NAIC for Hedgers: RILAs & FIAs

Practitioner's Notebook

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Contents

Chapter 1

Preliminaries

1.1 Glossary

Term	Desk-focused definition
AG 43 / AG 54	Actuarial Guidelines issued by the NAIC. AG 43 (2009) set stochastic reserving requirements for variable annuities with guaranteed benefits, predecessor to VM–21. AG 54 (2023) clarified that Registered Index-Linked Annuities (RILAs) fall under the VM–21 framework, rather than fixed annuity rules. Together, they mark the transition from formulaic reserves toward principle-based, hedge-recognizing stochastic reserving.
ALCO	Asset–Liability Committee. Senior governance forum (Finance, Risk, Actuarial, Investments) that approves hedge budgets/limits and reviews KPI packs. The hedge desk's escalation point.
AP&P	Accounting Practices & Procedures Manual. NAIC's official compilation of all SSAPs and guidance. Defines how derivatives and reserves must be recorded in statutory statements.
C–3 Phase II RBC	NAIC Risk-Based Capital framework for *market risk*. For FIAs and other fixed annuities, it applies factor-based charges on GA reserves/account values (e.g., duration factors + equity-crediting factors). For RILAs/variable annuities, it ties into VM–21 stochastic models, where C–3 capital is measured as a proportion of the tail gap (e.g., 0.25 * [CTE_{98} – CTE_{70}]). Thus, FIA C–3 is formulaic and hedge-blind, while RILA C–3 is tail-driven and explicitly sensitive to hedge effectiveness.
CDHS	Clearly Defined Hedging Strategy. Required under VM–21 §C.1.1 and §C.2.2 for hedges to be recognized in stochastic reserve and capital projections. Must specify instruments, objectives, and rebalancing rules.
CTE	Conditional Tail Expectation. Average of the worst x% of modeled losses (e.g., CTE_{70} = average of worst 30% scenarios). Defined in VM–21 §C.2.1. VM-21 prescribes CTE_{70} for reserves and CTE_{98} for capital.
DUP	Derivative Use Plan. NAIC-required policy (see AP&P Manual and SSAP 86 guidance), board-approved, that specifies why/when the insurer uses derivatives, permissible instruments, and limit frameworks. Auditors test compliance.
FIA	Fixed Index Annuity. General account product with crediting linked to an index but subject to caps/pars/spreads. Reserves deterministic (SNFL/SVL), so hedges smooth earnings.
General Account	Assets backing FIAs and other fixed liabilities. Invested in bonds/credit, subject to RBC capital charges. Hedge derivatives booked here unless tied to RILA separate account.
GPVAD	Greatest Present Value of Accumulated Deficiency. Defined in VM–21 §C.2.1. The maximum (over all projection periods) of the present value of accumulated deficiencies, discounted at the Net Asset Earned Rate (NAER). Statutory reserve is set as CTE_{α} over the distribution of scenario GPVADs, floored by the Standard Scenario Amount (SSA).
Hedge Budget	Option premium and turnover capacity allocated to the desk per year. Sets how much vega/gamma protection can be purchased. ALCO-approved.
IMR / AVR	Interest Maintenance Reserve / Asset Valuation Reserve. Statutory mechanisms to smooth unrealized gains/losses (IMR) and credit risk losses (AVR). Desk needs to understand how derivative P&L interacts with them.
NAER	Net Asset Earned Rate. Defined in VM–21 §C.1.1 as the rate used to discount projected deficiencies, derived from portfolio book yield assumptions. Distinct from market risk-free rates.
NAIC	National Association of Insurance Commissioners. U.S. standard-setter for statutory accounting, reserving (VM-21), and derivative oversight. Issues SSAPs, AP&P, AGs, VMs.
RBC	Risk-Based Capital. Statutory capital requirement based on C-1 (credit), C-2 (insurance), C-3 (market), C-4 (business). Hedge programs aim to reduce C-3 volatility.
RILA	Registered Index-Linked Annuity. Separate account product with buffer/floor downside and registered prospectus. VM-21 reserving recognizes hedges explicitly.
Schedule DB	Statutory filing schedule listing all derivatives: type, purpose, counterparty, valuation. Desk must ensure every trade ties to Schedule DB fields at inception.
SNFL / SVL	Standard Nonforfeiture Law / Standard Valuation Law. State laws defining minimum guarantees and reserve methods for FIAs. Hedge P&L does not change these reserves.
SSA	Standard Scenario Amount. Deterministic reserve floor under VM–21 Appendix 3. Applies per contract form. Based on stylized equity shock, rate path, and limited hedge recognition.
SSAP	Statutory Statement of Accounting Principles. Individual accounting rules (e.g., SSAP 86 for derivatives). Collected in the AP&P manual. Dictates how hedge trades flow into earnings/surplus.
VM–21	Valuation Manual 21. NAIC standard for variable annuity and RILA reserves/capital. Prescribes use of GPVADs, CTE, SSA floor, and hedge recognition via CDHS. See VM–21 §C.1–C.4.

1.2 Background on Products: FIAs & RILAs

1000-foot view. Fixed Index Annuities (FIAs) and Registered Index-Linked Annuities (RILAs) both offer equity-linked upside with downside constraints, but they differ in where assets sit, how guarantees are framed, how reserves/capital are computed, and what that implies for hedging. At a high level:

- **FIA** = a *fixed* insurance product. Policy values live on the insurer's *general account* (GA). Crediting methods (caps/pars/spreads) are formulaic, with a statutory *minimum nonforfeiture value* (SNFL) floor. Reserving is largely deterministic (SVL/SNFL).
- **RILA** = a *variable* annuity product (registered). Policy values are in a *separate account* (SA), legally segregated from the GA. Payoff is via a prospectus-filed buffer/floor formula. Reserving follows VM–21 with *stochastic* CTE tails and hedge recognition.

FIA: key characteristics.

- **Crediting:** Index-linked via caps/participations/spreads; formula declared per policy terms.
- **Downside:** Principal protection anchored by SNFL (minimum nonforfeiture accumulation).
- **Balance sheet:** Backed by GA assets (bonds/credit). Derivatives, if used, typically booked in GA.
- **Reserving:** Deterministic under SVL/SNFL; hedge results do *not* directly change reserve formulas.
- **Capital:** RBC charges (C-1 credit, C-3 market) apply to GA. Hedges mainly smooth *earnings*, not reserves.
- **Investor recourse:** SNFL floor is the hard statutory backstop; index crediting is contractual but not a separate guarantee.

RILA: key characteristics.

- **Crediting:** Prospectus-filed buffer or floor structure (e.g., first 10% loss absorbed; or max loss of 10%).
- **Downside:** Investor bears losses beyond buffer or up to the floor limit; no SNFL-like statutory floor.
- **Balance sheet:** Policyholder owns units in SA; assets are legally segregated from GA creditors.
- **Reserving:** VM–21 *stochastic* reserves via CTE tail averages of GPVAD; *recognized* hedges reduce tails.
- **Capital:** RBC (C-3 market) tied to modeled tails; hedge effectiveness can materially reduce required capital volatility.
- **Investor recourse:** Hard recourse to SA value and the prospectus payoff formula (buffer/floor), not to a nonforfeiture floor.

Why hedging matters (different reasons).

- **FIA:** Desk hedges to stabilize GA earnings (P&L) and manage C-3 charges. Reserves are formulaic; hedge credit is *not* recognized.
- **RILA:** Desk hedges to deliver the prospectus formula and to reduce *stochastic tail* losses. VM–21 *does* recognize DUP-compliant hedges and rebalancing rules, lowering CTE reserves (to the SSA floor, if binding).

	FIA (Fixed Index Annuity)	RILA (Registered Index-Linked Annuity)
Where assets sit	General Account (GA)	Separate Account (SA), legally segregated
Payoff framing	Index crediting via caps/pars/spreads	Prospectus buffer/floor formula
Downside backstop	Statutory SNFL (minimum nonforfeiture)	No SNFL; investor bears losses beyond buffer / up to floor
Reserving regime	Deterministic (SVL/SNFL); hedge-blind	VM–21 stochastic (CTE); hedge recognition if rules-based
Reserve floor	SNFL mechanics	Standard Scenario Amount (SSA) under VM–21
Capital signal	RBC on GA (C-1, C-3)	RBC C-3 per modeled tails (hedge sensitive)
Hedge purpose	Smooth earnings; manage GA market risk	Reduce tail GPVAD/CTE; deliver formula under stress
Reporting	Schedule DB for derivatives; GA booking	Schedule DB for derivatives; SA/VM–21 alignment required
Investor "hard" recourse	SNFL floor; filed crediting formula	SA value; prospectus formula (buffer/floor)

Table 1.1: High-level comparison of FIAs vs. RILAs (desk and statutory lenses).

VM–21 Nuance: Starting Assets Must Equal the Reserve (and why you may see a "negative asset" at t=0). Under VM–21 projections, starting assets are aligned so that, at the projection start, the *modeled asset amount equals the statutory reserve*. If the book of assets you intend to project is larger than the reserve at t=0, a balancing entry (often shown as *negative GA cash/asset*) is introduced so that total starting assets net to the reserve amount.

- **What this means in practice:** You can still project the full intended portfolio (e.g., bonds + options), but you will also carry an offsetting negative cash/asset line so that assets = reserve at start.
- **Why it exists:** Ensures apples-to-apples comparison of per-scenario liability cashflows (GPVAD) and prevents artificial reserve relief from "overfunding" the start.
- **Hedge desk implications:** This is *modeling plumbing*, not a real trade. It can affect *attribution* if you reconcile to accounting balances; be explicit in model documentation about the balancing entry so finance/audit aren't surprised.

Takeaway. FIA risk lives primarily in the *GA earnings/capital* channel with deterministic reserves; RILA risk lives in *stochastic tails* (VM–21), where hedge design, rebalancing rules, and governance (DUP/Schedule DB) directly influence reserves and RBC. This split explains why FIA desks emphasize earnings smoothing and capacity, while RILA desks emphasize tail control, tenor/vega ladders, and model-recognized rules.

1.3 Background on the NAIC

1.3.1 What is the NAIC?

The **National Association of Insurance Commissioners (NAIC)** is a U.S. standard-setting and regulatory support organization composed of the chief insurance regulators from the 50 states, the District of Columbia, and five U.S. territories. Although it is not a government agency, it plays a central role in harmonizing insurance regulation across jurisdictions.

1.3.2 History and Founding

The NAIC was founded in 1871 in response to the patchwork of differing state insurance laws that complicated interstate business. Its creation allowed state regulators to coordinate, share expertise, and promote consistent regulatory standards. Over the decades it has grown into the primary forum for developing model laws, regulations, and guidelines for the U.S. insurance sector.

1.3.3 How the NAIC Exerts Influence

The NAIC does not itself have statutory authority — regulation of insurance remains at the state level under the U.S. system of federalism (the U.S. system of government in which authority is divided between a national

(federal) government and individual state governments. In insurance regulation, this means that states — not the federal government — hold the primary statutory authority, which is why the NAIC operates as a coordinating body rather than a federal regulator). Instead, the NAIC influences through:

- **Model laws and regulations:** Drafted by NAIC committees; states may adopt them (sometimes with modifications) into their own law.
- **Accounting and reporting standards:** NAIC maintains the *Accounting Practices and Procedures Manual (AP&P)*, which most states require insurers to follow for statutory financial reporting.
- **Risk-based capital (RBC) and valuation manuals:** The NAIC develops frameworks such as RBC formulas and the Valuation Manual (VM) that states adopt, driving consistent capital and reserving standards.
- **Accreditation program:** States must meet NAIC accreditation standards to have their insurance departments recognized as effective and to participate fully in multi-state regulation. This creates strong incentives to conform.

1.3.4 Why This Matters for RILAs and FIAs

For hedgers, the NAIC matters less as a daily counterparty and more as the source of *the rules of the game*. Its guidelines (e.g. AG 43, AG 54) and valuation standards (VM-21, SNFL) determine:

- How liabilities are classified (fixed vs variable),
- Which reserving frameworks apply (deterministic vs stochastic),
- How derivative use, counterparty exposure, and reporting are regulated,
- What capital and reserve outcomes actuaries are optimizing toward (and therefore what hedgers must deliver).

In practice, the NAIC creates the common regulatory backbone that every FIA and RILA hedge program must be designed against.

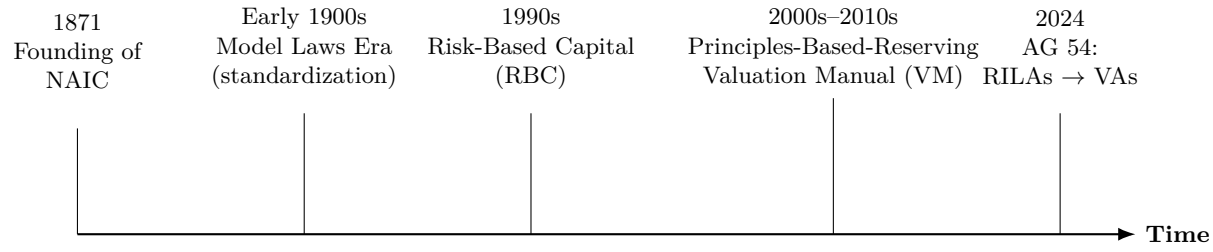

Figure 1.1: Milestones in NAIC regulatory evolution.

1.4 Background on Statutory Non-Forfeiture Laws (FIA lens)

1.4.1 Purpose and Scope

Nonforfeiture laws are NAIC-developed consumer protection rules that ensure policyholders receive a *minimum guaranteed value* upon surrender, even when credited index returns are poor. For **Fixed Indexed Annuities (FIAs)**, which are legally treated as fixed annuities and backed by the insurer's **general account**, these rules impose a statutory floor on accumulated value that exists *in addition to* any index-linked crediting.

1.4.2 What the Rule Requires (Hedger's Cut)

At a high level (details vary by jurisdiction and revision):

- A minimum proportion of gross premiums (typically $\approx 87.5\%$, net of withdrawals) must accumulate at a **minimum statutory interest rate** r_{stat} (a rate specified by law/regulation, often formula-based and periodically updated).
- Upon surrender, the contract value paid must be at least this **Minimum Nonforfeiture Value (MNV)**, regardless of index performance or declared caps/pars/spreads.

1.4.3 Minimum Nonforfeiture Value (MNV) — Simple Form

For intuition (ignoring fees, timing wrinkles, partial withdrawals, and surrender charges), the **floor** behaves like:

$$\text{MNV}(t) \;=\; \alpha \left(\sum_i \text{Premium}_i \cdot (1 + r_{\text{stat}})^{\,t - t_i} \right) \;-\; \text{Withdrawals Accumulated Back},$$

where $\alpha \in (0, 1]$ is the statutory accumulation proportion (commonly 0.875) and r_{stat} is the prescribed minimum rate. This floor is *separate from* the index-crediting outcome and must be honored at surrender.

1.4.4 Clarifying the Minimum Statutory Interest Rate

Definition and role. The *minimum statutory interest rate* (also called the *valuation interest rate* or *standard valuation rate*) is a regulatory guardrail applied to statutory reserving calculations. It prevents insurers from using overly low discount rates to understate reserves. It is specified by law or regulation (e.g., the Standard Valuation Law, SNFL/SVL for FIAs, and incorporated into the Valuation Manual for VAs/RILAs), and is periodically updated.

General features.

- **Formula-based.** The minimum rate is not arbitrary; it is tied to trailing averages of long-term benchmark yields (e.g., 5- or 10-year Treasuries).
- **Floors and dampers.** Statutes specify a floor rate (e.g., 3%) and adjustment factors to reduce volatility, ensuring stability across years.
- **Product-specific.** Different formulas apply to life insurance, deferred annuities, immediate annuities, and other lines of business.

Typical formula structure.

A representative structure is:

$$i_{\min} \;=\; \max\Big\{ i_{\text{floor}},\; \alpha \cdot Y_{\text{benchmark}} - \beta \Big\},$$

where

- $Y_{\text{benchmark}}$ = average of 5- or 10-year Treasury yields over the last 36 months,
- α, β = adjustment parameters (e.g., 0.85 multiplier and 0.5% subtraction),
- i_{floor} = statutory minimum (e.g., 3%).

This ensures that the statutory valuation rate follows market yields but never drops below the floor.

Concrete U.S. example (historical).

For many years, the NAIC's prescribed minimum rate for annuities was:

$$i_{\min} = \max\Big(3.0\%,\ 0.85 \times Y_{10} - 0.50\%\Big),$$

where Y_{10} is the 36-month average of the 10-year Constant Maturity Treasury yield.

- If $Y_{10} = 6.0\%$, then
$$0.85 \times 6.0\% - 0.50\% = 4.6\%.$$
The statutory rate would be 4.6% (above the 3% floor).
- If $Y_{10} = 2.0\%$, then
$$0.85 \times 2.0\% - 0.50\% = 1.2\%.$$
The 3% floor applies, so the statutory rate is 3.0%.

Implications. During low-rate periods, this floor forced insurers to reserve using discount rates well above actual portfolio yields, creating statutory strain. In high-rate regimes, the formula tracks market levels more closely.

Why it matters for FIAs and RILAs.

- **FIAs:** Deterministic reserves (SVL/SNFL) are directly discounted at no less than this minimum rate. If actual GA yield < statutory rate, reserve strain emerges.
- **RILAs:** VM–21 stochastic projections discount at NAER (book yield). However, the *Standard Scenario Amount* (SSA) and other prescribed floors may reference the statutory minimum interest rate, anchoring results even when hedges reduce tails.
- **Hedging overlay:** Hedge results do not move this rate. For desks, this makes FIA reserves appear "conservative and sticky," insensitive to hedge effectiveness.

Takeaway. The minimum statutory interest rate is not arbitrary: it is a formula-driven benchmark designed to ensure conservative reserving across cycles. A canonical NAIC example is

$$i_{\min} = \max\{\,3\%,\ 0.85 \times Y_{10} - 0.5\%\,\},$$

which held annuity reserves at 3% or higher even when market yields collapsed. For hedging desks, it is a fixed statutory assumption that can drive reserve strain in low-yield environments and limit the perceived effectiveness of hedge overlays.

1.4.5 Why Minimum Non-Forfeiture Value Matters to Hedging

From the desk's perspective, an FIA liability decomposes cleanly into two layers:

$$\textbf{FIA Liability} \approx \underbrace{\text{Bond-like Floor (SNFL)}}_{\text{general account obligation}} + \underbrace{\text{Option Overlay (caps/pars/spreads)}}_{\text{equity-linked exposure}}.$$

Practical consequences:

- The floor creates a persistent **bond allocation** need (duration/convexity risk that lives outside the option hedge).
- The indexed crediting creates **option exposures** (delta, gamma, vega, etc.) that are managed via listed/OTC derivatives.
- Product design (cap/participation/spread) is constrained by the option budget *after* assets are reserved to satisfy the floor.

1.4.6 Illustrative Example

Consider an FIA crediting the greater of 0% and the annual S&P 500 return, capped at 5%. Even if equity performance is negative for multiple years, the surrender value cannot fall below the MNV:

$$\text{Surrender Value}(t) \;\geq\; \text{MNV}(t).$$

Hedging posture:

- Hold bonds (and permissible general-account assets) to cover MNV(t) pathwise.
- Layer a call or call-spread program to replicate the capped upside.
- Manage deltas with futures as needed; monitor gamma around cap strikes and vega for long-dated tenors.

1.4.7 Visualization: Floor + Overlay Decomposition

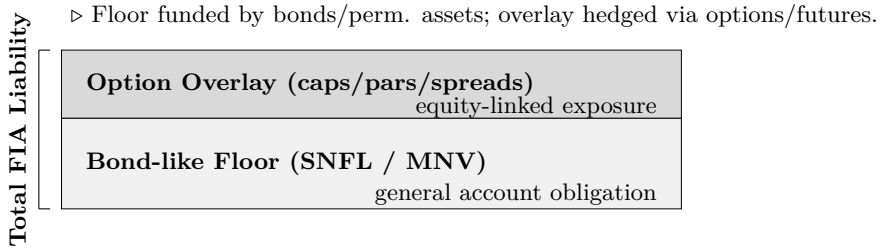

Figure 1.2: FIA liability as "bond floor + option overlay". The nonforfeiture floor (MNV) is statutory; the overlay comes from index-crediting terms.

1.5 Background on Stochastic Reserving (RILA/VA lens)

Executive summary. Stochastic reserving under VM–21 sets reserves for VAs and RILAs using *tail averages of present-valued net liability cashflows* across many simulated scenarios. Hedges can be *recognized* (if rules-based and booked), reducing tail losses; however, the final reserve is floored by the *Standard Scenario Amount (SSA)* and any other prescribed minima.

1.5.1 Purpose and Scope

- **Purpose.** Capture the *option-like* risk of guarantees (e.g., buffers/floors) whose losses are nonlinear and state-dependent; simple deterministic formulas miss this.
- **Scope.** Applies to variable annuities broadly and, via AG 54, to RILAs classified as VAs. Products with market-sensitive guarantees (ratchets, buffers, floors, GMxBs) are in scope.
- **Outcome.** A reserve reflecting *tail risk* (e.g., CTE_{70}), not just average outcomes.

1.5.2 What the Rules Require

Let $s = 1, \ldots, N$ index calibrated equity/rate/lapse scenarios and t index time steps. For each scenario:

1. Project **policy cashflows**: benefits (incl. guarantee shortfalls), fees/charges (reduce liability), and expenses.

2. Compute the per-scenario **present value** of net liability cashflows at the *Net Asset Earned Rate (NAER)*:

$$\Delta_t^{(s)} = \underbrace{\text{Outgo}_t^{(s)}}_{\text{benefits + expenses}} - \underbrace{\text{Income}_t^{(s)}}_{\text{fees + other inflows (incl. hedge cashflows)}}$$

$$\text{PVAccDef}^{(s)}(u) = \sum_{t=1}^{u} \frac{\Delta_t^{(s)}}{\prod_{k=1}^{t}\left(1+\text{NAER}_k\right)}$$

$$\text{GPVAD}^{(s)} = \max\Big\{\, 0,\ \max_{1\le u\le T} \text{PVAccDef}^{(s)}(u) \Big\}.$$

3. Aggregate the $\{\text{GPVAD}^{(s)}\}$ distribution via a **CTE tail average** (e.g., CTE_{70} = average of the worst 30% of outcomes) to get the *stochastic reserve*.

4. Set the reported reserve as the **maximum** of:

$$\boxed{\text{Reserve} = \max\{\ \text{CTE tail}\,,\ \text{SSA}\,,\ \text{any other prescribed floors}\ \}}.$$

1.5.3 Inputs and Modeling Standards

- **Economic scenarios:** Equity levels/vol, interest rates, dividend/borrowing assumptions calibrated to approved standards; scenario count sufficient to stabilize tails.
- **Policy behavior:** Crediting terms, lapses, withdrawals, rider options, fees, and expenses consistent with policy forms and credible experience.
- **Discounting:** *NAER* (book-yield basis), not risk-free. Aligns with statutory asset adequacy.
- **Floors:** Standard Scenario (deterministic recipe) must be calculated consistently (see §4.1.4).

