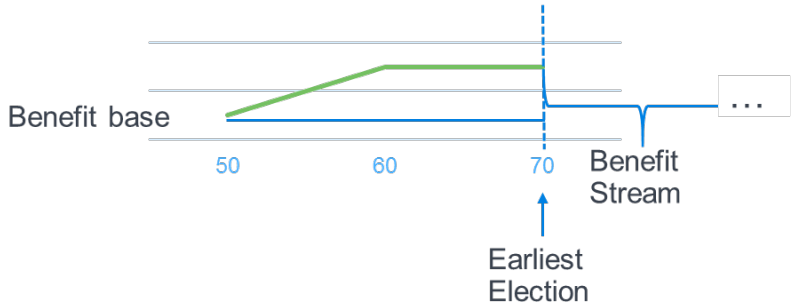
# Guarantee Actuarial Present Value—An Example

## GAPV – for GMDB




## GAPV – for VAGLBs




Assume that:

- The GAPV is calculated at a50
- The benefit base rollup stops at a60
- The earliest VAGLB exercise age is a70
- For VAGLBs, benefit rate is:
  - 0 until a70
  - The guaranteed purchase rate for Traditional GMIBs
  - The dollar for dollar threshold for Hybrid GMIBs
  - The MAWA% for GMWBs
- Potential special cases:
  - Joint policies
  - Product designs where the MAWA% changes when the AV is depleted will require tracking the AV in the inner loop



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# Prescribed Assumptions—Lapses

| Standard Table for Full Surrenders | | | |
|---|---|---|---|
| ITM | In SC period OR in t=1-3 for no SC contracts | First year post-SC period | Later years or t > 3 for no SC contracts |
| < 50% | 4.0% | 25.0% | 15.0% |
| 50-75% | 3.0% | 18.0% | 10.0% |
| 75-100% | 2.5% | 12.0% | 7.0% |
| 100-125% | 2.5% | 8.0% | 4.5% |
| 125-150% | 2.5% | 6.0% | 3.0% |
| 150-175% | 2.5% | 5.0% | 2.5% |
| 175-200% | 2.5% | 4.5% | 2.0% |
| > 200% | 2.5% | 4.0% | 2.0% |

| Rider type | Adjustment to ITM ratio |
|---|---|
| GMDB | 75% |
| GMAB | 150% |
| Trad GMIB | 100% |
| Hybrid GMIB | 100%* |
| GMWB | 100% |

* Applied to max(Annuitization GAPV, Withdrawal GAPV)

- Lapse rate is assigned based on ITM, which is a function of the ratio of the GAPV to AV, with a prescribed multiplicative adjustment
  - Adjustment varies from 75-150%
  - For hybrid GMIBs, the GAPV used for ITM purposes is equal to max(Annuitization GAPV, Withdrawal GAPV)
- For contracts with both a VAGLB and GMDB, the lapse rate is min(Lapse Rate [GMDB ITM], Lapse Rate [VAGLB ITM])
- For GMWB or Hybrid GMIB contracts, a 60% haircut is applied to the assigned lapse rate for all years in which a withdrawal is projected
- For contracts without riders, use the ITM < 50% row
- For GMWB contracts on AV depletion, the prescribed lapse rate is 0%



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# Prescribed Assumptions—Annuitizations

| Standard Table for Traditional GMIB Annuitization | | |
|---|---|---|
| Annuitization GAPV / AV | First year of exercisability | Subsequent years |
| 0-100% | 0.0% | 0.0% |
| 100-125% | 5.0% | 2.5% |
| 125-150% | 10.0% | 5.0% |
| 150-175% | 15.0% | 7.5% |
| 175-200% | 20.0% | 10.0% |
| 200%+ | 25.0% | 12.5% |

| Standard Table A for Hybrid GMIB Annuitization | |
|---|---|
| Annuitization GAPV / AV | First year of exercisability |
| 0-100% | 0.0% |
| 100-125% | 0.5% |
| 125-150% | 1.0% |
| 150-175% | 1.5% |
| 175-200% | 2.0% |
| 200%+ | 2.5% |

| Standard Table B for Hybrid GMIB Annuitization | |
|---|---|
| Annuitization GAPV / AV | First year of exercisability |
| 0-100% | 0.0% |
| 100-125% | 5.0% |
| 125-150% | 10.0% |
| 150-175% | 15.0% |
| 175-200% | 20.0% |
| 200-225% | 25.0% |
| 225-250% | 30.0% |
| 250%+ | 35.0% |