1.5.4 Hedge Recognition (When Hedges Lower Reserves)

- **Clearly defined strategies.** Only *booked* positions and *rules-based* rebalancing (as documented in the DUP) may be reflected in projections.
- **Operational consistency.** Modeled rules (delta bands, option rolls, cash sweeps) must match actual practice; ad-hoc decisions get *no* reserve credit.
- **Effect.** Recognized hedges reduce per-scenario shortfalls in the tail, lowering the CTE—often until the SSA floor binds.

1.5.5 Why This Matters to Hedging

- **Targeting the tail.** Reserves (and C-3 capital) are driven by the *worst scenarios*, not the mean. Hedge programs that tame tail shortfalls are most impactful.
- **Governance leverage.** Documenting rebalancing and reinvestment rules in the DUP converts economic prudence into *statutory credit*.
- **Design trade-offs.** Longer-tenor vega/skew ladders and robust basis management move the desk closer to the SSA floor (see the "pendulum" in §4.3.17).

1.5.6 Illustrative Example (Toy, One-Year Buffer RILA)

Assume $AV_0 = \$100\text{mm}$, 10% buffer, one-year horizon, NAER $\approx 0\%$ for simplicity. Five scenarios yield ending S_T and insurer top-ups (shortfalls):

$$[0, 0, 5, 10, 20] \text{ mm}.$$

Ordering and averaging the worst 30% (top two) gives $\text{CTE}_{70} = (10 + 20)/2 = \$15\text{mm}$. If SSA = \$12mm, the reserve is $\max\{15, 12\} = \$15\text{mm}$. Now include recognized hedges so net losses become $[0, 0, 2, 5, 9]$mm; $\text{CTE}_{70} = (5+9)/2 = \$7\text{mm}$, so the reported reserve is $\max\{7, 12\} = \$12\text{mm}$—the SSA binds. *Moral:* hedges reshape tails, but floors limit how low reserves can fall.

1.5.7 Common Pitfalls and Frictions

- **Unrecognized rebalancing.** Economic deltas/rolls not formalized in the DUP do not reduce reserves.
- **Basis leaks.** Index choice (TR vs PR), dividend/borrow assumptions, and funding spreads can leave residual shortfalls in tails even with good delta.
- **Liquidity/tenor gaps.** Short-dated or coarse-strike hedges blunt but do not eliminate tail risk; diminishing returns appear without long-tenor vega.
- **Scenario undercoverage.** Too few paths or weak calibration makes tails unstable and governance-challenged.

1.5.8 Key Terms (as used here)

- **Guarantee shortfall** (a.k.a. net amount at risk in some parlance): $\max\{\text{Guarantee}_t - \text{AV}_t, 0\}$.
- **NAER (Net Asset Earned Rate):** Book-yield discount rate applied to liability cashflows.
- **GPVAD:** Present value of net liability cashflows (benefits+expenses–premiums) per scenario; the reserve is the CTE tail of $\{\text{GPVAD}^{(s)}\}$, floored by SSA.
- **SSA (Standard Scenario Amount):** Deterministic floor reserve from a prescribed stress run (see §4.1.4).

Takeaway. Stochastic reserving converts scenario-by-scenario *guarantee shortfalls* (plus fees/expenses) into present values at *NAER*, then sets reserves from the *tail average*, subject to floors. For desks, the lever is clear: codify hedge rules that *reliably reduce tail shortfalls* and ensure those rules are *recognized* in VM–21 projections.

1.6 Derivative Use Plans (DUPs)

A **Derivative Use Plan (DUP)** is a formal document insurers must file and have approved (typically by their board of directors and the domiciliary state regulator) before engaging in derivative transactions. The DUP sets boundaries on:

- **Permissible purposes:** e.g. hedging, income generation, replication. Pure speculation is prohibited.
- **Permissible instruments:** Options, futures, swaps, forwards, etc. with detail on allowed indices, tenors, and structures.
- **Risk management framework:** Policies on counterparty limits, collateral, monitoring, stress testing, exception reporting.
- **Governance:** Responsibilities of the board, risk committees, and reporting cadence.

For a hedge desk, the DUP is effectively the *rulebook* tying what you trade to what regulators and auditors expect. Violating DUP limits is a serious regulatory breach.

1.7 Schedule DB

Schedule DB is a statutory financial reporting schedule within the NAIC Annual Statement where insurers disclose their derivative positions. It provides granular detail by:

- Instrument type (e.g. options, swaps, forwards, futures).
- Hedging purpose (e.g. hedging vs income generation vs replication).
- Counterparty identification, credit rating, and exposure.
- Notional amounts, fair values, book values, and maturity profiles.

For the trading desk, Schedule DB is where every derivative trade ultimately lands in statutory reporting. It links front-office positions to back-office accounting and regulator-facing disclosures. Clean tie-outs from trade blotter $\rightarrow$ ledger $\rightarrow$ Schedule DB are a key part of quarter-end and year-end audits.

1.8 DUP & Schedule DB: FIA vs. RILA Context

Overview. Both the *Derivative Use Plan (DUP)* and *Schedule DB* apply to all U.S. life insurers that transact in derivatives. They are not FIA-specific. What differs is how these requirements interact with the reserving regime: deterministic for FIAs (SNFL/SVL) versus stochastic/CTE for RILAs (VM–21).

From DUP to CDHS to Hedge Recognition (VM–21 linkage). The *Derivative Use Plan (DUP)* is the board-approved policy that authorizes purposes, instruments, limits, and governance for derivatives enterprise-wide. Under VM–21, hedge credit in reserves/capital requires a *Clearly Defined Hedging Strategy (CDHS)* that is *consistent with the DUP* and is *rules-based* so it can be embedded in the stochastic projections.

- **DUP (policy):** Why/when we hedge; permissible instruments; limits; approval and monitoring; exception handling.
- **CDHS (modelable rules):** Concrete rebalancing logic (e.g., delta bands, roll calendars, cash sweep rules), stated *ex ante*, applied *mechanically* in projection.
- **Hedge recognition (VM–21):** Only positions/actions that (i) are permissible under the DUP, (ii) are specified in the CDHS, (iii) are *booked and traceable* (Schedule DB), and (iv) are modeled consistently, receive reserve/capital credit. *Ad-hoc/discretionary* trades are ignored for recognition.

Schematic:

DUP (board policy) $\Rightarrow$ CDHS (rules) $\Rightarrow$ Modeled in VM–21 $\Rightarrow$ Hedge recognition in CTE/SSA results.

	FIAs (General Account)	RILAs (Separate Account, VM–21)
Derivative Use Plan (DUP)		
	• Required by NAIC for any insurer using derivatives. • Board-approved document; defines purpose, permissible instruments, limits. • For FIAs, reserves are deterministic (SNFL/SVL), so DUP governs *usage* but hedges do not reduce reserves.	• Also required and board-approved. • Under VM–21, only hedges documented in a DUP as *clearly defined strategies* may be reflected in stochastic reserve projections. • Ad-hoc trades outside the DUP receive *no reserve credit*.
Schedule DB		
	• Statutory filing of all derivatives: type, purpose, counterparty, valuation. • Ensures GA hedges (used for FIAs) are transparent to regulators and auditors. • Required even though FIA reserves are not hedge-sensitive.	• Same statutory reporting applies to SA hedges used for RILAs. • VM–21 recognition requires consistency: hedges modeled in reserve projections must be traceable to trades on Schedule DB. • Regulators and auditors check Schedule DB to confirm hedges actually exist as booked.

Table 1.2: Comparison of DUP & Schedule DB roles for FIAs vs. RILAs. Both apply across the board; the difference is that under VM–21 for RILAs, compliance directly affects reserve recognition.

Key takeaway.

- **FIA context:** DUP & Schedule DB = governance and reporting requirements only. Reserves remain deterministic and do not change with hedge activity.
- **RILA context:** DUP & Schedule DB = determinative for reserves. If a hedge is not in the DUP and not properly on Schedule DB, it cannot reduce the modeled GPVAD or the CTE.

Chapter 2

Products & Risks

2.1 FIA mechanics

2.1.1 Overview

Fixed Indexed Annuities (FIAs) are fixed annuity contracts where credited interest is linked to an external index (most commonly the S&P 500). Despite the equity linkage, the liability resides in the insurer's **general account**, so the insurer is the ultimate guarantor of benefits. The *hedger's challenge* is that the insurer promises policyholders option-like payoffs while holding and managing the replicating hedge portfolio internally.

Key characteristics:

- **Minimum guarantee:** FIAs must comply with statutory nonforfeiture laws, typically guaranteeing some positive floor (e.g., 87.5% of premiums accumulated at a statutory rate).
- **Crediting strategy:** Defined in terms of caps, participation rates, and/or spreads applied to the chosen reference index.
- **General account obligation:** Unlike RILAs, no separate account exists; investment risk is on the insurer's balance sheet.

2.1.2 Investor Recourse & Guarantees (FIA lens)

What is *hard*-guaranteed. Under the Standard Nonforfeiture Law (SNFL) and Standard Valuation Law (SVL), an FIA policy must provide a *minimum nonforfeiture value* (MNV): a statutory floor that accumulates from premiums at prescribed interest (less permitted charges). This is the **only** regulatory backstop available to the policyholder beyond general insurer solvency.

What is *not* guaranteed. Index-linked credits (via caps/pars/spreads) are a *contractual formula*, not a separate guarantee of an option payoff. The insurer is obligated to credit according to the declared method, but there is no statutory guarantee of returns in excess of the SNFL floor.

Recourse outside SNFL?

- **Statutory:** None. Policyholder recourse is to the MNV; reserves are computed deterministically and do not pass through hedge P&L.
- **Contractual:** The company must apply the filed crediting formula as written. Disputes are contract/market-conduct matters, not capital backstops.
- **Economic shortfalls:** If hedges underperform, the *insurer* bears the loss in earnings/surplus; the credited rate to the policyholder does not retroactively change.

- **Economic windfalls:** If hedges outperform, the policyholder does not participate beyond the contract formula.

"Soft" protections (not guarantees).

- **Reputation & franchise value:** Strong incentive to adhere precisely to declared formulas and maintain competitive renewal terms.
- **Market conduct oversight:** Regulators supervise that credited rates follow filed methods and disclosures, but do not guarantee returns above SNFL.
- **Solvency regime:** RBC and reserving requirements constrain risk-taking, indirectly supporting the ability to honor formulas.

Hard vs soft: quick map.

Hard (enforceable)	SNFL minimum nonforfeiture value; application of the filed crediting formula as written.
Soft (indirect)	Reputation risk; market conduct review; general solvency/capital regime (RBC); competitive pressures on renewal terms.

2.1.3 Caps, Participation Rates, Spreads

- **Cap rate:** Maximum interest credited, e.g. $\max(0, \min(\text{index return}, 5\%))$.
- **Participation rate:** A proportion of the index return credited, e.g. $80\% \times$ index return.
- **Spread / margin:** A fixed deduction from index return, e.g. $\max(\text{index return} - 2\%, 0)$.

These parameters are reset at the insurer's discretion each crediting period (subject to guaranteed minimums), allowing dynamic management of option budgets given market conditions.

2.1.4 Hedge Targets (Concise)

From the desk's perspective, FIA crediting features translate into embedded option exposures:

- **Delta:** Sensitivity to underlying index level (primary hedge metric).
- **Gamma:** Nonlinear exposure from caps and spreads; important around strike/cap boundaries.
- **Vega:** Volatility sensitivity; higher under long-dated or cliquet/ratchet designs.
- **Vanna/Volga:** Cross-sensitivities (relevant for dynamic hedging of structured payoffs).

The insurer typically targets a hedge that stabilizes statutory earnings, statutory reserves, and RBC capital, not necessarily full economic neutrality.

2.1.5 Hedge Targets (Optional Expanded Discussion)

The exposures embedded in FIA crediting strategies go beyond simple delta. Two dimensions often overlooked outside hedge desks are **gamma management** (especially near caps and strike boundaries) and **vega management** (especially for long-dated options or path-dependent designs).

Gamma around strikes and caps. Gamma measures the sensitivity of delta to movements in the underlying index. For an FIA with a point-to-point payoff capped at C:

$$\text{Credited Return} = \max(0, \min(\text{Index Return}, C)),$$

the liability resembles a *long call spread*.

- As the underlying index return approaches the cap level, delta shifts rapidly from positive to zero.
- This transition is the source of **high gamma**: a small market move can cause large swings in hedge requirements.
- Practical impact: hedgers must monitor exposures closely when markets hover near the cap boundary, often using intraday futures adjustments to keep risk within tolerance.

Gamma is less critical when the index is deep out-of-the-money (delta ≈ 0) or far beyond the cap (delta already collapsed), but it dominates hedging considerations in the "near-the-cap" zone.

Vega for long-dated tenors. Vega measures sensitivity to implied volatility. For short-dated, at-the-money exposures, vega may be modest. But for FIAs:

- Tenors often run $\geq$ one year, and in many products multi-year resets or ratchets extend exposure further.
- The longer the maturity, the more sensitive the liability's option value becomes to volatility assumptions.
- Unlike equity delta, volatility cannot be hedged with futures; it requires option positions (listed or OTC) and careful calibration of skew/term structure.
- Practical impact: vega shocks can drive reserve volatility, so hedgers maintain option ladders or variance exposures to cushion long-dated volatility risk.

Combined perspective. In practice, delta, gamma, and vega interact:

- Gamma spikes increase the *frequency of delta rebalancing*.
- Vega sensitivity increases the *cost and complexity of option overlays*, especially when implied vol levels or skews shift.
- Effective hedge programs track both together, ensuring that near-cap gamma risk does not consume rebalancing budget and that long-tenor vega risk does not accumulate unnoticed in stochastic reserve models.

Rule of thumb for targeting hedge objectives. Unlike a pure trading book, the hedge desk is not judged solely on economic P&L. The goal is to stabilize **statutory earnings**, **reserves**, and **RBC capital** in a way consistent with regulatory models and management's risk appetite. A practical thought process is:

1. **Start with the liability profile.** Decompose FIA credits into bond floor + option overlay. The bond floor drives predictable statutory accrual; the option overlay drives volatile market sensitivity.
2. **Translate into model outputs.** Actuarial teams project reserves under VM-21 or SNFL; capital is measured via RBC factors or CTE projections. These models are sensitive to deltas, vegas, and stress scenarios rather than every last tick of market P&L.
3. **Design hedge tolerances around the models.** For example:
   - Maintain delta neutrality within a band that keeps one-day statutory reserve changes inside budgeted limits.
   - Hold option positions that dampen vega shocks over one-month horizons, even if they are not perfect economic hedges.

- Accept small residual gamma exposure if it does not move CTE-based capital metrics beyond tolerance.

4. **Calibrate to governance.** Reports to ALCO or risk committees emphasize *explainable stability*: reserves and capital move predictably with market shocks, and deviations can be tied back to specific hedge trade-offs (e.g. saving option budget vs tighter vega control).

In short, the hedge target is not "zero Greeks everywhere" but "minimize volatility in the statutory metrics the regulator and CFO care about," even if that means tolerating some open risk on a trading-book basis.

Callout: Why FIA Hedges Don't Move Deterministic Reserves. For FIAs, statutory reserves are set by *deterministic* SVL/SNFL formulas and minimum statutory interest rates. These do *not* credit hedge effectiveness. Option overlays can stabilize *earnings/surplus* and reduce GA P&L volatility, but they will not reduce the booked reserve itself. **Desk implication:** hedge targets for FIAs are earnings- and budget-driven (e.g., gamma at caps, vega for tenor mix), not "reserve minimization."

2.1.6 Typical Hedge Instruments

Common hedging tools include:

- Exchange-traded equity index options (calls/puts) to replicate caps and participation features.
- OTC equity index options (vanillas and digitals) for tailored strikes/maturities.
- Equity index futures for coarse delta management.
- Variance swaps or dispersion trades (less common; sometimes used to fine-tune vega exposure).

2.1.7 Crediting Type → Hedge Greeks

A quick mapping of common FIA crediting structures into hedge exposures:

Crediting Type	**Hedge Analog**	**Key Greeks**
Annual point-to-point w/ Cap	Long call spread	Δ, Γ, V
Annual point-to-point w/ Participation	Scaled long call	Δ, V
Annual point-to-point w/ Spread	Call spread shifted by spread	Δ, Γ, V
Monthly sum (cliquet)	Strip of short-dated calls	Γ, V (path-sensitive)
Monthly average	Asian option	Δ, V (lower vol sensitivity)
Fixed rate (multi-year guarantee)	Bond floor, no optionality	Duration, convexity only

Table 2.1: Mapping FIA crediting types to hedge analogs and primary Greek exposures.

2.2 RILA mechanics

2.2.1 Overview

Registered Index-Linked Annuities (RILAs) are hybrid annuity products that link contract value to equity indices while giving the policyholder structured downside protection. Unlike FIAs, which are general account products, RILAs are **separate account** products and are treated as **variable annuities** for regulatory purposes (per AG 54). This distinction drives both their accounting treatment and hedging posture.

Key characteristics:

- **Index-linkage:** Policyholder return tied to external indices, subject to caps and/or participation multipliers.

- **Downside shaping:** Buffers (partial loss absorption) or floors (loss limited beyond a threshold).
- **Separate account:** Liability cash flows reference a segregated pool of assets, not the insurer's general account.

2.2.2 Investor Recourse & Guarantees

Nature of RILAs. Registered Index-Linked Annuities (RILAs) are classified as *variable annuities* under NAIC guidance (AG 54, VM-21). They are funded through separate accounts and sold via prospectus. This structure affects what is and is not guaranteed to the investor.

What is *hard*-guaranteed.

- **Account value:** Policyholder owns units in a separate account. Assets are legally segregated from the insurer's general account and protected from the insurer's creditors. The account value is always at least equal to the market value of separate account assets (minus contract charges).
- **Payoff formula:** The buffer/floor mechanics (e.g., first 10% loss absorbed, losses beyond passed to investor; or a floor of -10% max loss) are prospectus-filed and contractually binding. The insurer must deliver the payoff per the stated formula at reset/maturity.

What is *not* guaranteed.

- There is *no statutory minimum nonforfeiture value* analogous to FIAs. Because RILAs are variable annuities, state SNFL rules do not apply.
- No guarantee of positive returns. The contract explicitly passes through downside risk beyond the buffer/floor level to the investor.
- Hedge performance has no direct recourse to policyholders: if the insurer hedges poorly, it still must honor the payoff formula, but no "option-like" guarantee exists beyond the stated terms.

Soft protections (not guarantees).

- **Prospectus regime (SEC/FINRA):** Product terms and risks must be fully disclosed and are subject to securities regulation. This creates strong legal incentive to adhere to stated payoff formulas.
- **Reputation & competitive pressures:** Insurers price and hedge to deliver terms credibly; deviation would be reputationally damaging in a competitive marketplace.
- **Capital/regulatory regime (VM-21):** Requires stochastic reserve/capital recognition, aligning hedge programs with long-term solvency, indirectly supporting policyholder protections.

Hard vs soft: quick map.

Hard (enforceable)	Separate account ownership; buffer/floor payoff formulas filed in prospectus and contractually binding.
Soft (indirect)	SEC/FINRA disclosure regime; insurer reputation; RBC/VM-21 solvency framework; competitive product discipline.

2.2.3 Buffers and Floors

Two common downside-protection mechanisms:

- **Buffer:** Insurer absorbs losses up to a preset percentage (e.g. first 10% loss), policyholder bears losses beyond. Payoff sketch:

$$\text{Credited Return} = \begin{cases} \text{Index Return}, & \text{if Index Return} \geq 0, \\ 0, & \text{if } -B \leq \text{Index Return} < 0, \\ \text{Index Return} + B, & \text{if Index Return} < -B, \end{cases}$$

  where B is the buffer size.

- **Floor:** Policyholder bears losses up to a floor (e.g. 10% max), insurer absorbs everything beyond. Payoff sketch:

$$\text{Credited Return} = \max(\text{Index Return}, -F),$$

  where F is the floor magnitude.

2.2.4 Distinctions from FIAs (Hedger's View)

- **Separate account:** RILAs are accounted for as variable annuities; FIAs are general account liabilities with statutory nonforfeiture floors. Hedge implication: RILA exposures flow directly into VM-21 stochastic reserve models, which recognize hedge effectiveness.
- **Downside shape:** FIAs typically have a hard floor at 0% credited interest; RILAs can have buffers or capped floors, creating more complex option profiles (digital-like payoffs, knock-ins).
- **Regulatory treatment:** FIAs are subject to SNFL minimum guarantees; RILAs are registered securities with prospectus disclosure, overseen by SEC/FINRA.
- **Capital impact:** For RILAs, hedging reduces reserve and RBC volatility directly under VM-21. For FIAs, hedge effectiveness is less explicitly recognized in deterministic reserving.

2.2.5 Hedge Targets

For the desk, RILA exposures decompose into:

- **Delta:** Sensitivity to the underlying index, scaled by cap/participation and adjusted for buffer/floor zones.
- **Gamma:** High near buffer or floor thresholds; small index moves around these kinks can change exposure abruptly.
- **Vega:** Long-dated option structures (often 1–6 years) create material volatility sensitivity; volatility skew and term structure matter.
- **Tail risk:** Buffers and floors push liability exposure into tails, which requires stress-hedging beyond first-order Greeks.

2.2.6 Typical Hedge Instruments

- Long/short vanilla options (puts and calls) to replicate buffers/floors.
- Option spreads and collars to match upside caps and downside truncations.
- Equity index futures for delta maintenance between re-hedges.
- Digital or exotic OTC structures (e.g. knock-in puts) for efficient replication of buffer/floor profiles (subject to DUP limits).

2.2.7 Crediting Type → Hedge Greeks

Crediting Type	Hedge Analog	Key Greeks
Buffer (10%) w/ Cap	Long call spread + short put spread	Δ, Γ, V
Floor (10%) w/ Cap	Long call spread + long put spread	Δ, V, tail risk
Participation only	Scaled forward exposure	Δ
Buffer + Par	Call spread + digital put	Δ, Γ, V
Multi-year term	Basket of long-dated options	Δ, V (term structure)

Table 2.2: Mapping RILA crediting designs to hedge analogs and key Greek exposures.

Callout: Hedge Recognition Requires a CDHS (VM–21). Under VM–21, hedges are only *recognized* in stochastic reserves/capital if the firm specifies a *Clearly Defined Hedging Strategy (CDHS)* that is rules-based and consistent with the DUP. In practice, this means modeling *explicit* rebalancing rules (e.g., delta bands, roll calendars, cash sweeps) and applying them *mechanically* in projection. Ad-hoc or discretionary trades are *ignored* for recognition. **Desk implication:** document the rules you actually run—modeled hedging must match operational playbooks to receive credit.