- For contracts without a GMIB, the annuitization rate is 0%
- For GMIB contracts the annuitization rate is 0% if not contractually exercisable
- On AV depletion, any contractual features that terminate the GMIB are voided and an annuitization rate of 100% is assumed (resulting in a lump sum claim)
- For a Traditional GMIB contract, the annuitization rate should follow the Standard Table for Traditional GMIB Annuitization if the AV is not depleted
- For a Hybrid GMIB contract, if the AV is not depleted, then:
  - If Withdrawal GAPV > Annuitization GAPV and Annuitization GAPV > AV and the contract is in not in the last 3 years in which the GMIB is exercisable, then the annuitization rate is 0.25%
  - If Annuitization GAPV > Withdrawal GAPV and the contract is in not in the last 3 years in which the GMIB is exercisable, then the annuitization rate follows Standard Table A for Hybrid GMIB Annuitization
  - If the contract is in the last 3 years in which the GMIB is exercisable, then the annuitization rate follows Standard Table B for Hybrid GMIB Annuitization
  - Otherwise the annuitization rate is 0%
- If the GAPV of another rider on the contract exceeds the Annuitization GAPV, the annuitization rate is adjusted to be min(50% of the prescribed rate, 12.5%)



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# Prescribed Assumptions

- Withdrawals
  - Varies by rider type
  - For GMWB and Hybrid GMIB contracts that have either not elected as of the valuation date or have taken an excess withdrawal, the Withdrawal Delay Cohort Method ("WDCM") applies
    - Prescriptive WDCM process splits existing records into multiple records/cohorts (Σ cohorts = original)
    - Based on Withdrawal GAPV, but with modifications to the GAPV process
    - Each cohort has AV, benefit, and related fields split by a calculated weight (Σ cohorts = original)
    - Each cohort has a specified timing of deferral
- Expenses
  - $100 in year 1 (inflated at 2% thereafter) and 7 bps of AV p.a. if company is responsible for contract administration
  - $35 in year 1 (inflated at 2% thereafter) if company is not responsible for contract administration
- Hedging and reinsurance cash flows are modeled in the same way as the CTE 70 (Adjusted)
- No transfers (e.g., automatic rebalancing or portfolio management strategies) and no deposits are allowed unless contractually required



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# Prescribed Assumptions

- Modeling treatment for policies that have more than one VAGLB rider (as defined by VM-01)
  - Company should select the guaranteed benefit type deemed best applicable and be consistent in this selection from one valuation date to the next

    *If a VAGLB has both lifetime GMWB and non-lifetime GMWB features and the company determines that the lifetime GMWB is the most prominent component; assumptions for all contracts with such a VAGLB shall be set as if the VAGLB were only a lifetime GMWB and did not contain any of the non-lifetime GMWB features. If the company determines that the non-lifetime GMWB is the most prominent component; assumptions for all contracts with such a VAGLB shall be set as if the VAGLB were only a non-lifetime GMWB and did not contain any of the lifetime GMWB features.*
  - If a contract cannot be classified into any categories within a given assumption, the company shall determine the defined benefit type with the most similar benefits and risk profile as the company's benefit and utilize the assumption prescribed for this benefit
- Modeling treatment on account value depletion
  - For GMWB contracts, assume 100% of MAWA
  - For GMIB contracts, assume 100% annuitization (over-riding any contractual provision that specifies termination of the rider on AV depletion)
  - For any other riders, including a GMDB, the contract should remain in force (over-riding any contractual provision that specifies termination of the rider on AV depletion) but with no benefit provisions



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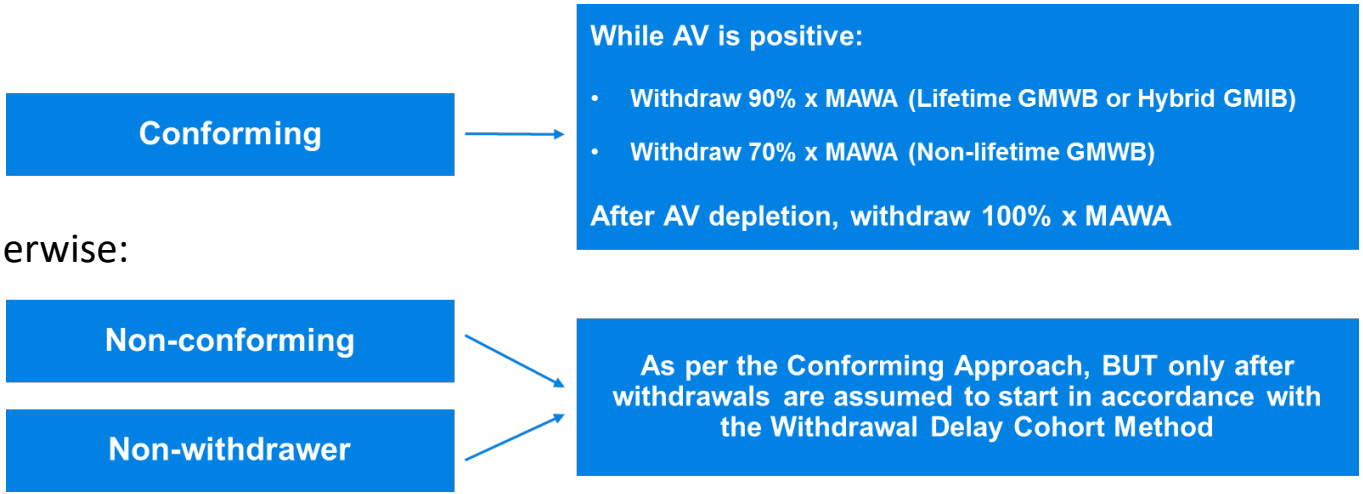
# Hierarchy of Withdrawal Behavior (GMWB and Hybrid GMIB)

- A policyholder is referred to as conforming if both of the following statements are true:
  - They make a withdrawal in the previous policy year
  - Such a withdrawal was NOT an excess withdrawal (not > maximum allowable withdrawal amount = MAWA)



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# Prescribed Assumptions—Partial Withdrawals




- WDCM does not apply to policies currently on systematic payment options ("SPOs"), i.e., as of the valuation date
  - Such withdrawals are capped at the MAWA
- Should a policy become an SPO in reality, the WDCM no longer applies to that policy
- WDCM does not apply to policies without a GMWB or Hybrid GMIB
- WDCM may apply to non-SPO's GMWB and Hybrid GMIB policies
  - Applies if policy did not take a withdrawal in the last policy year
  - Applies if policy did take a withdrawal in the last policy year, but it was an excess withdrawal
- The prescribed haircut of 70% (non-lifetime GMWB) and 90% (lifetime GMWB and Hybrid GMIBs) applies for all non-SPOs once withdrawals start



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# Withdrawal Delay Cohort Method

- Applies to GMWB and Hybrid GMIB policies that have either:
  - Not started taking withdrawals (“non-withdrawers”), OR
  - Taken an excess withdrawal in the last policy year (“non-conforming”)
- Prescribed approach, with the purpose of splitting existing in-force records into multiple cohorts
- Cohorts simulate each potential age of starting withdrawals (i.e., initial withdrawal ages)
- Calculate a vector of GAPVs from issue age (not attained age on the valuation date) to a120, and apply a prescriptive algorithm to determine a cumulative distribution function (“CDF”) of cohort weights
  - Same GAPV approach as for ITM purposes, but with a 3% discount rate
- Prescribed “shocks” apply if the policy is qualified and/or there is guaranteed growth in the benefit
  - If multiple guaranteed growth features exist, shock is added to the initial withdrawal age with the higher GAPV
- Also defines a “never elect” cohort, whose weight varies by benefit type and tax status
  - GMWB: 5% if qualified, 20% if non-qualified; Hybrid GMIB: 15% if qualified, 40% if non-qualified
- Any weights before the valuation date are discarded and the remaining CDF is rescaled