2.2.8 RILA Payoff Diagrams: Buffer vs Floor (with Cap)

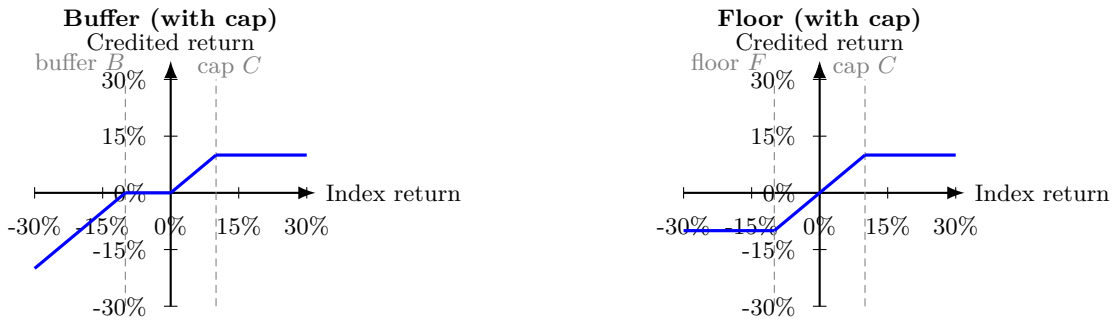

Figure 2.1: RILA credited return vs index return under buffer and floor designs (example $C = 10\%$).

2.3 Separate vs General Account

2.3.1 Overview

A critical structural distinction between FIAs and RILAs is whether liabilities reside in the insurer's **general account** or a **separate account**. This classification drives:

- Which assets can be held and how derivatives are booked,
- How statutory accounting recognizes reserves and hedge effectiveness,
- How capital charges are applied under NAIC frameworks.

2.3.2 General Account (FIAs)

- **Definition:** All premiums are pooled in the insurer's balance sheet; liabilities are obligations of the insurer's general account.
- **Permissibility:** Investments must comply with state *legal lists* and NAIC risk-based investment limits. Derivatives may be used for hedging but only within the bounds of the firm's approved *Derivative Use Plan (DUP)*.

- **Accounting:** General account assets and liabilities are recorded on the insurer's statutory balance sheet. FIA guarantees (nonforfeiture floor + index crediting) are valued using deterministic reserve formulas.
- **Capital recognition:** Risk charges for general account exposures follow RBC formulas. Hedge effectiveness is only partially recognized: derivative positions appear in *Schedule DB*, but statutory reserves are not recalculated stochastically to reflect hedges.

2.3.3 Separate Account (RILAs)

- **Definition:** Premiums are allocated to a segregated account, legally insulated from the insurer's general creditors (subject to state law). Policyholder returns are linked directly to the market performance of this account, subject to buffer/floor structures.
- **Permissibility:** Separate account assets can include derivative structures that replicate the liability profile more flexibly than the general account. Still governed by the DUP, but the scope is wider.
- **Accounting:** Because RILAs are treated as variable annuities, reserves fall under *VM-21* principle-based reserving. This framework explicitly incorporates hedge effectiveness into stochastic reserve calculations.
- **Capital recognition:** RBC requirements use CTE-based stochastic scenarios that reflect both liability exposures and hedging. Effective hedge programs directly reduce measured capital volatility.

2.3.4 Implications for Hedgers

- **For FIAs:** Hedge gains and losses are recognized in accounting and reporting, but statutory reserves remain deterministic. Hedge value often shows up as statutory earnings volatility rather than reserve stability.
- **For RILAs:** Because VM-21 allows hedge recognition, the hedge desk has direct influence over reserve and capital outcomes. Programs are judged not just on economic P&L but on how well they stabilize statutory metrics.
- **Governance:** Separate vs general account also affects reporting lines: Schedule DB detail is required for both, but VM-21 stochastic results are a focal point for RILAs while SNFL floors dominate FIA compliance.

Callout: Starting Assets Must Equal the Reserve at t=0 (VM–21 plumbing). In VM–21 projections (GA or SA), the modeled starting *asset amount* is aligned to the statutory *reserve* at valuation start. If the intended portfolio exceeds that amount, the model includes a balancing entry (often shown as *negative cash/asset*) so that assets = reserve at t=0. This is modeling plumbing, not a real trade, and prevents artificial reserve relief from overfunding. **Desk implication:** be explicit about the balancing line in documentation and reconciliations so finance/audit are not surprised.

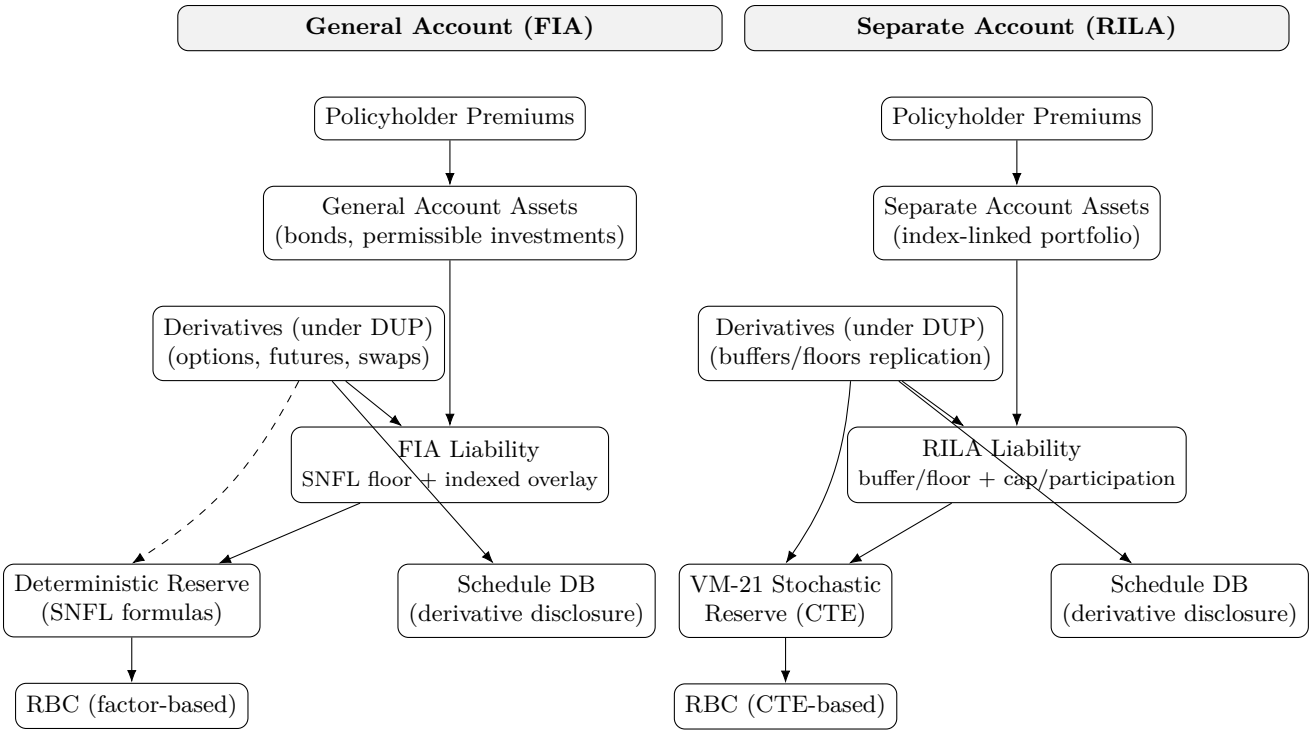

Figure 2.2: Flow comparison: General Account (FIA) vs Separate Account (RILA). Arrows show how premiums fund assets/derivatives, how liabilities are valued, and how reserves/capital recognize hedges. Solid arrows indicate direct statutory relationships: for FIAs, the liability feeds directly into deterministic reserves based on SNFL formulas, which are hedge-blind. Dashed arrows indicate indirect or limited influence: in FIAs, derivative results booked in the general account can affect statutory earnings and surplus, but do not explicitly change the reserve calculation itself. In contrast, under VM-21 for RILAs, stochastic reserve models do incorporate hedge positions, so hedge effectiveness is explicitly recognized.

2.3.5 Clarifying Aside: RILAs & FIAs vs. Defined Outcome ETFs

Why this matters. RILA payoffs often look like what a defined outcome ETF delivers, but the *ownership and obligation* structures are fundamentally different. This drives whether a hedge desk is needed and who bears replication error.

Core distinctions (desk view).

- **FIA (General Account):** Policyholder has a claim on the insurer; assets and hedges sit in the *general account*. Index crediting is a contractual formula; only the SNFL minimum accumulation is hard-guaranteed. Hedge error hits the insurer's earnings/surplus; reserves are deterministic (hedge-blind).
- **RILA (Separate Account):** Policyholder owns units in a *separate account* (legally segregated from general creditors), but still holds a *contractual payoff* (buffer/floor) rather than direct ownership of the hedge portfolio. The insurer must deliver the formula at reset; under VM-21, hedges are modeled in reserves/capital.
- **Defined outcome ETF:** Shareholder owns a pro-rata slice of the actual option/treasury portfolio. There is no insurer promise or statutory capital; replication error flows directly into NAV. No hedge desk is "on the hook."

	FIA (General Account)	**RILA (Separate Account)**	**Defined Outcome ETF**
Who owns assets?	Insurer (GA balance sheet)	Separate account (segregated), but investor owns *units*, not the hedge set	Fund shareholders own the portfolio
Obligation type	Contractual crediting formula; SNFL floor is hard guarantee	Prospectus-filed buffer/floor formula; no SNFL floor	No guarantee; NAV reflects portfolio performance
Who bears replication error?	Insurer (earnings/surplus)	Insurer (must honor formula; capital under VM-21)	Investor (NAV)
Hedges recognized in reserves?	No (deterministic formulas; hedge-blind)	Yes (VM-21 stochastic with hedge inclusion)	N/A (no statutory reserves)
Need for hedge desk?	Yes (economic, earnings smoothing)	Yes (deliver formula; stabilize CTE/capital)	No insurer hedge desk; replication is the fund itself

Table 2.3: Structural differences drive who must hedge and who bears replication error.

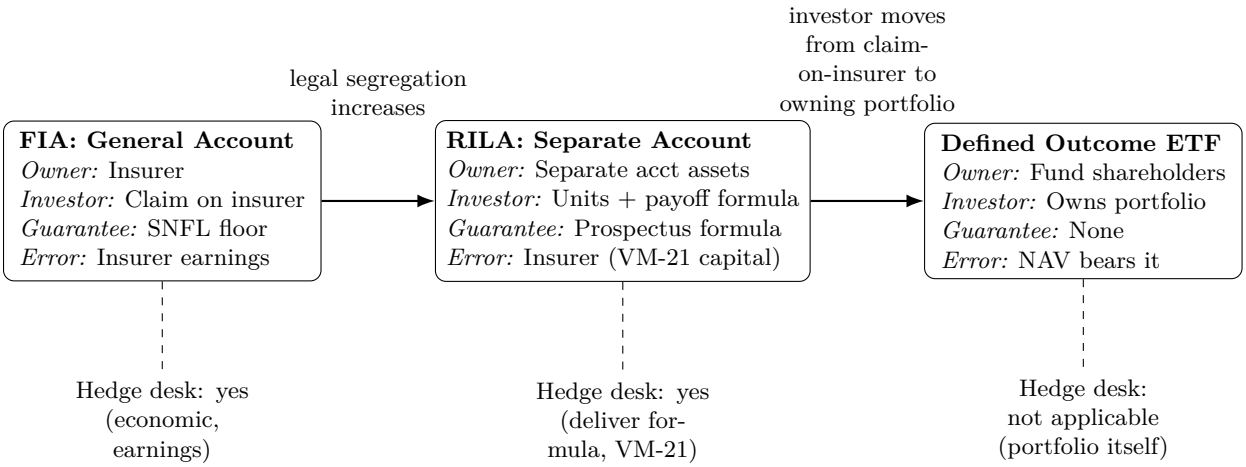

Figure 2.3: From General Account to Separate Account to ETF: investor protection increases via legal segregation, but only in the ETF does the investor directly own the replicating portfolio; in FIAs and RILAs the insurer remains on the hook to deliver the formula, hence hedging.

Chapter 3

Classification & Frameworks

3.1 RILAs as Variable Annuities

3.1.1 Role of AG 54

Actuarial Guideline 54 (AG 54) was adopted by the NAIC in 2024 to resolve the question of how **Registered Index-Linked Annuities (RILAs)** should be classified for reserving and capital purposes. Prior to AG 54, RILAs occupied a gray area: their equity linkage and structured payoffs (buffers, floors, caps) looked similar to variable annuities, but some regulators leaned toward treating them as fixed annuities. This ambiguity created uncertainty for both insurers and hedge desks.

AG 54 made the determination explicit: **RILAs are to be treated as variable annuities**. This classification ensures that RILA reserves and capital are governed by the *principle-based reserving* framework rather than by deterministic fixed-annuity rules.

3.1.2 Linkage to VM-21

The classification in AG 54 ties RILAs directly into the **Valuation Manual section 21 (VM-21)**, the NAIC's principle-based reserving standard for variable annuities. VM-21 requires:

- **Stochastic reserve modeling:** Reserves are based on a Conditional Tail Expectation (CTE) measure under thousands of economic scenarios.
- **Recognition of hedging:** Actual derivative holdings, if approved and consistent with the Derivative Use Plan (DUP), are explicitly modeled and reduce projected liability cash flows.
- **Standard scenario floor:** A conservative benchmark calculation sets a minimum reserve, ensuring hedges cannot reduce reserves below prescribed thresholds.

For hedgers, this means RILA hedge positions are not only economically relevant but also *statutorily recognized* in reserve and capital outcomes.

3.1.3 Legacy AG 43 Context

Before VM-21, variable annuities were governed by **Actuarial Guideline 43 (AG 43)**, which introduced stochastic reserve requirements for guaranteed living and death benefits. VM-21 essentially codified and updated AG 43 into the Valuation Manual framework.

Thus, the progression is:

$$\text{AG 43 (2009)} \longrightarrow \text{VM-21 (2020)} \longrightarrow \text{AG 54 (2024 classification of RILAs).}$$

3.1.4 Practical Implications for Hedge Recognition

- **Direct reserve impact:** Hedge positions (e.g. option spreads replicating buffer/floor profiles) are modeled in the same projection system that generates reserves. Well-structured hedges reduce the CTE tail liability directly.
- **Capital smoothing:** RBC capital is tied to VM-21 CTE results, so effective hedges mitigate capital volatility.
- **Governance focus:** Management, auditors, and regulators expect hedge desks to demonstrate that their programs align with modeled reserves. Hedge effectiveness is evaluated not just by P&L attribution but also by stability of statutory metrics.
- **Contrast with FIAs:** In FIAs, hedges primarily dampen earnings volatility but do not change formulaic reserves. In RILAs, hedges change the reserve and capital numbers *themselves*.

Key Takeaway

AG 54 resolves classification: RILAs belong in the variable annuity world. Under VM-21, hedge effectiveness is directly recognized in reserve and capital models. This makes hedge design, execution, and documentation central not only to economic risk management but also to statutory outcomes.

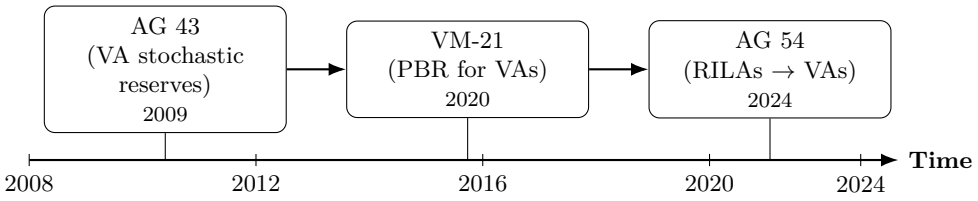

Figure 3.1: Regulatory lineage for variable-annuity reserving: AG 43 (2009) introduced stochastic VA reserves, VM-21 (2020) codified PBR for VAs, and AG 54 (2024) classified RILAs as variable annuities under this framework.

3.1.5 Impact of AG–54 on C–3 Capital

What AG–54 did. Actuarial Guideline 54 (2020) did not introduce a new C–3 capital formula. Instead, it clarified that RILAs should be treated as *variable annuities* for statutory purposes, bringing them under the scope of VM–21. As a result, their reserves are now set stochastically (CTE_{70} with SSA floor) and their C–3 capital requirement flows directly from the same VM–21 engine.

No change to the formula.

- **Before AG–54:** In some states, RILAs were treated like FIAs, with deterministic reserves and factor-based C–3 charges on GA assets.
- **After AG–54:** RILAs are VA-classified, so C–3 capital proportional to (i.e. 25% of) the difference between a deep-tail measure (e.g., CTE_{98}) and the reserve tail (CTE_{70}). This is the same treatment as traditional VAs.

Why it mattered operationally. Although the formulas were already established in VM–21 and RBC instructions, many insurers writing RILAs had never run full VM–21 stochastic frameworks before. The operational lift was in:

- Building and validating stochastic scenario engines (equity, rates, lapses).
- Implementing NAER discounting, SSA floors, and policyholder behavior assumptions.

- Documenting hedge rebalancing rules in the DUP so that hedges could be *recognized* in reserves and capital.
- Enhancing model governance, audit, and regulator engagement to handle the shift from factor-based to tail-based capital.

Takeaway. AG–54 did not modify the C–3 formula. Its impact was to route RILAs into the VM–21 box, where both reserves and capital come from the same stochastic GPVAD distribution. The challenge for firms was not the mathematics, but the *infrastructure and governance* needed to satisfy VM–21 requirements.

3.2 FIAs as Fixed Annuities

3.2.1 Regulatory Lens: SVL and SNFL

Fixed Indexed Annuities (FIAs) are legally classified as **fixed annuities**, despite their index-linked crediting. This classification brings them under the **Standard Valuation Law (SVL)** and the **Standard Nonforfeiture Law (SNFL)**.

- **SVL (reserving):** States that reserves for fixed annuities must be computed using deterministic formulas based on prescribed interest and mortality assumptions.
- **SNFL (nonforfeiture):** Requires that a minimum contract value accumulate over time (typically 87.5% of premiums, with a minimum interest rate defined by statute). This creates the *bond-like floor* of FIA liabilities.
- **Result:** Even though FIAs behave economically like a bond floor plus an option overlay, the reserving regime ignores dynamic hedge recognition and instead applies formulas that guarantee conservative accumulation values.

3.2.2 Deterministic Reserve Features

For FIAs, statutory reserves typically reflect:

- The guaranteed minimum nonforfeiture value (the statutory floor),
- Prescribed valuation interest rates that do not vary with market conditions or hedge effectiveness,
- Formula-based adjustments that treat option exposures conservatively, without stochastic modeling.

The formulas are designed to protect policyholders, but from a risk management perspective, they often overstate the liability relative to the insurer's hedge-adjusted economic exposure.

3.2.3 Why They Feel Conservative to a Hedger

From the trading desk's standpoint:

- **Hedges not recognized:** Gains from option hedges reduce actual exposure but do not reduce statutory reserves, since reserves are locked to formulas.
- **Capital drag:** RBC factors applied to FIA reserves may be higher than the effective risk after hedging, leading to "excess" capital consumption.
- **Earnings volatility:** Hedge P&L flows through statutory earnings, but the deterministic reserves remain static. This creates mismatches that hedgers must explain even when programs perform as designed.
- **Asymmetry vs RILAs:** In RILAs (treated as VAs), hedges are directly recognized in VM-21 stochastic reserve modeling. In FIAs, the hedge is invisible to reserves, so hedgers are judged against formulas that do not reflect economic reality.

Key Takeaway

For FIAs, the SVL/SNFL framework anchors reserves to conservative, hedge-blind formulas. To the hedge desk, this makes FIA reserves feel "heavy" relative to economic risk, and it shifts the role of hedging toward stabilizing earnings and protecting surplus, rather than directly reducing statutory reserves.

3.3 What This Means Day-to-Day

3.3.1 Impact on KPIs

The classification of an annuity as *fixed* (FIA) or *variable* (RILA) changes which performance metrics the hedge desk is expected to manage against.

- **FIAs (fixed annuities):**
  - KPIs emphasize *earnings stability*, since reserves are deterministic and hedge P&L flows straight into statutory income.
  - *Option budget adherence* is closely watched: caps, pars, and spreads must align with available option costs after funding the nonforfeiture floor.
  - RBC ratios are monitored, but hedge effectiveness does not directly reduce required capital; it only shows up in earnings and surplus.
- **RILAs (variable annuities):**
  - KPIs emphasize *reserve stability under VM-21*, where hedge effectiveness is explicitly recognized in stochastic projections.
  - Capital volatility (CTE-based RBC) is a primary performance measure: hedge programs are judged by their ability to keep tail metrics inside governance bands.
  - Prospectus-linked metrics (e.g. disclosure of hedge strategy, alignment with contract illustrations) also appear in KPI packs.

3.3.2 Impact on Hedge Targets

- **For FIAs:** Hedge targets are set to dampen *P&L swings* in the general account. The reserve itself is fixed by formula, so hedging is about smoothing earnings and protecting surplus. Desks tolerate some residual Greek risk if it fits within earnings-volatility tolerances.
- **For RILAs:** Hedge targets are set to align with the *CTE metrics* used in VM-21 projections. This often means more attention to tail hedging and longer-dated vega, since those directly feed the reserve and capital models. The hedge desk must calibrate positions so modelled statutory outcomes move smoothly with markets.

3.3.3 Impact on Governance and Reporting

- **FIAs:**
  - Reports to ALCO/risk committees emphasize attribution of statutory earnings and demonstration that option budgets were respected.
  - Auditors review tie-outs from trade blotters to *Schedule DB*, but reserve validation is straightforward (formulaic).
  - Governance asks: explain hedge losses when reserves do not change, reconcile derivative book to statutory results.
- **RILAs:**

- Reports emphasize *reserve and capital stability*, with CTE attribution packs that show how hedges reduced tail exposure.
- Governance asks include stress-testing under VM-21 assumptions, validating hedge recognition in stochastic models, and explaining residual tail risk tolerances.
- Regulators and auditors focus on whether the hedge program is consistent with the Derivative Use Plan and the prospectus representations made to policyholders.

Key Takeaway

For FIAs, hedging is about stabilizing earnings against a fixed reserve regime. For RILAs, hedging is about stabilizing reserves and capital within a stochastic framework that explicitly incorporates hedge effectiveness. Classification determines not only how products are reported, but also which KPIs the hedge desk is held accountable for and how governance frameworks are applied.

Chapter 4

Reserves, Capital, and Hedge Interactions

4.1 VM-21 essentials for hedgers

4.1.1 What VM-21 does (hedger's cut)

VM-21 is the NAIC's principle-based reserving (PBR) standard for variable annuities (which, per AG 54, includes RILAs). It sets reserves as a *tail-risk* measure from stochastic projections of asset/liability cash flows, with explicit recognition of *actual* hedge positions held in accordance with the DUP.