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# Withdrawal Delay Cohort Method

- Intended to be a one-time approach to determine weights for policies with the same “Withdrawal Delay Cohort Method cell key”
- Withdrawal Delay Cohort Method cell key includes issue age, benefit design and tax status (and implicitly, gender)
- At subsequent valuation dates, if a policy begins conforming withdrawals, the Withdrawal Delay Cohort Method no longer applies
- New business with different benefit designs will need to be considered on a going concern basis
- Potentially significant run-time concerns exist due to cohorting approach
- A priori work needed to determine how to mitigate the run-time challenge
- Some allowance for discarding cohorts exists (subject to VM-31 disclosures)

***Guidance Note:*** *The instructions in Section 6.C.5 are meant to improve computational tractability for companies that have large in force portfolios; accordingly, companies may also elect not to discard any initial withdrawal ages in constructing the withdrawal cohorts. Additionally, if necessary to avoid unmanageable computational intensity, companies may discard more initial withdrawal ages in constructing withdrawal cohorts or assign only a small number of withdrawal cohorts to each contract via random sampling*



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# Withdrawal Delay Cohort Method

- Illustrative example using a non-conforming qualified lifetime GMWB policy
  - Issue age = 55
  - Attained age on valuation date = 65
  - Rollup feature stops at age 60
  - Qualified status

    → 5% never elect cohort (so 95% does elect)

  - Rollup shock = 35%
  - Required minimum distribution shock (qualified status) = 50%

Prescribed, per the instructions

- **Will only use a55 to a75 for simplicity (normally should be determined from issue to a120)**
- **Other reasonable interpretations of the prescriptive Withdrawal Delay Cohort Method are possible**



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# Withdrawal Delay Cohort Method

## Discard odd (even) individual withdrawal ages, if issue age is odd (even)

| Age (IWA) | Policy Year | GAPV | Adjusted GAPV | Normalized GAPV | Initial CDF | Rollup Shock Flag | RMD Shock Flag | Shock Adjustment | Final CDF | Bi-annual CDF | Discards |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | 1 | 14,068 | 98,961,335 | 0.02271 | 0.02271 | FALSE | FALSE | - | 0.02271 | 0.02271 | 1 |
| 56 | 2 | 14,118 | 99,665,595 | 0.02287 | 0.04557 | FALSE | FALSE | - | 0.04557 | 0.02271 | 0 |
| 57 | 3 | 14,325 | 102,604,837 | 0.02354 | 0.06912 | FALSE | FALSE | - | 0.06912 | 0.06912 | 1 |
| 58 | 4 | 14,525 | 105,490,537 | 0.02420 | 0.09332 | FALSE | FALSE | - | 0.09332 | 0.06912 | 0 |
| 59 | 5 | 14,717 | 108,302,383 | 0.02485 | 0.11817 | FALSE | FALSE | - | 0.11817 | 0.11817 | 1 |
| 60 | 6 | 14,753 | 217,643,365 | 0.04994 | 0.16811 | TRUE | FALSE | 0.27366 | 0.44177 | 0.11817 | 0 |
| 61 | 7 | 14,934 | 223,036,492 | 0.05118 | 0.21929 | TRUE | FALSE | 0.25575 | 0.47504 | 0.47504 | 1 |
| 62 | 8 | 15,106 | 228,198,245 | 0.05236 | 0.27165 | TRUE | FALSE | 0.23742 | 0.50907 | 0.47504 | 0 |
| 63 | 9 | 15,267 | 233,091,635 | 0.05348 | 0.32513 | TRUE | FALSE | 0.21870 | 0.54383 | 0.54383 | 1 |
| 64 | 10 | 15,417 | 237,689,017 | 0.05454 | 0.37967 | TRUE | FALSE | 0.19962 | 0.57928 | 0.54383 | 0 |
| 65 | 11 | 15,435 | 238,236,658 | 0.05466 | 0.43433 | TRUE | FALSE | 0.18048 | 0.61481 | 0.61481 | 1 |
| 66 | 12 | 15,570 | 242,428,944 | 0.05563 | 0.48996 | TRUE | FALSE | 0.16102 | 0.65097 | 0.61481 | 0 |
| 67 | 13 | 15,581 | 242,774,392 | 0.05570 | 0.54566 | TRUE | FALSE | 0.14152 | 0.68718 | 0.68718 | 1 |
| 68 | 14 | 15,551 | 241,823,944 | 0.05549 | 0.60115 | TRUE | FALSE | 0.12210 | 0.72325 | 0.68718 | 0 |
| 69 | 15 | 15,473 | 239,416,348 | 0.05493 | 0.65608 | TRUE | FALSE | 0.10287 | 0.75895 | 0.75895 | 1 |
| 70 | 16 | 15,467 | 239,216,302 | 0.05489 | 0.71097 | TRUE | FALSE | 0.08366 | 0.79463 | 0.75895 | 0 |
| 71 | 17 | 15,432 | 238,150,205 | 0.05464 | 0.76561 | TRUE | TRUE | 0.12446 | 0.89007 | 0.89007 | 1 |
| 72 | 18 | 15,421 | 237,799,520 | 0.05456 | 0.82018 | TRUE | TRUE | 0.08763 | 0.90781 | 0.89007 | 0 |
| 73 | 19 | 14,579 | 212,552,927 | 0.04877 | 0.86895 | TRUE | TRUE | 0.05471 | 0.92366 | 0.92366 | 1 |
| 74 | 20 | 13,711 | 187,982,506 | 0.04313 | 0.91208 | TRUE | TRUE | 0.02560 | 0.93768 | 0.92366 | 0 |
| 75 | 21 | 12,856 | 165,269,716 | 0.03792 | 0.95000 | TRUE | TRUE | - | 0.95000 | 0.95000 | 1 |



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# Withdrawal Delay Cohort Method

## Re-normalize weights, including the “never elect” cohort

| Age (IWA) | Policy Year | Final CDF | Final PDF | Final Weights |
|---|---|---|---|---|
| 56 | 2 | 0.02271 | 0.02271 | Discard IWAs prior to known attained age a65 on val date |
| 58 | 4 | 0.06912 | 0.04641 | Discard IWAs prior to known attained age a65 on val date |
| 60 | 6 | 0.11817 | 0.04905 | Discard IWAs prior to known attained age a65 on val date |
| 62 | 8 | 0.47504 | 0.35686 | Discard IWAs prior to known attained age a65 on val date |
| 64 | 10 | 0.54383 | 0.06880 | Discard IWAs prior to known attained age a65 on val date |
| 66 | 12 | 0.61481 | 0.07098 | **15.56%** |
| 68 | 14 | 0.68718 | 0.07236 | **15.86%** |
| 70 | 16 | 0.75895 | 0.07177 | **15.73%** |
| 72 | 18 | 0.89007 | 0.13112 | **28.74%** |
| 74 | 20 | 0.92366 | 0.03358 | **7.36%** |
| Never Elect | N/A | 1.00000 | 0.07634 | **16.74%** |



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# Withdrawal Delay Cohort Method—Modeling Practice

- Rely on the instructions as written (Letter of the law approach)
  - Consistency with the guidelines
  - Resulting cohorted inforce file will likely be many multiples of the existing record count

- Limit to a pre-defined maximum number of cohorts
  - The number of cohorts from valuation date to valuation date is thus predictable
  - Need to develop a strategy to pick which cohorts to include and exclude
  - For example, cohorts with weights ≥ minimum threshold



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# Withdrawal Delay Cohort Method—Modeling Practice