- **Reserve basis:** Conditional Tail Expectation at a prescribed percentile (commonly CTE_{70}).
- **Hedge recognition:** Positions (options, futures, swaps) on the books *and* modeled per policy/desk rules flow through cash flows in every scenario.
- **Floors:** The stochastic result is bounded below by required floors (e.g., standard scenario / NPR-style floors, as applicable).

4.1.2 CTE refresher

Let L_s be the *NAER-discounted* scenario loss (positive = loss) under scenario s out of N scenarios. Sort $L_{(1)} \le \cdots \le L_{(N)}$ (losses increasing). For tail level α (e.g., $\alpha = 70$):

$$\text{CTE}_\alpha \;=\; \frac{1}{N - \lfloor \alpha N \rfloor} \sum_{i=\lfloor \alpha N \rfloor + 1}^{N} L_{(i)}.$$

Intuition: average of the worst $(100 - \alpha)\%$ outcomes.

4.1.3 Standard projection ingredients (what the model actually runs)

- **Economics:** Risk-free rate curves; risk-neutral equity/funding curves; vol/skew/term structures consistent with market as-of valuation date.
- **Policy mechanics:** Caps/pars/spreads (FIAs) or buffers/floors (RILAs), reset rules, ratchets, fees, riders.
- **Behavioral assumptions:** Lapse/partial withdrawal/annuitization; dynamic features allowed under VM-21 governance.
- **Hedges:** Actual positions, trade dates, strikes/tenors; rebalancing policy (rules-based) if recognized; model the full cash-flow path (premiums, margins, collateral).
- **Expenses/mortality/taxes:** As required by VM-21 and company standards.

4.1.4 The "Standard Scenario"

Definition. The *Standard Scenario* is a deterministic stress projection prescribed by the NAIC in VM–21. It produces a floor reserve amount (the Standard Scenario Amount, or SSA) that applies to variable annuities and, under AG 54, to RILAs. Every company must calculate it using the same recipe. Its purpose is to prevent reserves from collapsing to near zero in cases where stochastic projections (with hedge recognition) produce very small tail averages.

Who sets it. The Standard Scenario is defined nationally by the NAIC via the *Valuation Manual* (VM–21). It is not jurisdictional or firm-specific: all insurers apply the same deterministic stress assumptions.

Stress assumptions. In outline, the Standard Scenario applies the following prescribed shocks and runoff rules:

- **Equity market:** immediate drop of approximately -13% in the reference index at time zero; thereafter equity returns are held flat (0% growth).
- **Interest rates:** an immediate parallel downward shock (e.g. -50 bps across the curve), with the curve then held flat.
- **Policyholder behavior:**
  - No lapses if the contract is *in the money* (i.e. the guarantee has positive value to the policyholder).
  - Higher lapses if the contract is *out of the money* (i.e. the guarantee has negligible value).
- **Expenses and margins:** follow contractual levels; no management actions are permitted unless explicitly authorized.
- **Discounting:** use the *Net Asset Earned Rate* (NAER) based on the statutory book yield of the insurer's asset portfolio, not a market risk-free rate.

How it is applied.

- Project the block of contracts under these deterministic assumptions over their remaining lifetimes.
- At each time step, compute guarantee shortfalls (insurer top-ups) as in the stochastic GPVAD method.
- Discount the resulting liability cashflows back to the valuation date using the NAER.
- The present value total = the *Standard Scenario Amount (SSA)*.

Illustrative example. Consider a block of RILAs with current account value \$100 mm and a 10% buffer:

- At $t = 0$, the equity shock reduces AV to \$87 mm.
- The contractual buffer guarantees \$90 mm, so the insurer must top up \$3 mm immediately.
- Thereafter, equity is flat at \$87 mm while the guarantee crediting continues to accrete; future shortfalls emerge as the guarantee grows relative to stagnant AV.
- Discounting these shortfalls at the NAER produces, say, \$12 mm.

Thus, even if stochastic CTE reserves with hedges recognized come in at \$7 mm, the statutory reserve is floored at \$12 mm by the Standard Scenario.

Key implication. From a hedge desk perspective, the Standard Scenario explains why reserves cannot collapse toward zero even if replication hedges appear to fully cover market risks. From a regulatory perspective, it ensures a consistent, conservative baseline across all companies.

Callout: How SSA Treats Hedges and Reinvestment (Static vs. Dynamic). The *Standard Scenario Amount (SSA)* is more than a stylized market path; it also constrains what actions are recognized during projection.

- **Static hedges at t=0 (recognized).** Derivatives *already on the statutory books at valuation start* (e.g., options, futures) are included in the starting asset portfolio and projected to maturity under the SSA path. Their contractual cashflows (payoffs, coupon-like features if any) are recognized as they occur. *No new hedges may be added, and no rolls assumed.*
- **Dynamic hedging / rebalancing (not recognized).** The SSA assumes no management actions to *adjust* the hedge overlay after t=0. That is, no re-deltaing, no rolling of options, no new overlay initiation, and no tactical unwinds during the projection. Thus, strategies that require ongoing rebalancing to stay effective will *not* receive credit beyond their time-0 holdings.
- **Fixed-income reinvestment (limited recognition).** Maturing/couponing *fixed-income* assets are reinvested per SSA's prescribed rules (e.g., at a specified reinvestment rate consistent with NAER mechanics). This recognizes bond cashflows and book-yield continuation, but does *not* open the door to new equity option overlays or dynamic derivatives during the path.

Practical consequence. Even if a buffer RILA appears economically replicable, SSA's *frozen* hedge posture (static-only) plus its stylized equity/rate path typically leaves a positive floor: the static package rarely tracks the liability perfectly without rolls, and no dynamic hedge credit is allowed.

4.1.5 How hedges feed the stochastic results

1. **Include positions scenario-by-scenario.** Each scenario path revalues the hedge book (options, futures, swaps) and accrues its cash flows (premium paid/received, MTM, collateral).
2. **Project rebalancing if policy allows.** If VM-21 policy recognizes *rules-based* rebalancing (e.g., monthly delta banding), apply the rules across scenarios; ad hoc/back-fit rehedging is typically *not* recognized.
3. **Aggregate to policy/portfolio.** Roll up hedge+liability cash flows to get scenario loss L_s. Hedges reduce both central and tail losses; only the tail average (CTE) sets reserves (subject to floors).

4.1.6 What moves the VM-21 number (desk view)

- **Level moves:** Equity and rate shocks change liability *and* hedge MTM. Delta control limits how much CTE drifts.
- **Vol/skew/term moves:** Vanner/volga/vega exposure shows up strongly in tails for long tenors; option ladders dampen tail sensitivity.
- **Basis/slippage:** Index vs hedge underlyer, realized vs implied, funding vs collateral rates.
- **Model/assumption changes:** Lapse dynamics, fee paths, or rebal rules directly change scenario losses; governance requires change control.

4.1.7 Simple CTE attribution example

Setup. Assume $N = 10{,}000$ scenarios at both dates. Define:

$$\Delta\mathrm{CTE}_{70} = \underbrace{\Delta_{\mathrm{Mkt}}}_{\text{markets}} + \underbrace{\Delta_{\mathrm{Hdg}}}_{\text{hedge actions}} + \underbrace{\Delta_{\mathrm{Assump}}}_{\text{model/assumptions}} + \underbrace{\Delta_{\mathrm{Other}}}_{\text{mix/rounding/floors}}.$$

Computation sketch.

1. **Markets-only revalue:** Revalue last quarter's liability *and* last quarter's hedge *under current market curves/vols*, but *freeze* behavior/assumptions. Compute CTE_{70} change $\Rightarrow \Delta_{\text{Mkt}}$.
2. **Add actual hedge actions:** Layer in trades done this quarter (delta trims, option rolls). Recompute CTE_{70} change from step 1 $\Rightarrow \Delta_{\text{Hdg}}$.
3. **Apply updated assumptions:** Update lapse/expense/rebal rules per approved governance. Difference $\Rightarrow \Delta_{\text{Assump}}$.
4. **Residuals:** Any remaining change (policy mix, floors/rounding) $\Rightarrow \Delta_{\text{Other}}$.

Numerical toy (illustrative).

Component	CTE_{70} change (mm)	Cumulative (mm)
Start (prior quarter)	0.0	0.0
Markets-only (rates ↓, vols ↑)	+18.0	+18.0
Hedge actions (added long vega ladder)	-12.5	+5.5
Assumptions (lapse update)	+2.0	+7.5
Other (mix/floors/rounding)	-0.5	+7.0

Interpretation: adverse markets pushed tails up +18; hedge program offset −12.5; governance changes added +2; net reserve up +7.

4.1.8 Practical checklist for VM-21 alignment

- **Data lock and lineage:** Surfaces (level/skew/term), funding/dividends, and curves documented; tie to trading and modeling as-ofs.
- **Hedge policy encoding:** Desk's rebalancing rules expressed in a model-implementable form (bands, frequencies, tenors).
- **Tail-focus KPIs:** Track ΔCTE from *markets* vs *hedge actions*; don't rely on median-only metrics.
- **Stress ladders consistent with VM-21:** Daily/weekly shocks mapped to expected CTE drift to pre-empt governance breaches.
- **Attribution pack:** Markets / Hedge / Assumptions / Other table; reconcile to trade blotter and Schedule DB.

4.2 FIA reserving overview

4.2.1 Deterministic framework

Fixed Indexed Annuities (FIAs) fall under the **Standard Valuation Law (SVL)** and **Standard Nonforfeiture Law (SNFL)**. Unlike VM-21 for variable annuities, FIA reserves are computed using *formula-based methods*:

- **Accumulation value floor:** Minimum guaranteed accumulation value (often 87.5% of premium with a statutory interest rate) sets the lower bound.
- **Deterministic interest rate assumptions:** Prescribed valuation rates tied to statutory tables, not to current market hedges or volatility.
- **Option budget recognition:** Reserve calculations assume the cost of hedging/index credits is funded from the option budget, but *actual* hedge trades and MTM are not part of the statutory reserve formula.

4.2.2 Where (and if) hedges show up

- **Formulas:** Hedges do not appear explicitly. The statutory formulas assume the insurer can always purchase option structures consistent with caps/pars/spreads at the credited rate.
- **Reserves:** Deterministic reserves are insensitive to hedge P&L. Hedge effectiveness does not reduce the required reserve amount.
- **Earnings:** Hedge results *do* flow through statutory income each period, so they affect surplus and therefore available capital.
- **RBC:** Risk-based capital factors are applied to reserves. Hedge offsets are not directly credited; capital relief comes only indirectly if hedges stabilize earnings and reduce volatility of surplus.

4.2.3 Practical friction points for hedge desks

- **Earnings vs reserves disconnect:** Hedge P&L shows up in statutory earnings, while deterministic reserves remain fixed. Desk may appear to "lose money" in statutory terms even when hedges are performing.
- **Option cost variability:** Formulas assume option costs consistent with crediting design; in reality, option implied vols move, creating tension between hedge budgets and statutory reserves.
- **Capital drag:** RBC factors apply conservatively to formula reserves, often overstating capital needs relative to hedge-adjusted risk.
- **Governance questions:** Management and ALCO may ask why hedges did not "reduce reserves." Explaining that SNFL/SVL formulas are hedge-blind is a recurring education exercise.
- **Performance KPIs:** The hedge desk is judged by *earnings stability* and option budget adherence rather than reserve reduction. This changes how "success" is defined compared to RILAs.

Key Takeaway

In FIA reserving, hedges appear only indirectly (through statutory earnings and surplus), not in the reserve formulas themselves. For hedgers, this creates friction: reserves feel conservative, capital recognition is limited, and governance asks must be managed carefully.

4.3 RBC considerations

Risk-Based Capital (RBC) is the NAIC capital framework that assigns capital requirements to insurers based on the risks they take. For hedge desks, the relevant levers are the *market risk* components (commonly grouped under C-3 style charges) and how hedge programs influence *capital volatility* through time.

4.3.1 RBC building blocks (hedger's cut)

RBC aggregates several risk components with covariance formulas. In this context:

- **C-1 (Credit/Asset Risk):** Capital for credit risk on invested assets and counterparties (including OTC derivative counterparty exposure after collateral/CSA).
- **C-2 (Insurance/Other):** Morbidity/mortality for relevant products (limited for RILAs/FIAs).
- **C-3 (Market/Interest/Equity):** Capital for market risks arising from asset/liability mismatches, equity options/guarantees, rate/volatility shocks.
- **C-4 (Operational):** Residual/operational risk.

For **RILAs** (treated as variable annuities), the market component is tightly linked to *VM-21* stochastic results (CTE-based). For **FIAs** (fixed annuities), market capital more closely follows *factor/Formula-based* approaches tied to deterministic reserves and asset risks.

4.3.2 RILAs (VA treatment): C-3 tied to VM-21 tails

Because AG 54 brings RILAs into the VA/PBR umbrella, capital for market risk is tied to *tail outcomes* from the same stochastic engine used for reserves:

- **CTE linkage:** Capital is calibrated to tail losses (e.g., via CTE measures) that *explicitly include hedge positions and permitted rebalancing rules.*
- **Hedge effectiveness ⇒ capital stability:** Well-constructed option ladders and delta/vega bands reduce tail loss dispersion, directly damping C-3 capital volatility.
- **Governance sensitivity:** Model changes (lapse dynamics, fee paths, rehedge policy) can move both reserves and C-3 simultaneously; change control is critical.

4.3.3 How VM–21 Reserves Feed C–3 Capital

Overview. For RILAs (and VAs generally), the same GPVAD stochastic engine produces both the statutory reserve and the C–3 market risk capital requirement. The key difference is the *tail percentile* applied.

Reserve versus Capital

- **Reserves (VM–21):** Defined as a conditional tail expectation at a moderate percentile, typically CTE_{70}, floored by the Standard Scenario Amount (SSA).
- **C–3 Capital (RBC):** Defined using a more conservative tail percentile, such as CTE_{98} or CTE_{90} depending on RBC year and instructions. The capital charge is essentially the *gap* between the deep tail and the reserve tail:

$$\text{C–3} \;\approx\; 0.25 * \text{CTE}_{98}(\{\text{GPVAD}^{(s)}\}) \;-\; \text{CTE}_{70}(\{\text{GPVAD}^{(s)}\}).$$

- **Interpretation:** The stochastic framework is unified. Reserves anchor at the moderate tail; C–3 capital reflects how much *worse* things could get in more extreme scenarios.

Extreme Case Illustration

Imagine an insurer writing only a single RILA block:

- All statutory reserves would be set by the block's VM–21 CTE_{70}, floored by SSA.
- All C–3 capital would be determined by the difference between the block's CTE_{98} and CTE_{70}, i.e. the tail dispersion of the same GPVAD distribution.

Thus the entire firm's market risk profile flows through one stochastic reserve engine.

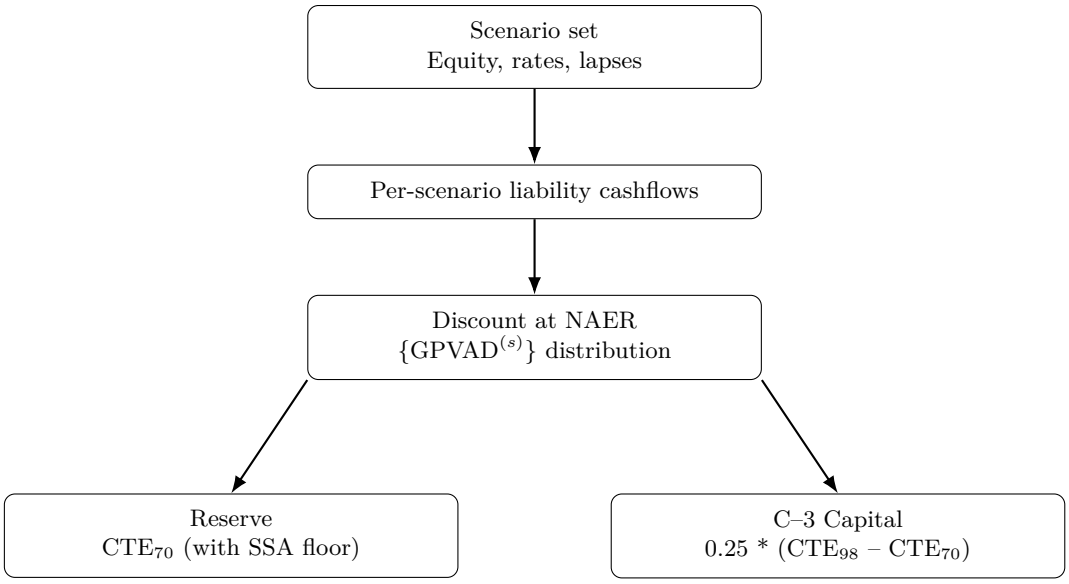

Figure 4.1: Both VM–21 reserves and C–3 capital flow from the same GPVAD stochastic distribution. The reserve is set at CTE_{70} (subject to SSA floors), while the C–3 capital charge is the excess risk in deeper tails (e.g. CTE_{98}).

Takeaway. Reserves and capital are two views of the same GPVAD distribution. For desks, this means hedges that reduce tail losses not only stabilize reserves but also directly compress the C–3 capital requirement.

4.3.4 Clarifying Aside: Why Two CTE Levels? (CTE_{70} vs. CTE_{98})

The apparent redundancy. Both VM–21 reserves and RBC C–3 capital are derived from the *same* GPVAD scenario distribution. In risk-theory terms, one might ask: why not just use a single deep-tail measure (e.g., CTE_{98}) and call a portion of it "reserves" and the rest "capital"?

Regulatory intent (why VM–21 uses CTE_{70} for reserves).

- **Policyholder floor vs. solvency cushion.** Reserves are a *statutory liability floor* recorded on the balance sheet (policyholder protection), while capital is an *additional cushion* for solvency. The NAIC wanted a bright line between the two.
- **Stability & comparability.** A moderate tail (CTE_{70}) produces reserves that are conservative yet less pro-cyclical than a deep-tail (e.g., CTE_{98}), limiting volatility in statutory earnings across market regimes.
- **Governance separation.** Reserves are governed by valuation law (VM–21); capital by RBC instructions. Distinct thresholds preserve clarity and supervisory control.

How to read the split.

- **Reserve (CTE_{70}):** Adequacy at a *moderate tail* — a policyholder-first liability floor, subject to floors like SSA.
- **C–3 capital (incremental tail):** Additional loss beyond the reserve tail, often expressed as $\text{CTE}_{98} - \text{CTE}_{70}$ (year-specific RBC instructions apply). This is the solvency margin for rarer, more extreme outcomes.

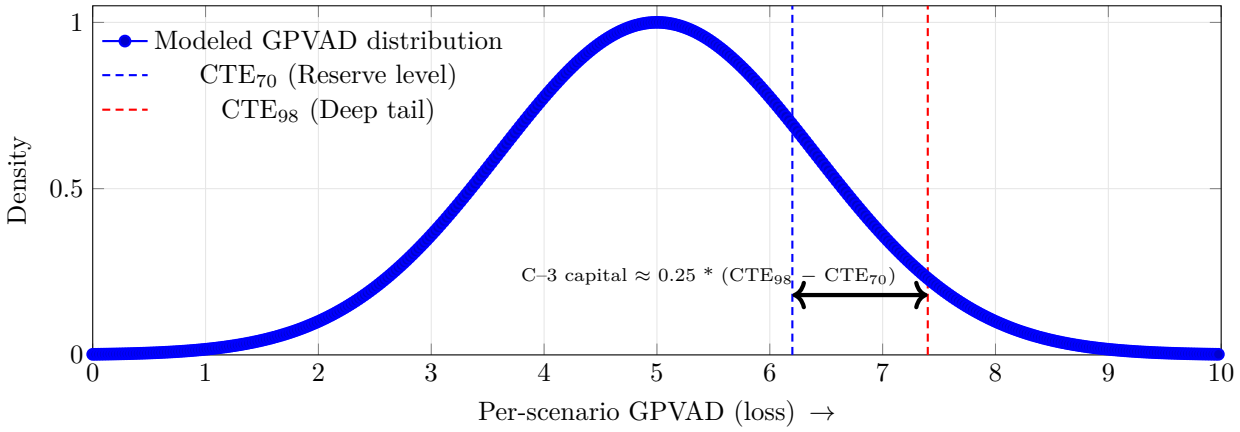

Figure 4.2: One distribution, two tails: VM–21 reserves use a moderate tail (e.g., CTE_{70}), while RBC C–3 capital reflects additional loss in deeper tails (e.g., CTE_{98}). The difference between the two is the C–3 charge.

Takeaway. From a coherent risk-measure lens, you can view the system as a single deep-tail (e.g., CTE_{98}) with a statutory split: *reserve* at CTE_{70} as a policyholder floor and *capital* as the incremental deep tail. The split reduces pro-cyclicality, preserves accounting/governance boundaries, and still keeps both layers anchored in the same stochastic engine.

4.3.5 FIAs (fixed treatment): C-3 style factors on a formula base

For FIAs, where reserves are deterministic and hedge-blind:

- **Factorized capital:** C-3 market charges are applied using prescribed factors to interest-rate and equity exposures implied by the liability/asset mix; hedges do not directly reduce those factors.
- **Where hedges show up:** Hedge gains/losses flow through statutory earnings and surplus, indirectly affecting *RBC ratios*, but not the *required* capital calculation itself.
- **Counterparty capital:** OTC hedging can *increase* C-1 counterparty charges unless mitigated by collateralization/clearing and counterparty limits.

4.3.6 How Deterministic FIA Reserves Tie to C–3 Capital

Overview. For FIAs, reserves and capital are set under a different lens than for RILAs. Reserves remain *deterministic* (via SNFL/SVL), while C–3 market risk capital is determined by *factor-based formulas* applied to the general account (GA). The hedge program does not directly alter statutory reserves, but it can influence C–3 capital through how GA exposures are reported and managed.

Reserve versus Capital

- **Reserves (SVL/SNFL):**
  - Based on minimum nonforfeiture laws and statutory valuation methods.
  - Deterministic accumulation of policyholder values subject to minimum floors.
  - Independent of hedge positions: option overlays do not reduce FIA reserves.
- **C–3 Capital (RBC):**
  - Calculated using factor-based charges on GA assets and liabilities.

  - Market risk factors (C–3) applied to bonds, equities, and derivative positions.
  - Hedge instruments may *alter exposures* reported for RBC, but do not change reserves.
- **Interpretation:** FIA statutory reserves are "blind" to hedges, while C–3 capital partially reflects the hedge overlay via GA exposure profiles and derivative schedules.

Extreme Case Illustration

Suppose an insurer only sells FIAs:

- Reserves are set deterministically via SNFL/SVL, regardless of how much hedging is in place.
- C–3 capital is computed by applying RBC factors to the GA portfolio, including hedge derivatives booked there. A well-structured hedge may reduce net option exposure (hence lower RBC charges), but reserves will not change.

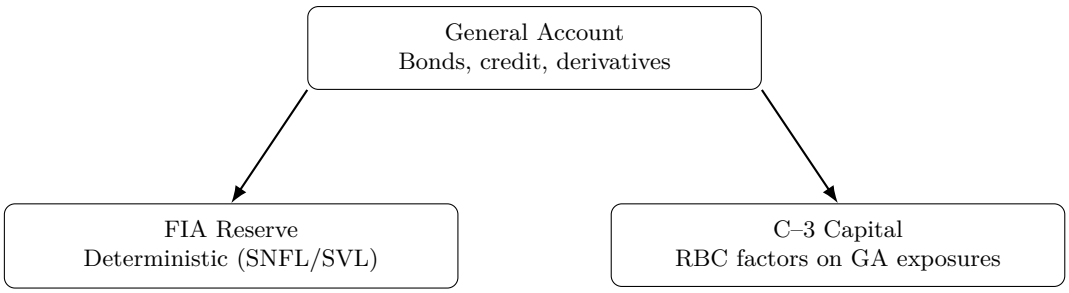

Figure 4.3: For FIAs, reserves are deterministic and hedge-blind (SNFL/SVL), while C–3 capital applies factor charges to GA exposures, including derivatives.

Takeaway. Unlike RILAs, where stochastic tails link reserves and capital directly, FIA reserves remain formulaic while C–3 capital is factor-based. For desks, hedges matter for *earnings smoothing* and *capital factors*, but do not reduce statutory reserves.

4.3.7 Factor-Based C–3 for FIAs

What it is. Unlike RILAs/VM–21, where C–3 capital is computed from a stochastic GPVAD/CTE engine, FIA C–3 is a *factor-based* add-on applied to general account (GA) exposures. The NAIC RBC instructions prescribe simple percentages by exposure type (liabilities and/or assets), intended to capture *interest-rate risk* and *equity-linked crediting risk* without running scenario models.

Where it applies. FIAs are treated as fixed annuities for RBC. Factors are applied to:

- **GA reserves (liability view):** to capture *interest-rate* / duration risk.
- **FIA account value (AV) or credited amount (exposure view):** to capture the *equity-linked crediting risk* arising from caps/pars/spreads and any hedge mismatch.

Representative factor set (illustrative). Specific factors are periodically updated by NAIC RBC instructions. A common schematic you will see:

$$C\text{–}3_{\text{FIA}} \;=\; \underbrace{\text{Reserves} \times f_{\text{IR}}}_{\text{interest-rate component}} \;+\; \underbrace{\text{FIA AV} \times f_{\text{EQ-cred}}}_{\text{equity-crediting component}} \;.$$

Example values used for pedagogy (not official):

$$f_{\text{IR}} \in \{0.25\%,\, 0.50\%,\, 0.75\%\} \text{ by duration bucket}, \qquad f_{\text{EQ-cred}} \in [1.0\%,\, 2.0\%].$$

Component	Description / Typical Basis
Interest-rate (IR) factor on reserves	Applied to *GA statutory reserves* for FIAs. Often tiered by *effective duration*, e.g. <5y: 0.25%, 5–10y: 0.50%, >10y: 0.75%. Captures liability sensitivity to rate shocks without scenarios.
Equity-crediting factor on FIA AV	Applied to *FIA account value* (or similar exposure base). Typical pedagogical range 1–2%. Captures market-risk element of index-linked crediting (caps/pars/spreads) in a hedge-blind, standardized way.

Table 4.1: Illustrative (non-authoritative) FIA C–3 factor components. Exact factors follow NAIC RBC instructions by year.

Numerical example (illustrative). Assume:

$$\text{FIA GA reserves} = \$1{,}000 \text{ mm}, \quad \text{FIA AV} = \$1{,}000 \text{ mm}, \quad f_{\text{IR}} = 0.40\%, \quad f_{\text{EQ-cred}} = 1.00\%.$$

Then

$$C\text{–}3_{\text{FIA}} \;=\; (1{,}000 \times 0.004) \;+\; (1{,}000 \times 0.010) = 4 + 10 = \boxed{\$14 \text{ mm}}.$$

Why it feels "sticky."

- **Hedge-blind by design:** Factors do not explicitly credit hedge effectiveness or rebalancing—unlike VM–21.
- **Low volatility, high comparability:** Same factors across firms increase comparability and reduce modeling disputes.
- **Desk implication:** Hedge overlays help *GA earnings* and reduce actual P&L volatility, but *do not* proportionally reduce C–3; the charge follows the factor formula until NAIC updates occur.

Contrast to RILAs/VM–21. For RILAs, both reserves and C–3 are sourced from the *same* GPVAD distribution (e.g., reserve at CTE_{70}, capital at a deeper tail such as CTE_{98}). For FIAs, reserves are *deterministic* (SVL/SNFL) and C–3 is *factor-based*—two separate, hedge-insensitive mechanics.

4.3.8 Relative Weight of Reserves vs. Capital: RILA vs. FIA

Overview. A useful mental shortcut is that *RILA/VA frameworks are capital-heavy*, while *FIA frameworks are reserve-heavy*. The asymmetry arises from different statutory regimes: VM–21 stochastic CTE (RILAs) versus SVL/SNFL deterministic formulas (FIAs).

RILAs / VAs (VM–21)

- **Reserve:** Moderate tail, e.g. CTE_{70}, subject to SSA floor.
- **Capital (C–3):** Deep tail, e.g. 0.25 * (CTE_{98} – CTE_{70}).
- **Implication:** The distance between the 70th and 98th percentile of GPVAD outcomes can be wide, especially for long-tenor option features. C–3 capital often *exceeds* reserves and is the main driver of volatility in hedge effectiveness discussions.

FIAs (SVL / SNFL)

- **Reserve:** Deterministic, floor-driven, based on minimum statutory interest rates and nonforfeiture laws. Large, sticky, and insensitive to hedges.
- **Capital (C–3):** Factor-based add-on, e.g. 0.25–0.75% of GA reserves plus 1–2% of FIA account value. Modest compared to reserves.
- **Implication:** Reserves *dominate* C–3. Hedge overlays stabilize earnings but do not meaningfully change either reserves or capital.

	RILA / VA (VM–21)	FIA (SVL / SNFL)
Reserve basis	Stochastic, CTE_{70} of GPVAD (with SSA floor)	Deterministic formulas, SNFL & minimum interest rates
Capital basis	Stochastic, 0.25 * (CTE_{98} – CTE_{70})	Factor-based add-on (reserves + AV)
Relative magnitude	C–3 capital often *larger than reserves*	Reserves usually *much larger than C–3*
Hedge recognition	Yes (DUP-defined hedges reduce tails)	No (hedges do not reduce reserves or factor charges)
Desk focus	Tail hedging to reduce capital volatility	Earnings smoothing; reserves dominate statutory profile

Table 4.2: Relative dominance of reserves versus capital under RILA vs. FIA regimes.

Takeaway. RILAs create a *capital-dominated* statutory profile, where hedges materially affect C–3 volatility. FIAs create a *reserve-dominated* profile, where hedges improve earnings but reserves and capital are largely insensitive to hedge overlays.

Callout: RBC Aggregation Uses Covariance, Not Simple Addition. Total life RBC is not the sum of category charges. The NAIC applies a covariance aggregation across the major components:

$$\text{Total RBC} \;=\; \sqrt{C_1^2 + C_2^2 + C_3^2 + C_4^2}\;,$$

where C_1 (credit), C_2 (insurance), C_3 (market), and C_4 (business) are category requirements (each possibly comprised of sub-components).

- **Why:** Recognizes diversification—risks are not perfectly correlated.
- **Desk implication:** Reducing C_3 via hedging lowers total RBC, but not one-for-one; the square-root structure dampens the marginal impact.
- **Reminder:** Category details (e.g., C-1 sub-factors for bonds/equities) and company action levels are defined in the RBC instructions; the top-level covariance form is standard.

4.3.9 Capital volatility vs hedge effectiveness (desk view)

- **RILAs:** Tail-sensitive vega and skew/term exposure dominate C-3 volatility. Long-tenor option ladders that smooth vega through time stabilize both *reserves and capital*.
- **FIAs:** Since required capital is factor-based, "economic" hedge success may not translate into lower required capital; instead, success is seen in steadier *surplus* (numerator of the RBC ratio).
- **Basis risks that matter:** Index vs hedge underlyer, realized vs implied volatility, funding vs collateral rates, correlation across indices/baskets. These can widen CTE tails (RILAs) or drive earnings noise (FIAs).

4.3.10 Gross Premium Valuation Actuarial Determination (GPVAD)

What GPVAD is (statutory definition). GPVAD is the VM–21 framework for valuing the *net liability cashflows* of a VA/RILA block. Formally,

$$\text{GPVAD} \;=\; \text{Present Value}\Big(\underbrace{\text{Future Benefits}}_{\text{incl. guarantee shortfalls, riders}} + \underbrace{\text{Future Expenses}}_{\text{admin, claims, acquisition (as applicable)}} - \underbrace{\text{Future Net Premiums}}_{\text{charges, fees, assessments}}\Big),$$

where the present value is taken using the *Net Asset Earned Rate (NAER)* rather than a market risk/free curve.

Discounting basis (why NAER). VM–21 is an *asset⁄adequacy, book⁄value* solvency framework. Assets are carried at amortized cost, so their *earned* yield (NAER) represents the funding available to meet liability outflows. Consequently, GPVAD discounts at NAER to preserve asset⁄liability consistency, stability, and comparability.[1]

Decomposition for VA/RILA blocks (intuition). For these products, Future Benefits are dominated by *guarantee shortfalls* (the insurer "top⁄ups" when $\mathrm{AV}_t < \mathrm{Guarantee}_t$). A useful working form is

$$\mathrm{GPVAD} \;\approx\; \sum_{t=1}^{T} \frac{\underbrace{\max\{\mathrm{Guarantee}_t - \mathrm{AV}_t,\, 0\}}_{\text{guarantee shortfall}} + \mathrm{Expenses}_t \;-\; \mathrm{Fees}_t}{(1+\mathrm{NAER})^t},$$

augmented by any rider benefits (e.g., GMDB/GMIB) per VM–21 prescription.

Stochastic aggregation to a reserve. GPVAD is computed *path⁄by⁄path* under a calibrated scenario set (equity, rates, lapses, etc.). Let $\{\mathrm{GPVAD}^{(s)}\}_{s=1}^{N}$ be the present values across N scenarios; the stochastic reserve is the tail average (e.g., CTE_{70}) of this distribution:

$$\mathrm{Res}_{\mathrm{stoch}} = \mathrm{CTE}_{\alpha}\big(\; \mathrm{GPVAD}^{(1)}, \ldots, \mathrm{GPVAD}^{(N)} \;\big).$$

The *reported* VM–21 reserve is then

$$\boxed{\mathrm{Reserve} \;=\; \max\big\{\; \mathrm{Res}_{\mathrm{stoch}},\; \mathrm{SSA},\; \text{any other prescribed floors} \;\big\}},$$

where SSA is the *Standard Scenario Amount* (see §4.1.4).

Hedge recognition (why it matters). If hedge positions and rebalancing *policies* are DUP⁄compliant and modeled as *clearly defined strategies*, their cashflows reduce $\mathrm{GPVAD}^{(s)}$ in tail paths (lowering CTE_{α}). Ad⁄hoc or discretionary actions do not receive credit (see the note in §6.3.2).

[1] See also the note in §?? distinguishing *Net Asset Earned Rate* from a hedge desk's *guarantee shortfall* exposure.

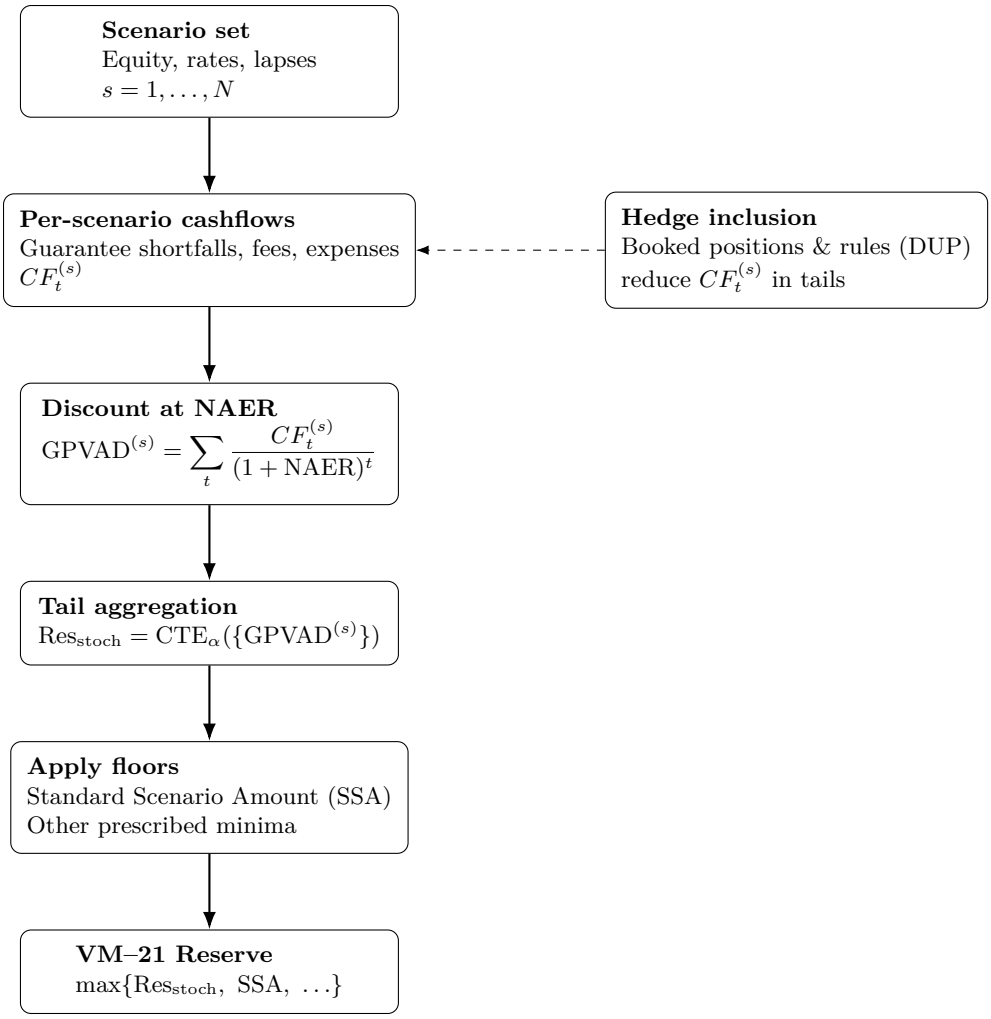

Figure 4.4: GPVAD pipeline under VM–21: scenario cashflows are discounted at NAER to produce per-scenario GPVADs; the reserve is the CTE tail average, floored by the Standard Scenario Amount (and any other minima). Recognized hedge programs reduce tail cashflows and thus the CTE.

Worked micro-example (one period, stylized). Suppose a 1-year horizon with fees = 1mm, expenses = 0.5mm, and guarantee shortfall $X^{(s)}$ that equals $\{0, 0, 5, 10, 20\}$mm across five scenarios. With NAER = 3%,

$$\mathrm{GPVAD}^{(s)} = \frac{X^{(s)} + 0.5 - 1.0}{1.03}.$$

Ordering the five GPVADs and taking CTE_{70} (worst 30% = top two) yields the stochastic reserve; the reported reserve is the max of that and the SSA. Introducing recognized hedges that reduce $X^{(s)}$ in stress paths lowers the CTE until the SSA floor binds.

Key takeaways.

- GPVAD is the *present value of net liability cashflows*, discounted at *NAER* (book-yield basis).
- The VM–21 reserve is the *tail average* (CTE) of scenario GPVADs, *subject to floors* (SSA, etc.).
- For VA/RILA, guarantee shortfalls are the primary driver of GPVAD; recognized hedge overlays reshape tail cashflows and reduce the CTE.

4.3.11 Net Asset Earned Rate (NAER)

- **Definition:** Effective yield on the insurer's general account asset portfolio, expressed relative to statutory book value. Practically: *annual coupons + amortizations* divided by book value of assets.
- **Nature:** An *interest rate assumption* (not a dollar exposure).
- **Role in GPVAD/VM-21:**
  - Used to discount projected liability cashflows (including guarantee shortfalls) back to present.
  - Ensures consistency between book-value asset carrying and liability valuation.
  - Emerges from asset adequacy testing traditions: do the booked assets, at their earned rates, support the projected guarantees?

Why not discount at a risk-free rate?

- **Book-value consistency:** Statutory accounting carries assets at amortized book, not fair value. Discounting liabilities at the portfolio's earned rate aligns liabilities with the assets that are actually recognized on the balance sheet.
- **Asset adequacy testing heritage:** The GPVAD approach is designed to answer whether existing booked assets are sufficient to fund projected benefits. This naturally implies using the earned rate on those assets, not a replication pricing rate.
- **Stability and conservatism:** NAER-based discounting smooths through market volatility (book yields change slowly) and often produces reserves higher than a risk-free/OIS rate, satisfying regulators' conservatism aims.
- **Contrast with hedge desk:** Risk-free discounting aligns with economic replication cost and hedge pricing. From the hedge desk perspective, NAER discounting can feel "off-market," but from a statutory solvency perspective it is more appropriate.

4.3.12 Why Options Don't Contribute to NAER

Why options don't feed NAER.

- **Accounting lens:** Plain-vanilla bonds are carried at *amortized cost* (SSAP 26/43), producing predictable interest income. Derivatives are carried at *fair value* (SSAP 86) with changes flowing through earnings/surplus; they do not generate a stable coupon-like stream.
- **Definition of "earned rate":** NAER is tied to *book yield* on the asset base. Option premia, theta, and realized/MTM hedge gains are not "coupon income" and therefore are excluded from NAER.
- **Model placement:** Under VM–21, options affect the *projected cashflows* (they reduce guarantee shortfalls in scenarios). The *discount rate* applied to those cashflows is NAER, which is set by the bond/credit portfolio—not by the option overlay.

Practical consequence. If an insurer attempted to hedge a RILA block with *only* options (no bonds):

- NAER would collapse toward $\sim 0\%$ (at most a cash-equivalent yield on residual balances).
- GPVADs would be *larger* simply because discounting occurs at a very low rate, even if option P&L offsets shortfalls economically.
- The options' benefit would show up in *per-scenario net cashflows*, not in the *discount rate*.

Rule of thumb for portfolio design.

- **Bonds/credit/mortgages** ⇒ drive NAER (discount rate) via coupons over amortized cost.
- **Options/futures/swaps** ⇒ reshape *cashflow tails* and reduce CTE; they do not raise NAER.

Toy comparison (one-year horizon, illustrative). Consider two otherwise identical RILA blocks with identical hedge effectiveness:

$$\text{Block A: } 0\% \text{ NAER (derivatives-only)} \quad \text{vs.} \quad \text{Block B: } 4\% \text{ NAER (bond-supported).}$$

Even if both produce the same *undiscounted* guarantee shortfall paths after hedging, Block B's *present values* are lower because each scenario's net cashflows are discounted at $1/(1+0.04)$ rather than $1/(1+0.00)$. Hence CTE_{70} (reserve) and the deep-tail measure for C–3 are lower for Block B—*purely via the discount-rate channel*.

Takeaway. Options manage *risk*, not *book yield*. NAER is driven by coupon-bearing assets carried at amortized cost; the option overlay belongs in the *cashflow* leg of VM–21, not in the *discount-rate* leg. In practice, RILA programs pair a bond/credit base (for NAER) with a derivatives overlay (for tail control).

4.3.13 Guarantee Shortfall (Net Amount at Risk)

Definition The **Guarantee Shortfall** is the excess of guaranteed benefits over the policyholder's account value (AV), floored at zero:

$$\text{GS}(t) \;=\; \max\big\{\, \text{Guarantee}_t \;-\; \text{AV}_t \,,\; 0 \,\big\}.$$

Intuitively, the guarantee shortfall is the "in-the-money" portion of the guarantee at time t. It is central to variable-annuity (and, via AG 54, RILA) reserving/capital frameworks.

Regulatory & capital context.

- **VM-21 (RILAs/VA):** Scenario projections produce cash flows where the guarantee shortfall widens when markets fall. Larger shortfall in the tail increases scenario losses L_s and thus raises CTE-based reserves/capital.
- **RBC (C-3 market risk):** The shortfall proxies the option-like exposure that attracts market capital. As the shortfall grows (deep ITM guarantees), required C-3 capital and its volatility generally rise.
- **Reporting:** Some firms monitor average and tail shortfall (e.g., $\mathbb{E}[\text{GS}]$ and CTE(GS)) as leading indicators for reserves and capital movements.

Hedge-desk interpretation.

- **Option analogy:** Guarantee shortfall behaves like the intrinsic value of a short put (downside protection) or a put spread (buffer) embedded in the contract. Rising shortfall ⇒ more downside option exposure.
- **Targets & sizing:** Desks often track a *shortfall-hedged ratio* = (delta/vega coverage attributable to hedges) / shortfall-implied exposure. Near zero shotrfall (high markets), coverage can be lighter; as shortfall grows, hedge size and tenor emphasis increase.
- **Gamma zones:** For RILAs with buffers/floors, shortfall can jump as the index approaches the buffer/floor. Tight $|\Delta|$ bands and intraday futures allow for responsive management in these hot zones.
- **Tenor/vega:** Sustained shortfall in stress scenarios pushes VM-21 tails; long-tenor vega ladders help damp tail ΔCTE sensitivity.

Illustrative forms of Guarantee_t **(informal).**

- **Simple VA floor:** Guarantee_t = present value of a floor/GMxB promise.
- **RILA (buffer) at horizon** T**:** terminal payoff $\approx \max\{S_T - K, 0\} - \max\{-(1-b)(K - S_T), 0\}$, so downside protection up to buffer b creates put-spread-like shortfall when $S_T \downarrow$.
- **RILA (floor) at horizon** T**:** terminal payoff includes a minimum return; shortfall grows like a long put as S_T moves below the floor level.

Behavior (rules of thumb).

Situation	shortfall behavior / hedge cue
Markets rally; AV $\gg$ Guarantee	shortfall ≈ 0; maintain lighter delta/vega; mind cap/ratchet effects.
Markets fall toward buffer/floor	shortfall grows, often nonlinearly; tighten delta bands; watch gamma near kinks.
High vol regime persists	Tail shortfall increases in scenarios; add longer-tenor vega to smooth ΔCTE.
Large withdrawals/lapses	AV changes alter shortfall path; coordinate with actuarial lapse assumptions.