- Single (deferral) cohort approach—Non-randomized
  - Variety of possibilities to collapse cohorts, e.g. based on maximum GAPV, weighted average cohort, median cohort
  - Can significantly reduce the post-WDCM record count
  - Need to get buy-in and show that it reasonably approximates the letter of the law approach
  - May still need to model the never-elect cohort explicitly
- Single (deferral) cohort approach—Randomized
  - Use a random draw to collapse cohorts
  - Can significantly reduce the post-WDCM record (essentially to the pre-WDCM number of records)
  - Need to get buy-in and show that it reasonably approximates the letter of the law approach
- Can get buy-in for whichever simplified approach is chosen by comparing to the full-blown WDCM approach to the simplified approach for a certain subset of scenarios



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# Prescribed Assumptions—403(b) Contracts

- A variable annuity contract issued within a 403(b) retirement savings plan that does not have a VAGLB
- Comments in this presentation to-date have been solely for (normal) variable annuities
- 403(b)-specific prescribed assumptions exist for:
  - Lapses
  - Partial withdrawals
  - Additional deposits



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# Standard Projection—Implementation and Challenges

- Complexity/runtime concerns issues with the Withdrawal Delay Cohort Method (Standard Projection)
  - Can be mitigated using optimization techniques; e.g., random sampling
- Withdrawal Delay Cohort Method—case study using random sampling
  - ~ 50,000 variable annuity contracts with GLWBs
  - $6.5 BB in account value in force
  - GLWB design includes
    - An annual ratchet
    - 5% benefit base rollup for the first 10 years
  - MAWA % varies between 3% and 6% by attained age
- On implementation of the Withdrawal Delay Cohort Method, the in-force record count increased by x10 to ~ 600,000 cohorts.



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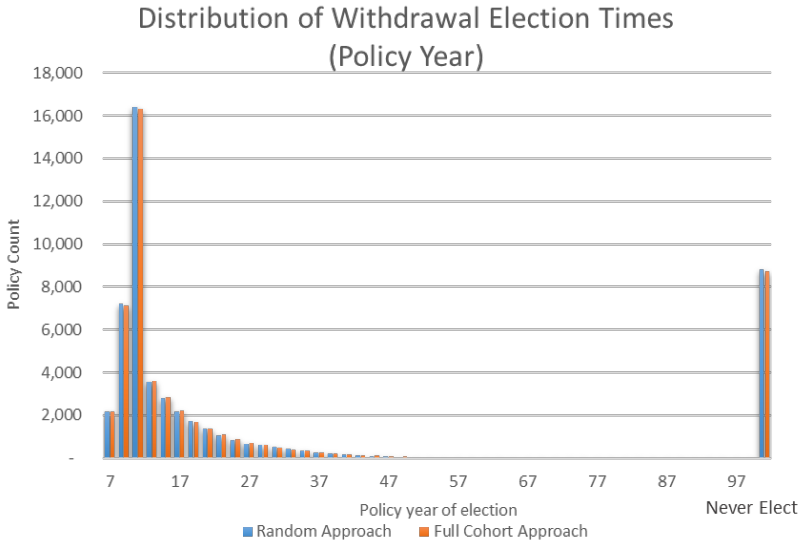
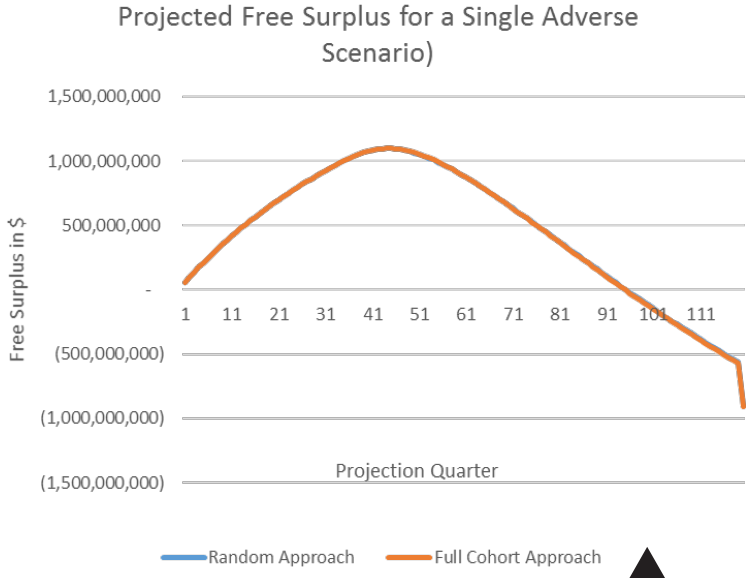
# Standard Projection—Implementation and Challenges