Guarantee Shortfall in Reserves vs. Practice

Regulatory/statutory role.

- **VM-21 mechanics:** The reserve is defined as a CTE measure over projected liability cashflows. Guarantee shortfall is not a line-item in the formula; it *emerges implicitly* whenever projected account values fall below guarantees and the insurer must "top up."
- **Capital framing:** Likewise, RBC C-3 market risk charges come from stochastic tests of guarantees, not an explicit shortfall factor. Large shortfall simply produces larger tail losses in those tests.

Operational/desk role.

- **Dashboard metric:** Many firms calculate gross shortfall (guarantee – AV) daily, and net shortfall (after hedge offsets). These are intuitive bases for hedge sizing.
- **Limits & governance:** ALCO or risk committees often set tolerance bands on net shortfall, or require a minimum hedging percentage of shortfall exposure.
- **Attribution & explanation:** Movements in shortfall provide a clean narrative for why CTE reserves or RBC requirements moved from one period to the next.

Key takeaway. Guarantee shortfall is the *economic driver* of option-like exposure, but it is not an explicit statutory formula input. Instead, it flows implicitly into stochastic results. On the hedge desk and in governance, however, shortfall is elevated into a *primary KPI*, bridging actuarial reserve/capital metrics with daily hedge management.

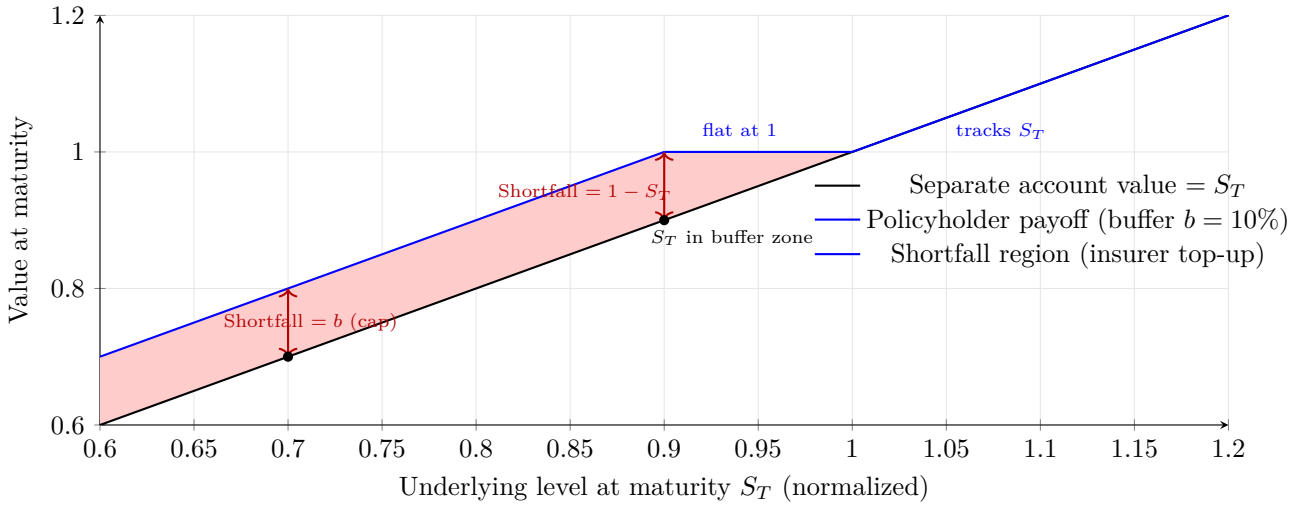

Figure 4.5: Guarantee shortfall for a buffer RILA (example with $b = 10\%$). The policyholder payoff (blue) lies above the separate account value (black) when losses are within the buffer; the vertical gap is the insurer's top-up obligation (shortfall). For $S_T \in [0.9, 1]$ the gap declines linearly to zero; for $S_T < 0.9$ the gap is capped at b.

Practical KPIs.

- **Shortfall coverage:** Hedge coverage $\approx \frac{\text{hedge-implied short put/put-spread exposure}}{\text{shortfall-implied exposure}}$.
- **Tail sensitivity:** Track ΔCTE contribution from shortfall-heavy scenarios before/after hedge actions.
- **Hot-zone monitor:** Distance to buffer/floor (in σ) with alert thresholds for intraday delta trims.

Key takeaway. Guarantee shortfall connects the actuarial/stat world (VM-21 tails, RBC C-3) to trading reality: it is the portion of the guarantee that behaves like a short option. As shortfall expands, hedges must scale and extend in tenor to stabilize both reserves (CTE) and capital.

4.3.14 Side-by-side summary

	RILAs (VA / VM-21)	**FIAs (Fixed / SVL&SNFL)**
Reserve basis	Stochastic (CTE, floors)	Deterministic formulas (nonforfeiture floor, valuation rates)
C-3 market capital	Tied to VM-21 tail outcomes (hedge-recognizing)	Factor-based on liability/asset exposures (hedge-blind)
Hedge impact on capital	Direct: hedges modeled in scenarios reduce tails	Indirect: hedges smooth earnings/surplus; required capital unchanged
Counterparty/credit	Separate C-1 charges for OTC exposure (mitigate via CSA/clearing)	Same; GA counterparties/CSA drive C-1
Key volatility driver	Long-tenor vega, skew/term structure in tails	Option budget variability $\rightarrow$ earnings; factor capital steady

4.3.15 Illustrative capital attribution (toy)

A quarterly change in required capital (ΔRC) can be explained via:

$$\Delta\text{RC} = \underbrace{\Delta_{\text{Markets}}}_{\text{levels/vol/skew}} + \underbrace{\Delta_{\text{Hedges}}}_{\text{new ladders/rebalances}} + \underbrace{\Delta_{\text{Mix/Runoff}}}_{\text{business mix, maturities}} + \underbrace{\Delta_{\text{Model}}}_{\text{assumptions/policy}} + \underbrace{\Delta_{\text{Other}}}_{\text{floors/rounding}}.$$

For RILAs, Δ_{Hedges} is typically *negative* when vega ladders were added against a vol-up quarter (tail relief). For FIAs, Δ_{Hedges} often books to earnings, while required capital changes concentrate in Δ_{Markets} and Δ_{Mix}.

4.3.16 Practical checklist

- Align hedge tenors to **capital horizons**: long vega ladders for RILAs; earnings-vol bands for FIAs.
- Track **tail KPIs**: ΔCTE from markets vs hedge actions (RILAs); surplus volatility vs factors (FIAs).
- Manage **counterparty C-1**: CSA thresholds, clearing where feasible, diversification limits.
- Maintain **change control**: any rehedge policy/model updates documented and approved (affects RC directly for RILAs).
- Reconcile to **Schedule DB**: ensure positions that drive capital are visible and tie out to statutory ledgers.

Key Takeaway

For RILAs, hedge effectiveness *directly* stabilizes required capital because VM-21 tail calculations include the hedge book. For FIAs, required capital is largely *insensitive* to hedging; desks create value by stabilizing earnings and surplus, managing counterparty C-1, and keeping factor exposures within governance bands.

4.3.17 Clarifying Aside: The Pendulum of RILA Reserving

Idea. Under VM–21, RILA reserves slide on a spectrum between two conceptual extremes: *no hedge* (highest stochastic tail loss, largest reserve) and *perfect hedge* (minimal tail loss; reserve limited by the VM–21 floor, e.g. the Standard Scenario Amount). Real programs live between these poles; where you land depends on how completely and rules–based the overlay neutralizes tail scenarios.

Extremes (thought experiment).

- **No hedge overlay.** Stochastic projections run with naked buffer/floor guarantees. Tail scenarios are large; CTE_α is high $\Rightarrow$ *highest reserve*.
- **Perfect hedge overlay (hypothetical).** A booked, DUP–compliant, rules–based portfolio exactly replicates the payoff path; hedge gains offset guarantee losses in every scenario. Tail average collapses to a near flat line. *Reserve approaches (but cannot go below)* the VM–21 floor (e.g. Standard Scenario Amount, SSA) $\Rightarrow$ *lowest reserve*.

Recognition conditions (why "perfect" still isn't zero). VM–21 gives credit only for *actual* positions and *permitted, rules–based* rebalancing reflected in the model. Even then, reserve is floored by SSA (and any other prescribed floors). Therefore the conceptual lower bound is *SSA*, not zero.

Continuum view (rule of thumb). Let RC$(\cdot)$ denote the VM–21 required reserve and $\mathsf{HE} \in [0,1]$ a qualitative hedge–effectiveness score (1 = perfect replication within policy; 0 = none):

$$\text{RC}(\mathsf{HE}) \in \Big[\underbrace{\text{SSA}}_{\text{floor (best case)}}, \underbrace{\text{CTE}_\alpha(\text{no hedge})}_{\text{ceiling (worst case)}}\Big], \quad \frac{d\,\text{RC}}{d\,\mathsf{HE}} < 0.$$

In practice, curvature appears: early improvements (basic delta control) shrink CTE quickly, then gains taper; long–tenor vega/skew control is needed to approach the floor.

Drivers that move you along the spectrum.

- **Up (toward SSA):** Laddered long–tenor vega; tight gamma/delta bands near buffer/floor; basis minimization (index, dividends, funding); rules–based rehedge embedded in the model; liquidity–aware rolls.
- **Down (toward naked CTE):** Discrete strikes/tenors only (gaps), weak skew/term coverage, index/return basis mismatches, ad hoc (non–recognized) rehedging, operational frictions during stress.

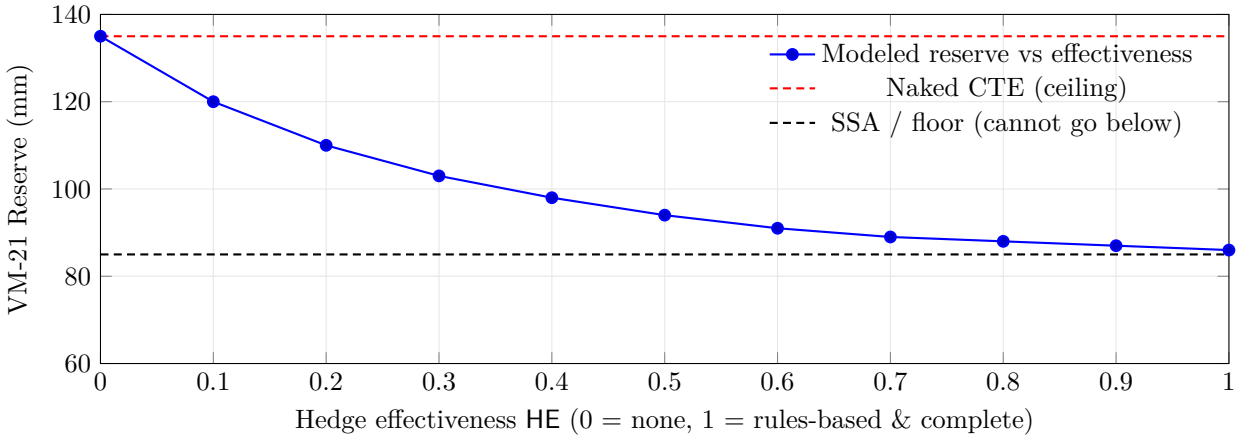

Figure 4.6: "Pendulum" of hedge effectiveness: reserves decline from the unhedged CTE ceiling toward the VM–21 floor (e.g. SSA) as the overlay becomes more complete and governance–recognizable. Gains typically exhibit diminishing returns without long–tenor vega and recognized rebalancing.

Practical read–across.

- **Design implication.** If you can only run listed 0–2y vega and coarse delta, expect a big early drop from the ceiling, then a plateau; to approach the floor you need stable long–tenor vega, skew control, and model–recognized rules.
- **Governance implication.** Reserve credit tracks what the model sees: booked positions + DUP–compliant rehedge logic. Economic hedging that isn't encoded *does not* lower reserves.
- **Communication.** Frame reserve moves as *Markets* vs *Hedge* vs *Assumptions/Floors* (see §6.4); show where current practice sits on the curve and what changes shift it leftward.

4.3.18 Clarifying Aside: Why Reserves Don't Go to Zero, Even Under Perfect Replication

Set-up (perfect replication thought experiment). Consider a buffer RILA liability that is *economically* replicable by a portfolio such as:

$$\text{Replicator} \approx \text{stock exposure} + \text{long put spread (buffer band)} + \text{short call (cap)}.$$

If this overlay is maintained perfectly (continuous rebalancing, matched strikes/tenors, no frictions), the insurer's aggregate position (liability + hedge assets) is flat in *every* market state. From a purely economic lens, one would conclude "reserve = 0" and "capital = 0."

Why VM–21 still yields positive numbers. Under VM–21, the *reported* reserve is

$$\max\{\text{CTE}_{70}, \text{SSA, other floors}\}.$$

Even if recognized hedges drove the stochastic tail low, the **Standard Scenario Amount (SSA)** functions as a *conservative floor* that typically remains *positive*. Two structural reasons keep the floor from collapsing to zero:

1. **The SSA is a liability-side deterministic recipe, not a hedge-recognition model.** It applies prescribed market shocks (e.g., an immediate equity drop and then flat), prescribes behavior assumptions, and discounts at NAER. It does *not* simulate the firm's hedge program the way the stochastic engine can.
2. **Recognition of hedging under the SSA is intentionally limited** (details below), so the SSA persists as a non-zero benchmark even when the economic replication looks exact.

"Limited how?" — dimensions of hedge recognition under the SSA. The following contrasts a *market-consistent replication* mindset with what the SSA actually credits:

Aspect	Economic replication view	SSA treatment (why credit is limited)
Projection paradigm	Jointly project *assets + liability* so hedge P&L offsets shortfalls each path	SSA is a *liability-side* deterministic runoff with prescribed shocks; it does not re-simulate firm-specific hedge policies
Hedge dynamics (rebalancing, rolls)	Continuous/periodic rebalancing earns explicit credit (delta bands, roll rules)	SSA does not model *dynamic* hedging rules; at most, it reflects static, stylized effects embedded in account mechanics
Option valuation details (vol surface, term-structure, skew)	Replicating options are valued under market-consistent vol/term; theta/vega flows recognized	SSA uses stylized equity paths (drop then flat) and simplifications; no pathwise recognition of implied vol dynamics or theta carry
Funding/discounting	Hedge cashflows discounted at risk-free / funding curve consistent with asset pricing	SSA discounts liability cashflows at *NAER* (book-yield basis), not at hedge funding; this can leave a positive PV even if hedge is "flat" economically
Behavior interaction (lapses/fees)	Hedge is sized to contract behavior; offsets realized shortfalls in all states	SSA applies *prescribed* behavior (e.g., lapses), which may be conservative versus the hedge design and produce residual shortfalls
Management actions	Documented actions (cash sweeps, reinvestment, clearing) reduce tail exposure	SSA generally ignores *management actions* beyond what's explicitly prescribed, limiting offset recognition

Table 4.3: Why hedge credit is limited under the SSA: the test is a prescribed *liability* stress, not a firm-specific hedge replication model.

Concrete intuition for a buffer RILA. Take the canonical SSA shock: an immediate equity drop (e.g., $\sim$13%) at $t = 0$, then *zero* growth thereafter, plus prescribed rate and behavior assumptions. In a true replication build, a long put spread and short call combined with delta in the separate account would offset the payoff formula across the path, including theta/vega effects. Under the SSA:

- The liability is marched forward on the *stylized* equity path; hedge rebalancing and implied-vol evolution are not modeled.
- Any immediate top-up at $t = 0$ (e.g., AV falls below the buffer floor) is *recognized* as a liability outflow, while the offsetting option gains are not explicitly modeled via a firm's hedge book.
- Future shortfalls are discounted at NAER (book yield), not at a hedge funding curve, keeping PVs positive.

Thus even if the economic replicator would *flatten* the profile, the SSA run still produces a positive number—hence the non-zero floor.

What about C–3 capital (deep tail)? C–3 for RILAs is sourced from the *stochastic* VM–21 engine (e.g., a CTE_{98} level or gap to CTE_{70}). In a theoretical, frictionless world with perfectly matched, *recognized* hedges, the tail spread could compress toward zero. In practice, prescribed assumptions (NAER discounting, behavior floors), modeling limits, and governance constraints keep a non-zero residual, so capital does not vanish.

Takeaway. *Economic replication* and *statutory solvency* are intentionally distinct. VM–21 allows hedge recognition in the *stochastic* reserve if strategies are clear and booked; however, the *Standard Scenario* remains a conservative, hedge-light floor. This design prevents "zero" statutory results even for products that look perfectly replicable in continuous-time theory.

4.4 Toy VM-21 Reserve Example (Buffer RILA)

4.4.1 Setup

We illustrate, end-to-end, how a VM-21 stochastic reserve is produced from scenario cashflows. Consider a **1-year buffer RILA** portfolio with:

- Current account value (today): $AV_0 = \$100$ mm.
- Buffer $b = 10\%$ (insurer absorbs the first 10% of losses over the year).
- Horizon $T = 1$ year; discount rate $r \approx 0\%$ for simplicity (set $DF = e^{-rT} \approx 1$).
- Reserve method: VM-21 CTE_{70} with Standard Scenario Amount (SSA) floor.

Policyholder payoff at T (buffer form). Let S_T denote the end-of-year value of the separate account (normalized to AV_0). The contract credits:

$$\text{Payoff}(S_T) = \begin{cases} S_T + b\,AV_0, & S_T < (1-b)\,AV_0 \\ AV_0, & (1-b)\,AV_0 \le S_T \le AV_0 \\ S_T, & S_T > AV_0 \end{cases}$$

Intuition: within the 10% buffer, the policyholder is held up to the buffer cap; beyond that, they track the market.

4.4.2 Scenarios and cashflows (hypothetical, 5 paths for pedagogy)

In practice firms run 10^3–10^5 scenarios; we use 5 for clarity.[2]

Scenario	$\frac{S_T}{AV_0}$	S_T (\$mm)	Payoff(S_T) (\$mm)	Top-up = max(Payoff $- S_T, 0$)	Loss_s (\$mm)
1	1.20	120	120	0	0
2	1.05	105	105	0	0
3	0.95	95	100	5	5
4	0.85	85	95	10	10
5	0.70	70	90	20	20

Table 4.4: Illustrative 1-year scenarios. The insurer's liability in each path is the "top-up" (a shortfall realization at T).

[2] More scenarios ⇒ smoother tail averages; with 5, CTE_{70} uses the worst 30% = 2 scenarios.

Discounting to valuation date. With $DF = e^{-rT} \approx 1$, present values equal the terminal top-ups. If $r \neq 0$ or there are interim cashflows, apply scenario-consistent discounting; the CTE is then taken on PV losses.

4.4.3 Compute the tail average (CTE)

Order the losses: $[0, 0, 5, 10, 20]$. For CTE_{70} with 5 paths, the worst $30\% = \lceil 0.30 \times 5 \rceil = 2$ paths:

$$\text{CTE}_{70} = \frac{10 + 20}{2} = \$15 \text{ mm}.$$

(With many scenarios N, $\text{CTE}_\alpha = \frac{1}{\lfloor (1-\alpha)N \rfloor} \sum_{\text{worst } (1-\alpha)N} \text{Loss}_s$.)

4.4.4 Apply floors and pick the reserve

VM-21 sets the reserve as the *maximum* of the modeled CTE and any prescribed floors (e.g., the Standard Scenario Amount):

$$\text{Reserve} \;=\; \max\big\{\, \text{CTE}_{70},\ \text{SSA},\ \text{other floors} \,\big\}.$$

Suppose SSA = \$12 mm. Then:

$$\boxed{\text{Modeled reserve} = \max\{15, 12\} = \$15 \text{ mm}}.$$

4.4.5 What hedges do to the same scenarios (recognition matters)

Assume the company has booked, DUP-compliant, rules-based hedges that offset part of the top-ups in stress:

$$\text{NetLoss}_s \;=\; \text{Top-up}_s \;-\; \text{HedgeGain}_s.$$

Illustrative net losses after hedging: $[0, 0, 2, 5, 9]$ (mm). Ordered: $[0, 0, 2, 5, 9]$. Worst $30\% = 2$ paths:

$$\text{CTE}_{70}^{(\text{with hedge})} = \frac{5 + 9}{2} = \$7 \text{ mm}.$$

Reserve becomes $\max\{7,\ 12\} = \boxed{\$12 \text{ mm}}$ due to the SSA floor. *Key point:* Hedges pulled the tail down, but the reserve cannot drop below the floor.

4.4.6 Why Guarantee Shortfall "explains" the numbers without being explicit

In each scenario, the *top-up* is exactly the realization of the insurer's guarantee shortfall (a shortfall-at-T view). Large top-ups in many tail paths ⇒ larger tail average ⇒ higher reserve. Hedges reduce those top-ups path-by-path (when recognized), lowering the CTE.

4.4.7 Sensitivity and governance hooks (checklist)

- **More shocky scenarios** (lower S_T mass): tail average rises ⇒ higher reserve.
- **Heavier skew/vol** (unhedged): paths 4–5 worsen ⇒ higher reserve.
- **Recognized rehedging** (VM-21 rules-based): reduces net losses in tails ⇒ lower CTE, down to SSA.
- **Non-recognized trading** (ad hoc): helps earnings but *does not* move modeled CTE.
- **Floors (SSA)**: bind when hedges are strong; explain why reserve does not go to zero even with near-perfect replication.

4.4.8 Takeaway

VM-21 reserve is the **tail average** of scenario losses (CTE) *subject to floors*. Those losses are the insurer's *top-ups* whenever guarantees exceed account value (shortfall realizations). *Recognized* hedges change the loss profile and thus the reserve; *floors* cap how low the reserve can go.

Chapter 5

Derivatives, Limits & Statutory Accounting

5.1 Derivative Use Plans (DUPs)

5.1.1 Definition and Purpose

A **Derivative Use Plan (DUP)** is the formal governance document that an insurer must maintain and have approved in order to transact in derivatives. It sets boundaries on *why* the firm may use derivatives, *which* derivatives are permissible, and *how* risks are monitored and reported. For the hedge desk, the DUP functions as the "rulebook" that defines the space within which trades may be executed.

5.1.2 Board Approval

- The DUP must be **approved by the Board of Directors** (or a designated Board Risk Committee) and typically reviewed annually.
- Approval includes sign-off that the DUP aligns with the company's overall *risk appetite*, capital framework, and statutory/regulatory obligations.
- Amendments (e.g., adding new permissible instruments) must follow formal escalation and re-approval processes.

5.1.3 Scope

The DUP clearly articulates:

- **Permissible purposes:** hedging, replication, income generation; pure speculation is prohibited.
- **Permissible instruments:** listed futures and options, cleared or OTC swaps, forwards, swaptions, collars, exotic structures (if allowed).
- **Underlying references:** equity indices, interest rates, credit, FX (per company's product mix).
- **Concentration limits:** position sizes, tenor bands, counterparty diversification.
- **Collateralization rules:** CSA standards, clearing requirements, margining policies.

5.1.4 Monitoring

DUP compliance requires robust monitoring and reporting:

- Daily or weekly checks that positions remain within purpose, type, size, tenor, and counterparty limits.

- Greeks and stress ladders reported against DUP tolerances.
- Independent risk management verification and variance reporting to ALCO.
- Tie-outs from trade blotter → ledger → Schedule DB to ensure regulatory consistency.

5.1.5 Exception Handling

- Exceptions (e.g., exceeding counterparty limit, temporarily holding non-permitted derivative due to unwind timing) must be documented.
- Root cause, remediation plan, and proposed sunset date are recorded.
- Escalation path: front office → risk management → ALCO → Board if material.
- Waivers require ALCO sign-off and are tracked for audit.

5.1.6 What Auditors Look For

Auditors (internal and external) typically focus on:

- **Board governance:** Evidence of annual DUP approval and any amendments logged.
- **Trade consistency:** Random trade samples tested against DUP permissions (purpose, instrument, counterparty).
- **Reporting:** Verification that DUP-related metrics flow into ALCO/Board packs and match statutory disclosures.
- **Exceptions:** Exception logs complete, timely, and closed out with Board-approved remediations.
- **Documentation:** Version control of the DUP itself, and evidence that all users reference the current approved version.

Key Takeaway

The DUP is both a *regulatory requirement* and a *practical operating constraint* for hedge desks. It governs what can be traded, how exposures are monitored, and how exceptions are handled. Auditors test adherence rigorously, making DUP alignment a non-negotiable part of daily risk management.

Legend: Solid arrows = standard process flow. Dashed arrows = feedback or approved exception return to execution.

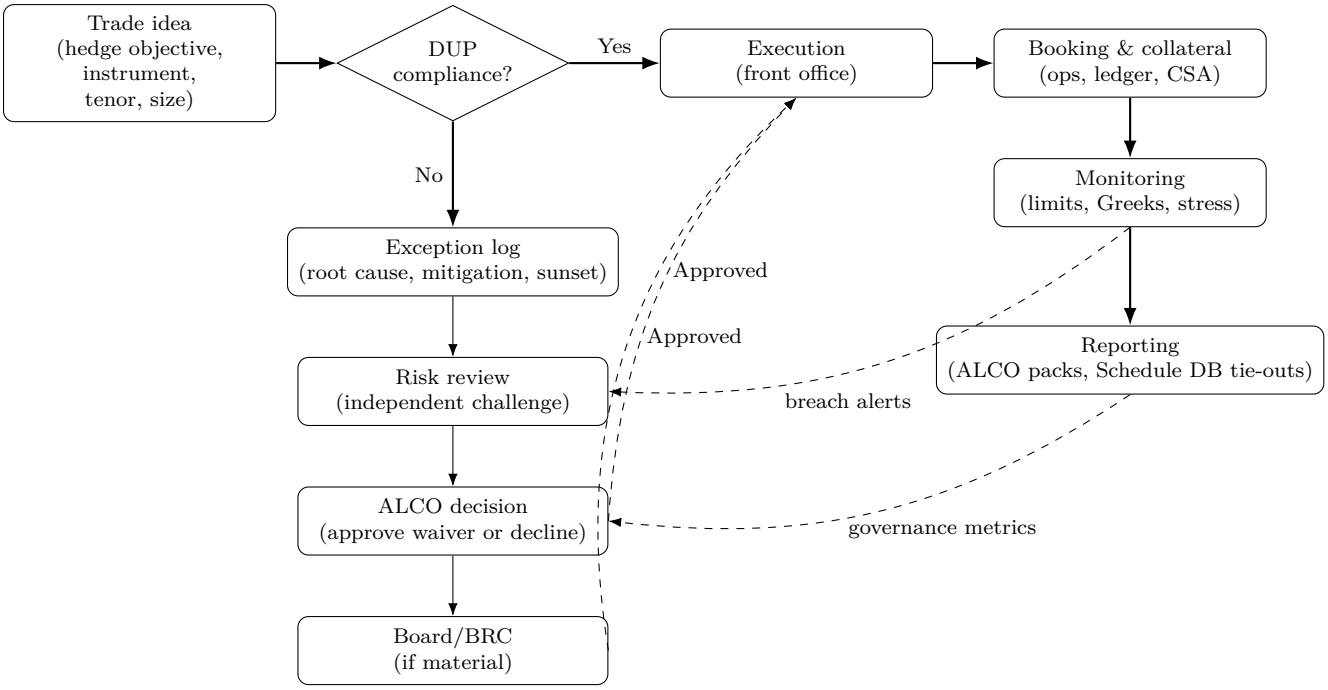

Figure 5.1: DUP-controlled hedge workflow: ideas are checked against the DUP, executed if compliant, and monitored and reported through to ALCO. Noncompliant ideas follow an exception path with risk review and ALCO approval before execution.

5.2 Permissible instruments & limits

5.2.1 Instrument set (hedger's toolkit)

Within an approved DUP, the following instruments are typically permissible for RILA/FIA hedging. Purpose tags (hedge / replication / income) must match DUP language.

Listed options (index calls/puts, spreads).

- **Use:** Replicate caps (call spreads), buffers/floors (put spreads), tail hedges.
- **Pros:** Exchange liquidity, transparent pricing, central clearing ⇒ minimal counterparty credit risk.
- **Cons:** Discrete strikes/tenors; slippage on term/strike granularity; roll logistics.
- **Common limits:** Max notional per tenor bucket; max open interest share; max net long gamma; max short vega.

Equity index futures.

- **Use:** Coarse delta maintenance between option re-hedges; intraday adjustments near cap/buffer boundaries.
- **Pros:** Highly liquid; standard margins; easy intraday sizing.
- **Cons:** Basis to total-return index (dividends, funding); roll calendar exposure.
- **Common limits:** Max futures notional vs. AUM; max tenor concentration; roll window policies.

OTC options (vanillas, digitals, barriers as allowed).

- **Use:** Better fit to product features (e.g., digital-like buffer strikes, long tenors, bespoke calendars).
- **Pros:** Customization (strike, tenor, calendar, underlyer); potentially tighter replication error.
- **Cons:** Counterparty credit risk; collateral costs; model risk on exotics; documentation overhead.
- **Common limits:** Approved payoffs list; min strike distance; max vega per counterparty; WWR screens.

Swaps/variance products (if permitted).

- **Use:** Vega ladders (variance swaps), funding/total-return overlays.
- **Pros:** Efficient vega term exposure; fewer strikes to manage.
- **Cons:** Model/settlement conventions; collateral/funding sensitivity; liquidity episodic in stress.
- **Common limits:** Max variance notional per tenor; settlement conventions (realized vs conditional); approved underlyers.

Replication notes/structured notes (select cases).

- **Use:** Package of options/futures embedded in a note for operational simplicity.
- **Pros:** Operationally simple booking; embedded netting.
- **Cons:** Issuer credit risk; opacity of embedded costs; less flexibility to adjust legs.
- **Common limits:** Issuer rating floor; max tenor; concentration caps by issuer.

5.2.2 Cleared vs. bilateral execution

Cleared (exchanges/CCPs).

- **Risk:** CCP novation materially reduces counterparty credit risk; IM/VM via clearinghouse models (e.g., SPAN/VaR).
- **Ops:** Standardized margin calls; default management by CCP; portability of positions.
- **Trade-offs:** Less customization (discrete strikes/tenors); potential liquidity gaps in long tenors.

Bilateral (ISDA/CSA).

- **Risk:** Exposure managed via CSA thresholds, eligible collateral, haircuts, independent amounts; netting by agreement & underlyer.
- **Ops:** Daily VM; potential IM under uncleared margin rules; disputes management; rehypothecation terms matter for funding.
- **Trade-offs:** Flexibility in payoff design/tenor vs. higher governance load (C-1 counterparty capital, collateral frictions).

5.2.3 Counterparty & concentration limits

- **Counterparty rating floor:** e.g., A- or better; downgrade triggers for new trades/close-out planning.
- **Exposure ladders:** Max PFE/EE per counterparty by tenor bucket (e.g., 0–2y, 2–5y, 5y+); tighter limits for lower ratings.
- **Netting sets:** Define by underlyer/family; align with ISDA schedules to maximize legal netting recognition.
- **Wrong-way risk (WWR):** Prohibit or cap trades where counterparty credit correlates with underlyer (e.g., bank equity vs. bank counterparty).
- **Issuer & product concentration:** Caps by single issuer, by instrument type, and by underlyer/index family to avoid crowded tails.
- **Liquidity bands:** Stricter limits for illiquid strikes/tenors; minimum daily ADV and open-interest thresholds for listed.

5.2.4 Collateral & CSA norms (bilateral & cleared)

- **Eligible collateral:** Cash, U.S. Treasuries, high-grade corporates (per CSA); haircuts by asset class/tenor.
- **Thresholds & MTA:** Low thresholds (≈ 0) minimize unsecured exposure; MTA set to reduce operational noise.
- **IM/VM:** Independent Margin for uncleared trades per regulatory regime; daily VM in cash USD unless otherwise negotiated.
- **Interest on collateral:** Benchmark indices (e.g., SOFR) for cash collateral interest; specify in CSA.
- **Rehypothecation:** Permit/forbid per policy; consider liquidity and funding implications; align with DUP.
- **Dispute resolution:** Time-bound processes; third-party prices; escalation paths to avoid stale margin disputes.

5.2.5 Illustrative limit grid (example)

Instrument	Tenor	Per-CP Limit	Firm Limit	Venue	Notes
Index futures	$\leq$ 1y	20% AUM	50% AUM	Cleared	Roll window 5d; basis checks
Listed calls/puts	$\leq$ 3y	\$X vega	\$3X vega	Cleared	Min OI/ADV; strike clustering rules
OTC vanillas	$\leq$ 7y	\$Y vega	\$2Y vega	Bilateral	A- floor; CSA zero-threshold
OTC digitals	$\leq$ 5y	\$Z vega	\$Z vega	Bilateral	Only on approved indices
Variance swaps	$\leq$ 3y	\$W vega	\$1.5W vega	Bilat/Clr	Realized conv.; monthly settles

All values illustrative; align actual numbers with risk appetite & DUP. Vega caps aggregate across netting sets; tighter caps apply to illiquid strikes or stressed regimes.

5.2.6 Operational guardrails

- **Purpose tagging:** Every trade tagged hedge/replication/income; monitor mix against DUP.
- **Tenor laddering:** Avoid cliff risk; distribute vega across maturities aligned to reserve/capital horizons.
- **Underlyer alignment:** Match hedge underlyer to crediting index (total return vs. price return; divisor consistency).

- **Roll policies:** Pre-defined roll calendars; max slippage budget; no ad hoc date drift without approval.
- **Stress & liquidity tests:** Pre-trade impact on Greeks/tails and exit capacity; respect bid-ask and OI constraints.
- **Breach handling:** Auto-alerts; same-day plan; ALCO escalation for material breaches; documented sunset dates.

Key Takeaway

Permissible instruments & limits balance *replication accuracy* against *credit/liquidity/funding risks*. Cleared listed flow provides scalable delta/gamma control; bilateral OTC adds fit for buffers/floors but requires tight CSA, counterparty, and concentration governance.

5.3 Booking & Reporting

5.3.1 Overview

This section summarizes *statutory* booking for common hedge instruments, the derivative disclosure in Schedule DB, notes on AVR/IMR interactions, and the key differences between **general account** (FIA) and **separate account** (RILA) booking. The aim is a clean tie-out from front-office trades to statutory financials and regulator-facing schedules.

5.3.2 SSAP-style treatment (hedger's cut)

Statutory accounting for derivatives follows the NAIC *Statutory Statements of Accounting Principles* (SSAP). While specifics depend on instrument and designation, the working rules for hedge desks are:

- **Measurement:** Derivatives are recorded at *fair value*.
- **Income recognition:**
  - *Hedging use:* If a position qualifies for hedge accounting under SSAP guidance (documentation, effectiveness, designation), changes in fair value are recognized in a manner consistent with the hedged risk/item (pattern depends on designation).
  - *Non-hedging use (e.g., income generation):* Changes in fair value flow through statutory net income when recognized (subject to SSAP treatment for the instrument).
- **Documentation:** Hedge designation, risk being hedged, method for assessing effectiveness, and prospective/retrospective testing criteria must be in place *at inception* and maintained. This ties directly to DUP purpose tags.
- **Collateral & margin:** Variation margin on cleared trades is typically treated as settlement of current exposure; bilateral CSAs require balance sheet recognition of collateral receivable/payable per SSAP.
- **Embedded vs. stand-alone:** Embedded derivatives within host contracts follow bifurcation rules; stand-alone hedges book to derivative accounts and disclose on Schedule DB.

5.3.3 Schedule DB mapping (what lands where)

Schedule DB is the statutory *derivatives* schedule. It discloses, by instrument and purpose, details such as notional, fair value, maturities, counterparties/clearing status, and hedge purpose.

- **By instrument type:** options (calls/puts, caps/floors), futures, forwards, swaps (including variance/total-return where applicable).
- **By purpose tag:** hedging vs replication vs income generation (must match DUP).

- **By counterparty/venue:** cleared vs bilateral; CCP name; ISDA/CSA in place; credit ratings and exposure by netting set.
- **Key tie-outs:** Trade blotter → middle-office position reports → ledger balances → Schedule DB totals (by instrument, purpose, and counterparty). Differences are explained via reconciling items (e.g., timing, FX).

Instrument	Primary SSAP lens	Schedule DB disclosure focus
Listed options	Fair value; hedge vs non-hedge income	By series/expiry; purpose; fair value; delta/vega (if required)
Futures	Daily VM settlements; off-balance exposure	By contract; CCP; notional; open/closed positions
OTC options	Fair value; hedge designation docs	Counterparty; CSA terms; notional; fair value; maturities
Swaps/TRS/Var	Fair value; accruals per contract terms	Underlyer; reset terms; collateral; counterparty exposure
Forwards	Fair value; delivery vs NDF terms	Underlyer; settlement basis; tenor buckets

Table 5.1: High-level mapping: accounting treatment and Schedule DB emphasis by instrument.

5.3.4 AVR/IMR notes (what matters and what does not)

- **AVR (Asset Valuation Reserve):** A reserve for long-term asset value fluctuation, primarily relevant to invested assets (e.g., bonds, equities). Stand-alone derivative MTM changes generally do *not* flow to AVR; they affect statutory income/surplus per SSAP derivative guidance.
- **IMR (Interest Maintenance Reserve):** Defers certain *realized* gains/losses on fixed-income assets attributable to interest rate movements. Derivative gains/losses typically do *not* enter IMR directly; however, when hedges are accounted for under hedge accounting linked to fixed-income items, overall earnings patterns may align with the hedged item's recognition.
- **Hedge reality check:** Even with hedge accounting, do not assume derivative results will be re-routed to AVR/IMR: treatment follows the specific SSAP designation and hedge documentation rather than a blanket rule.

5.3.5 Separate vs general account booking (RILA vs FIA)

- **General account (FIA):**
  - All assets/derivatives booked on the insurer's balance sheet; gains/losses flow to statutory income (subject to SSAP and hedge designation).
  - Reserves are deterministic (SNFL/SVL); hedge MTM does not alter the reserve formula.
  - Schedule DB reports derivative positions used to support FIA crediting and surplus management; counterparty exposure contributes to C-1 capital.
- **Separate account (RILA):**
  - Assets and liabilities recorded in the separate account statements (subject to state law); permitted derivatives may be booked in the separate account where allowed, or in the general account with inter-account arrangements.
  - VM-21 stochastic reserves (on the company statement) *explicitly* reflect hedge positions and rules-based rebalancing, so booking data must reconcile to the VM-21 model's positions and cash flows.
  - Schedule DB still discloses derivative positions regardless of account location; tie-outs must be consistent with both separate account reporting and company statements.

5.3.6 Close & tie-out checklist (practical)

- **Designation & docs:** Hedge purpose, risk, effectiveness method *at inception*; re-paper any strategy changes; align with DUP language.
- **Positions & valuations:** End-of-period positions reconcile to pricing sources; collateral balances tie to CSA/clearing statements; FX translation consistent.
- **Ledger ↔ Schedule DB:** Instrument-level rollforwards (open, adds, closes, expiries) and fair value changes reconcile; exceptions logged and explained.
- **VM-21/SNFL interface:** For RILAs, the modeled hedge book (positions, cash flows, rebal rules) matches the booked positions; for FIAs, confirm reserves are per formula and P&L attribution bridges earnings to hedge drivers.
- **AVR/IMR sanity:** Confirm derivative activity is not inadvertently routed to AVR/IMR unless dictated by SSAP designation; document rationale in the close pack.

Key Takeaway

For hedge desks, *booking discipline* is as critical as trade selection: SSAP rules govern income recognition; Schedule DB makes the derivative book transparent to regulators; AVR/IMR largely pertain to fixed-income assets; and separate vs general account booking determines whether hedges are recognized in VM-21 (RILAs) or flow only through earnings (FIAs).

5.4 Counterparty Risk Management

5.4.1 Why it matters (hedger's cut)

Derivative replication pushes RILA/FIA risk out of market-only space and into **counterparty credit** space. NAIC designations drive capital, CSAs drive collateral frictions, and exposure ladders keep concentrations sane. This section summarizes ratings/designations, how to size & monitor exposure, and how to avoid wrong-way traps.

5.4.2 NAIC ratings & designations (stat lens)

- **External ratings:** S&P/Moody's/Fitch long-term ratings provide the primary credit signal (e.g., A-/A3 and better as a common floor in DUPs).
- **NAIC designations:** For invested assets, the NAIC 1–6 scale maps to capital factors. For derivatives, *counterparty exposure* contributes to C-1 charges; many firms map rating categories to internal *credit buckets* with limit tiers.
- **Triggers & actions:** Define rating-downgrade triggers (e.g., loss of A-): freeze new trades, reduce tenors, raise IM/IA, accelerate novation/clearing.

5.4.3 Exposure metrics & ladders

Key measures.

- **Current Exposure (CE)**: positive replacement cost today after netting and collateral.
- **Expected Exposure (EE)**: time profile of expected positive exposure.
- **Potential Future Exposure (PFE$_q$)**: high-quantile exposure at horizon t (e.g., 95% at 1y).
- **Wrong-Way Risk (WWR) add-on**: extra conservative uplift where exposure co-moves with CP credit.

Aggregation.

$$\text{AggExposure} = \sum_{\text{netting sets } n} w_n \cdot \max\big(\text{CE}_n,\ \text{PFE}_{q,n}\big) \ +\ \text{WWR add-on},$$

where w_n can reflect tenor/liquidity weights; aggregation is done *per legal netting set* (consistent with ISDA/CSA schedules) and then summed at the counterparty and firm levels.

Limit ladders (illustrative).

Rating	0–2y	2–5y	>5y	Per-CP Max	Notes
AA-/Aa3+	\$X	\$1.5X	\$2X	\$3X	Cleared preference beyond 5y
A/A2	\$0.8X	\$X	\$1.2X	\$2X	CSA zero-threshold; IM add-on
BBB+/Baa1	\$0.4X	\$0.5X	\$0.6X	\$1X	New trades limited; shorten tenor
Below BBB+	No new bilateral exposure				Unwind/novate plan

Set X to fit risk appetite; apply tighter caps for illiquid underlyers or exotic payoffs.

5.4.4 CSA/margin norms that actually reduce exposure

- **Zero thresholds & low MTA:** Minimize unsecured CE; set MTA just high enough to avoid operational noise.
- **Eligible collateral & haircuts:** Prefer cash/UST; pre-agree haircuts and settlement timelines.
- **Independent Amount (IA)/IM:** Use as rating-contingent buffer; step-ups on downgrade.
- **Daily VM in cash USD:** Reduce FX/settlement risk; align collateral rate (SOFR) with valuation.
- **Netting set hygiene:** Consolidate trades under a single ISDA/CSA per underlyer family to maximize legal netting recognition.
- **Clearing first:** Use CCPs where feasible (listed options/futures, clearable swaps) to replace bilateral C-1 with CCP risk.

5.4.5 Wrong-way risk (WWR) notes

- **Specific WWR:** Counterparty's credit linked to the underlyer (e.g., bank equity vs that bank as CP). Avoid or cap, require extra IM, shorten tenors, or switch venue (cleared/listed).
- **General WWR:** Macro stress increases both exposure and CP default risk (e.g., equity crash ⇒ put MTM up while bank credit widens). Capture with add-on factors in PFE and with stress tests.
- **Stress ladders:** Include combined shocks (equity −30%, vol +15 vols, credit spreads +200 bps) and check breach paths for each counterparty; pre-wire novation/unwind playbooks.
- **Collateral liquidity WWR:** Avoid taking CP's own securities; prefer cash/UST to break WWR loops.

5.4.6 Concentration management

- **Single-name caps:** Per-CP limits by tenor and instrument; lower caps for exotics/illiquid strikes.
- **Issuer/sector caps:** Avoid all exposure concentrated in one dealer group or sector.
- **Underlyer caps:** Index family and strike/tenor clustering caps to limit gap risk during stress.
- **Roll/expiry calendars:** Stagger maturities to avoid large same-day collateral/close-out flows.

5.4.7 Governance & documentation

- **DUP alignment:** Counterparty rating floors, concentration caps, and WWR prohibitions live in the DUP; trade tagging must match.
- **Downgrade playbooks:** Pre-approved actions (halt new trades, cut tenors, increase IM, novate/clear).
- **Audit trail:** Exposure reports (CE/PFE), limit utilization, exceptions with root-cause and sunset, reconciled to collateral calls.
- **Schedule DB tie-outs:** Counterparty exposure by netting set aligns with statutory disclosure; collateral balances reconcile to CSAs/CCPs.

Key Takeaway

Counterparty risk for RILA/FIA hedging is managed with *ratings/designations, CSAs, and ladders*: keep unsecured exposure near zero, diversify and cap concentrations, penalize WWR, and prefer cleared execution where possible. Limits and playbooks should be explicit in the DUP and exercised in stress.

Chapter 6

Program Design & Daily Operations

6.1 Objectives, budgets, and tolerances

6.1.1 What the desk is optimizing (at a glance)

Hedge programs are calibrated to **financial statement stability** and **risk appetite**, not to zeroing every Greek.

- **FIAs (fixed annuities):** Primary objective is *statutory earnings stability* under SNFL/SVL formulas. Reserves are deterministic; hedges smooth earnings and protect surplus.
- **RILAs (variable annuities):** Primary objective is *reserve/capital stability* under VM-21. Hedges explicitly reduce CTE tails; KPI focus is on ΔCTE and required capital.

6.1.2 Targets & bands (define success ex-ante)

Let M denote the primary metric:

$$M = \begin{cases} \text{Std. dev. of quarterly statutory earnings} & \text{(FIA)}, \\ \Delta\text{CTE}_{70} \text{ (per defined stress ladder)} & \text{(RILA)}. \end{cases}$$

Set acceptable bands:

$$M \in [M_{\min},\, M_{\max}] \quad \text{with breach/escalation rules.}$$

Illustrative KPI bands.