- Withdrawal Delay Cohort Method—case study using random sampling



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# Standard Projection—Implementation and Challenges

- Withdrawal Delay Cohort Method - case study using random sampling

| PROJECTION QUARTER | FREE SURPLUS | | |
|---|---|---|---|
| | FULL COHORT APPROACH | RANDOM APPROACH | % DIFFERENCE |
| 1 | 52,804,571 | 52,804,774 | 0.0% |
| 25 | 794,526,441 | 794,578,862 | 0.0% |
| 50 | 1,064,869,166 | 1,064,191,842 | -0.1% |
| 75 | 525,080,878 | 527,427,921 | 0.4% |
| 100 | (130,906,609) | (124,967,114) | -4.5% |
| 120 | (911,403,069) | (901,397,103) | -1.1% |

| | GPVAD | | |
|---|---|---|---|
| | 85TH PERCENTILE | 95TH PERCENTILE | WORST SCENARIO |
| Full Cohort Approach | (513,763,374) | (293,441,348) | 362,313,321 |
| Random Approach Run 1 | (508,157,194) | (286,549,708) | 373,580,935 |
| Random Approach Run 2 | (515,788,554) | (295,226,691) | 360,822,887 |
| Random Approach Run 3 | (512,286,245) | (291,652,102) | 365,459,258 |
| Random Approach Run 4 | (513,587,416) | (292,779,601) | 364,035,113 |
| Random Approach Run 5 | (514,675,793) | (294,887,823) | 358,851,912 |
| Mean for Random Approach | (512,899,041) | (292,219,185) | 364,550,021 |
| Ratio of Standard Deviation over Mean for Random Approach | -1% | -1% | 2% |



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# Standard Projection—Implementation and Challenges

- Considerations for random sampling
  - Number of policies and cohorts
  - Choice of random number generator
  - Defining the random number “seed” (e.g., vary by contract, vary by contract and/or scenario)
  - The number of cohorts to be assigned via random sampling (one or more?)
  - Stability of results (when changing the seed)
  - Storage of random seeds to replicate earlier results
  - Demonstrating that it closely fits to the full-blown approach (VM-31)



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# Standard Projection—Implementation and Challenges

- Indefinite mortality improvement (Standard Projection)
  - Likely punitive for long-tailed VAGLB business
- Data limitations for partial withdrawal activity
  - Is a contract on automatic withdrawal?
  - If not, is it known whether or not a contract took a withdrawal in the policy year preceding the valuation date?
  - If so, is the amount of the withdrawal known?
- Considerations for the GAPV calculation used in the Withdrawal Delay Cohort Method:
  - Approach to use if the benefit base is a function of Treasury rates
  - Future updates to the prescribed December 31, 2017, mortality improvement assumption



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# Standard Projection—Implementation and Challenges

- VM-31 disclosures
  - Appropriateness of any simplified modeling approach to the Withdrawal Delay Cohort Method
  - Allocation of the aggregate reserve to the policy level using a “risk metric”
  - Assessing the impact of aggregation and cumulative decrement analysis
- Categorizing non-standard riders when looking up prescribed assumptions
- Limitations of the existing AIRG, particularly in low-rate environments
- New York Department of Financial Services requirements for business issued in New York
  - Bifurcates treatment between pre-1/1/2020 business and post-1/1/2020 business
  - Modified AG 43 Standard Scenario in both cases
  - Post 1/1/2020 incorporates elements of VM-21



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# Questions - Panel discussion

Thank you

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