Product	Primary KPI	Green band	Yellow/Red
FIA	Earnings vol (mm/qtr)	≤ 5	>5 (yellow), >8 (red)
RILA	ΔCTE_{70} (mm, 1d stress)	≤ 3	>3 (yellow), >6 (red)

Tune to your firm; add secondary bands for delta/vega utilization.

6.1.3 Hedge budget (option spend and risk capacity)

Budget links product pricing to risk mitigation.

- **Option premium budget:** Annual envelope B_{prem} for listed/OTC options (by tenor buckets).
- **Vega capacity:** Limit on net long/short vega per tenor bucket to avoid concentration.
- **Liquidity budget:** Expected turnover costs (bid–ask, rolls) and intraday futures slippage.

Budget allocation rule-of-thumb. Distribute by horizon to align with KPI sensitivity:

$$B_{\text{prem}}^{(1\text{y})} : B_{\text{prem}}^{(2\text{–}3\text{y})} : B_{\text{prem}}^{(4\text{–}6\text{y})} \approx \begin{cases} 50{:}35{:}15 & \text{FIA (earnings focus),} \\ 30{:}40{:}30 & \text{RILA (tail/CTE focus).} \end{cases}$$

Interpretation: RILAs emphasize longer-tenor vega ladders to stabilize tails; FIAs bias to 0–2y where earnings volatility lives.

6.1.4 Operational tolerances (Greeks and stress)

Define tolerances that translate KPI bands into day-to-day limits.

- **Delta band:** $|\Delta| \le \Delta_{\max}$ at book and index-family level.
- **Gamma hot-zone guard:** tighter $|\Delta|$ near cap/buffer/floor kinks; intraday futures allowed.
- **Vega ladder:** $|V| \le V_{\max}^{(t)}$ per tenor $t \in \{1\text{y}, 2\text{–}3\text{y}, 4\text{–}6\text{y}\}$.
- **Stress ladder:** 1d/10d shocks (level, vol, skew) mapped to expected ΔCTE (RILAs) or earnings (FIAs); must remain within yellow band ex-ante.

6.1.5 Rebalancing triggers (when to trade)

Scheduled vs event-driven.

- **Scheduled:** Daily delta check; weekly vega/tenor check; monthly option rolls.
- **Event-driven:** Trade when any of the following trip:
  - $|\Delta| > \Delta_{\text{trig}}$ or $|\Delta|$ change $> \delta_{\text{intra}}$ within a day.
  - $|V^{(t)}| > V_{\text{trig}}^{(t)}$ for any tenor bucket.
  - ΔCTE (RILAs) or earnings-at-risk (FIAs) exceeds yellow band under the stress ladder.
  - Index level enters *gamma hot-zone* around strikes/caps: $|\text{Index} - K| < z\sigma$ window.

Example trigger grid (illustrative).

Control	Green	Yellow (trade within 1d)	Red (trade intraday)
Book $\|\Delta\|$	$\le 0.2\%$ AUM	0.2–0.4% AUM	$> 0.4\%$ AUM
Tenor $\|V^{(1\text{y})}\|$	$\le$ V1	V1–1.5V1	$>$ 1.5V1
Tenor $\|V^{(4\text{–}6\text{y})}\|$	$\le$ V3	V3–1.2V3	$>$ 1.2V3
ΔCTE_{70} (RILA, 1d stress)	$\le$ 3mm	3–6mm	$>$ 6mm
Earnings-at-risk (FIA, 1d stress)	$\le$ 4mm	4–7mm	$>$ 7mm

Set V1, V3 to internal vega caps; calibrate mm thresholds to appetite.

6.1.6 Budget-aware trading logic (practical sketch)

1. **Pre-trade:** Compute impact on Δ, $V^{(t)}$, stress ladder, and budget usage (% B_{prem}).
2. **Choose venue:** Futures for intraday Δ; listed options for liquid strikes; OTC only for structural fit (buffers/floors) within CSA/WWR guardrails.
3. **Tenor allocation:** If ΔCTE (RILA) too high, add longer-tenor vega first; if earnings (FIA) noisy, add 0–2y vega and tighten gamma near kinks. 4
4. **Post-trade:** Update budget tracker; log purpose per DUP; record expected KPI improvement.

6.1.7 Governance hooks

- **ALCO-approved bands:** All thresholds/budgets above live in the limits appendix and are reviewed at least annually.
- **Exception protocol:** Breaches require same-day plan, root cause, and sunset; material items to ALCO.
- **Attribution pack:** Monthly table decomposing KPI moves into *Markets / Hedge actions / Assumptions / Other* (see §4.1).

Key Takeaway

Define *what* you are stabilizing (earnings vs CTE/capital), set *bands* that make that objective operational, fund a *hedge budget* that matches the horizon of the risk, and act on *clear triggers* (especially near gamma hot-zones and long-tenor vega gaps). Document, attribute, and iterate via ALCO.

6.2 Data, models, and controls

6.2.1 Surface construction (equity/vol inputs)

Accurate option surfaces are the backbone of hedge replication and statutory recognition under VM-21.

- **Market data sources:** Consolidated feeds for listed (CBOE, CME) and OTC quotes. Apply filters for stale/bad ticks; maintain backups (e.g., composite vs broker).
- **Smile/skew fitting:** Use arbitrage-free spline/SVI/SABR methods to fit implied volatilities across strikes/tenors. Ensure no butterfly/calendar arbitrage remains.
- **Surface extrapolation:** Define rules for deep OTM strikes and long tenors; avoid extrapolation artifacts that overstate tails.
- **Lock policies:** VM-21 requires as-of-date locks; hedge desk typically locks daily at market close with governance stamps.

6.2.2 Dividends and borrow costs

- **Equity index dividends:** Forward pricing uses implied dividend yields. Monitor dividend futures curves for consistency with broker estimates.
- **Borrow costs (repo/stock loan):** Funding differentials drive option forward levels. Explicitly model equity index borrow rates to avoid systematic delta bias.
- **Hedge-book implication:** Mis-estimated dividends/borrows distort Δ hedge sizing, leading to chronic slippage between hedge P&L and liability behavior.

6.2.3 Calibration hygiene

- **Curve building:** Construct risk-free discount curves (SOFR, OIS) using market-standard bootstraps; document sources, interpolation, and extrapolation.
- **Vol surface fit checks:** Daily error metrics vs mid quotes; log residuals; escalate if fit error exceeds tolerance (e.g., < 1 vol point for liquid strikes).
- **Stress ladders:** Ensure shocks (level, skew, term) are applied consistently across surfaces; test shock propagation against known option ladder P&L.
- **Backtesting:** Periodic revaluation of historical trades under archived surfaces to confirm hedge model consistency with realized outcomes.

6.2.4 Model governance ties

- **Documentation:** Models used for hedging (surface fitters, Greeks calculators, scenario generators) must have model documentation consistent with the firm's model risk policy.
- **Validation:** Independent review of assumptions, calibration methods, and backtests. Regular re-validation cycle (e.g., annual).
- **Change control:** Any change in data sources, calibration method, or model code requires documented approval. Tie to model inventory and governance logs.
- **Alignment with statutory models:** VM-21 stochastic engines must use surfaces consistent with hedge desk inputs. Reconcile trading surfaces to actuarial surfaces at each lock date.
- **Auditability:** Maintain archives of daily surfaces, dividend/borrow curves, calibration reports, and governance approvals for traceability.

Key Takeaway

Daily hedge programs stand or fall on the quality of market surfaces and their governance. *Surface fit* → *dividend/borrow inputs* → *calibration discipline* → *model governance* is the chain that ties hedge P&L to statutory recognition. Failures at any link (bad data, sloppy extrapolation, undocumented model changes) can create both economic slippage and governance breaches.

6.3 Rebalancing & Exceptions

6.3.1 Why rebalancing matters

Rebalancing ensures hedge alignment with liability sensitivities through time and under stress. Without disciplined rebalancing rules, programs either *drift* into unmanaged exposures or *over-trade* and waste budget. Exceptions provide the governance buffer when limits are breached but not immediately correctable.

6.3.2 Rebalancing Policies under VM-21

> **Key point:** VM-21 allows hedge rebalancing to reduce stochastic reserves only if it is modeled as a *clearly defined, rules-based strategy.* Ad hoc or discretionary decisions do not qualify for reserve credit.

Recognized (reserve-reducing) policies.

- **Delta/gamma bands:** Explicit rule such as "rebalance S&P futures when net delta drifts more than 10% of NAER exposure." Frequency and sizing are encoded.
- **Option roll schedules:** Pre-defined laddering (e.g., roll one-third of 3-year vega each year at expiry).
- **Cashflow reinvestment:** If codified, e.g., "All hedge-related excess cash is reinvested monthly into investment-grade corporates at benchmark spreads, with 5-year duration." Because it is deterministic and repeatable, it can be included in VM-21 runs.
- **Collateral policy:** Rules for CSA/clearing collateral flows, if modeled explicitly.

Not recognized (economic only).

- **Manager discretion:** "Treasury will decide where to invest hedge cashflows based on current views." Cannot be reflected.
- **Opportunistic trades:** Ad hoc purchases/sales of options when spreads look attractive are outside rules-based definitions.

- **Non-documented practices:** Even if a team consistently reinvests in credit, if it is not written into the Derivative Use Plan (DUP) or hedge manual, it is treated as unrecognized.

Why it matters.

- **With recognition:** Hedge cashflows stay invested per rule, dampening tail losses; reserve requirement (CTE) is lower.
- **Without recognition:** Model assumes cash sits idle; tail scenarios show higher losses; reserve is higher.

Policy type	VM-21 recognition	Reserve effect
Delta bands, option rolls	Yes (rules-based)	Lowers reserve (CTE tail dampened)
Cash reinvestment (codified)	Yes	Lowers reserve
Cash reinvestment (ad hoc)	No	No reserve credit
Opportunistic hedging	No	No reserve credit

6.3.3 Greek- and stress-based triggers

Delta.

- Daily delta checks against book- and index-level tolerances.
- Intraday futures scalping permitted when $|\Delta|$ breaches intraday thresholds (e.g., >0.4% AUM).
- Tighter bands in gamma hot zones near cap/floor/buffer strikes.

Gamma.

- Explicit gamma bands around option expiry and ratchet dates.
- Higher-frequency rebalancing allowed during event windows (e.g., roll weeks).

Vega.

- Vega ladders checked weekly; deviations beyond tenor caps trigger OTC rolls or new vega ladders.
- Skew/term vega monitored in stress ladders; rebalancing if exposures exceed yellow band (e.g., >1.2x tenor cap).

Stress ladders.

- Pre-defined shocks (equity ±20%, vol ±15 vols, rates ±100bps).
- Metrics: change in CTE (RILAs) or earnings-at-risk (FIAs).
- Trade required when any stress metric breaches the yellow band, escalation when red band breached.

6.3.4 Exception logs

When tolerances are breached but trades are delayed (e.g., liquidity, market holiday), exceptions must be logged.

- **Contents:** Date/time, breach type, metric value vs limit, root cause, remediation plan, expected sunset date.
- **Approval:** Front office documents breach; risk management validates; ALCO reviews material breaches.
- **Sunset discipline:** Exceptions expire within set horizon (e.g., 5 business days) or require re-approval.
- **Audit trail:** Logs retained for internal/external audit; reconciled against DUP purpose and ALCO reporting.

6.3.5 Blackout periods

Certain periods restrict trading even if tolerances are breached.

- **Corporate events:** Earnings releases, Board meetings, regulatory filing dates may impose temporary no-trade windows.
- **Operational outages:** Market data or pricing system failures trigger conservative freezes until remediation; exceptions logged.
- **Holiday/illiquidity windows:** Known low-liquidity periods (e.g., late Dec, summer Fridays) may require pre-hedging and suppressed trading.
- **Escalation path:** Breach during blackout → log exception → risk review → ALCO sign-off. Hedge desk maintains documented playbook.

6.3.6 Governance ties

- **DUP alignment:** Rebalancing rules must match DUP language on permissible rebalancing (e.g., rules-based, not ad hoc).
- **ALCO reporting:** Monthly breach/exception summary with KPI impact.
- **Audit readiness:** Logs, stress ladders, and blackout rules subject to sample testing by auditors.

Key Takeaway

Rebalancing is rules-based: Greeks and stress ladders dictate when to trade; exceptions and blackouts provide governance flexibility. Documented logs and escalation paths convert what could be compliance risk into an auditable process.

6.4 Effectiveness & Attribution

6.4.1 What "effective" means for FIAs vs RILAs

Effectiveness is judged against *statutory* objectives, not pure economic P&L.

- **RILAs (VM-21):** Primary metric is the change in tail risk ΔCTE (e.g., CTE_{70}) under approved scenarios and floors. A hedge program is *effective* if it dampens the tail average, keeps reserve/capital within bands, and moves predictably with market shocks.
- **FIAs (SVL/SNFL):** Primary metric is *earnings volatility* and surplus protection, since reserves are deterministic. A program is *effective* if it reduces earnings-at-risk under stress and explains statutory income with small unexplained residuals.

6.4.2 CTE move explained (RILA pack staple)

Let L_s be per-scenario loss and $\mathcal{T}$ the tail set for CTE_α. We attribute quarter-over-quarter change into four mutually exclusive buckets:

$$\Delta\mathrm{CTE}_\alpha = \underbrace{\Delta_{\mathrm{Markets}}}_{\text{levels/vol/skew}} + \underbrace{\Delta_{\mathrm{Hedges}}}_{\text{new/rolled positions, rebalancing}} + \underbrace{\Delta_{\mathrm{Assump}}}_{\text{lapse/fees/rehedge policy}} + \underbrace{\Delta_{\mathrm{Other}}}_{\text{mix/floors/rounding}}.$$

Computation protocol (governance-friendly).

1. *Markets-only*: revalue prior-quarter liability & prior-quarter hedge under current curves/vols.
2. *Add Hedge Actions*: layer trades executed this quarter (rolls, ladders, delta trims).
3. *Apply Assumptions*: update lapses/fees/rehedge rules per approved change control.
4. *Residual*: whatever remains (mix, floors, rounding) is Δ_{Other}.

This sequence yields additive, audit-ready attribution that ties to trade blotter and model change logs.

6.4.3 Hedge P&L decomposition (desk economics)

Daily/weekly hedge P&L supports (but is distinct from) statutory metrics. A standard decomposition is:

$$\mathrm{dP\&L} \approx \underbrace{\Delta\,\mathrm{d}S}_{\text{delta}} + \underbrace{\tfrac{1}{2}\Gamma\,(\mathrm{d}S)^2}_{\text{gamma}} + \underbrace{V\,\mathrm{d}\sigma}_{\text{vega}} + \underbrace{\mathrm{Carry/Roll}}_{\text{theta, term}} + \underbrace{\mathrm{Funding/Collateral}}_{\text{SOFR, IA/IM}} + \underbrace{\mathrm{Dividends}}_{\text{index vs TR}} + \underbrace{\mathrm{Basis/Slippage/Tx}}_{\text{execution \& residual}}.$$

Templates (what to show).

- **Greeks ladder:** by index family and tenor (1y, 2–3y, 4–6y).
- **P&L bridge:** open → delta → gamma → vega → carry/funding/dividends → transaction costs → close.
- **Residual check:** residual < threshold (e.g., 5–10% of total) with commentary.

6.4.4 Monthly "why" pack (one-pager structure)

1. **Executive dashboard:** KPI bands (RILA: ΔCTE, RC; FIA: earnings vol), traffic lights vs limits.
2. **CTE/Earnings attribution:** Markets / Hedges / Assumptions / Other table with sign-consistent commentary.
3. **Greeks & stress:** book $|\Delta|$, $|V^{(t)}|$ vs caps; stress ladder outputs (1d/10d).
4. **Hedge actions log:** rolls, ladders, rebalances; expected vs realized KPI impact.
5. **Budget & liquidity:** option spend vs envelope, futures turnover, realized spreads.
6. **Counterparty & CSA:** CE/PFE vs ladders; disputes, thresholds, novations (if any).
7. **Exceptions/blackouts:** breaches, root cause, remediation, sunsets, ALCO approvals.
8. **Tie-outs:** trade blotter ↔ ledger ↔ Schedule DB; VM-21 position match (RILA).

6.4.5 Example tables (drop-in)

CTE (RILA) attribution.

Component	CTE_{70} change (mm)	Cumulative (mm)
Start (prior quarter)	0.0	0.0
Markets-only (rates ↓, vols ↑)	+18.0	+18.0
Hedge actions (added long vega ladder)	-12.5	+5.5
Assumptions (lapse update)	+2.0	+7.5
Other (mix/floors/rounding)	-0.5	+7.0

Hedge P&L decomposition (weekly).

	Delta	Gamma	Vega	Carry/Roll	Funding/Collat	Dividends	Tx/Other
S&P Book (mm)	+1.8	-0.6	+0.9	+0.2	-0.1	+0.1	-0.2
EuroStoxx Book (mm)	+0.7	-0.2	+0.3	+0.1	-0.0	+0.0	-0.1
Total (mm)	**+2.5**	**-0.8**	**+1.2**	**+0.3**	**-0.1**	**+0.1**	**-0.3**

Residual $\leq$ 10% rule: if $|Tx/Other|$ persistently large, review data, slippage, or model fit.

6.4.6 Narrative pointers (how to write the "why")

- **RILA example:** "CTE_{70} rose +$18mm on vol-up; our 2–5y vega ladder trimmed tails by −$12.5mm; net +$7mm primarily from rates down and lapse update."
- **FIA example:** "Earnings-at-risk improved despite vol-up; delta kept within 0.2% AUM band; option spend at 48% of YTD envelope; futures roll slippage 0.7bp."
- **Keep causality tight:** Markets → exposures → actions → KPIs.

6.4.7 Governance hooks

- Attribution method locked and version-controlled; changes require approval.
- Data lineage from trade systems to modeling (surfaces, curves) archived and reproducible.
- VM-21 link (RILAs): hedge positions in attribution must equal those in the reserve engine at lock.
- FIA link: earnings attribution reconciles to statutory close; *hedge doesn't change reserves* is stated explicitly.

Key Takeaway

Effectiveness is *measured* where regulators and CFOs care: ΔCTE/required capital for RILAs and earnings-at-risk for FIAs. A crisp, additive attribution (Markets/Hedges/Assumptions/Other) plus a Greeks/P&L bridge turns hedge activity into explainable, auditable stability.

Chapter 7

Disclosures, Filings & Audit Calendars

7.1 What lands on the desk

7.1.1 Overview

Disclosures and audits translate trading into artifacts that regulators, auditors, and governance bodies can verify. This section lists the *typical asks* the hedge desk receives, plus the *quarter-end (QE)* and *year-end (YE)* tie-outs that prevent last–mile fire drills.

7.1.2 Common information requests (who asks for what)

Regulators / Domiciliary State / NAIC filing support.

- **Schedule DB support:** instrument listings, purpose tags (hedge/replication/income), counterparties, notional/fair value, maturity ladders, cleared vs bilateral splits.
- **DUP evidence:** most recent approved version, change log, and proof of adherence (trade samples).
- **VM-21 (RILAs):** hedge inclusion policy, lock procedures, position extracts at lock, scenario engine inputs, linkage of booked positions to modeled positions.
- **SNFL/SVL (FIAs):** confirmation that reserves follow deterministic formulas; explanation that hedge MTM does not alter reserve calculation.
- **Counterparty exposure:** CE/PFE by netting set, CSA terms, downgrade playbooks.

External auditors (stat).

- **Trade-to-ledger tie-out:** blotter → position report → valuations → GL balances.
- **Schedule DB vouching:** sample selection, agrees to GL and trade confirms; purpose tags match DUP.
- **SSAP documentation:** hedge designation memos (e.g., under SSAP 86), prospective/retrospective effectiveness tests, model notes.
- **Collateral/VM:** CCP statements and CSA call reports; day-end balances and interest accruals.

Internal Audit / Model Risk / Risk (CRO).

- **Limit monitoring:** delta/vega/stress ladders vs bands; breaches and exception logs with sunsets.
- **Model governance:** inventory IDs, documentation, validation reports, change-control tickets, backtests.
- **Data lineage:** end-of-day surfaces, curves, dividends/borrows; archive hashes and reproducibility.
- **ALCO packs:** KPI dashboard, attribution (Markets/Hedges/Assumptions/Other), budget use.

Actuarial / Finance (close support).

- **RILAs:** VM-21 position snapshots at lock, rehedge rules as modeled, reconciliation of modeled to booked cash flows.
- **FIAs:** earnings attribution vs hedge P&L; proof that reserves per formula; option budget utilization.
- **FX & funding bridges:** collateral rate, dividend curves, basis adjustments used in pricing vs accounting.

7.1.3 Quarter-end tie-outs (desk checklist)

- **Positions & valuations:** end-of-period positions agree to independent pricing; price overrides documented and approved.
- **Trade roll-forward:** open $\rightarrow$ adds $\rightarrow$ closes/expiries $\rightarrow$ end; matches GL movement.
- **Collateral:** CCP/CSA statements agree to ledger receivable/payable; interest on collateral reconciled.
- **Schedule DB map:** instrument/purpose/counterparty tables agree to ledger totals; timing differences logged.
- **RILA VM-21:** lock files archived; hedge set in model equals booked set; differences (if any) explained.
- **FIA reserve bridge:** formula reserve proof; earnings bridge (market vs hedge vs other) with small residual.
- **Exceptions:** breach log updated; open items carry explicit sunset dates and ALCO acknowledgments.

7.1.4 Year-end add-ons (beyond QE)

- **DUP annual re-approval:** board minutes and redlines; instrument list and limit appendix refresh.
- **Model attestations:** annual validations, controls testing (SOX/SOC), reruns of backtests and sensitivity limits.
- **Counterparty review:** rating floors reaffirmed; exposure ladders recalibrated; downgrade playbooks tested.
- **Archival & retention:** surfaces/curves/quotes, lock files, and audit packs stored with immutable timestamps.

7.1.5 Typical PBC list (Prepared By Client) *excerpt*

Item	Description	Owner
Positions extract	End-of-period trades by instrument/counterparty/tenor, with fair values	FO/MO
Valuation files	Quotes, curves, surfaces, pricing notes; override approvals	Val/Model
Collateral reports	CCP and CSA calls, balances, interest calc worksheets	Treasury
Schedule DB support	Instrument-purpose map, reconciliations to GL and confirms	Stat/FO
DUP package	Current DUP, change log, board approval, sample testing	Risk/Legal
VM-21 lock (RILAs)	Lock snapshots, modeled hedge set, reconciliation to booked	Actuarial/FO
Earnings attribution (FIAs)	Markets/Hedges/Assumptions/Other bridge	FO/Finance
Exceptions log	Breach details, remediation, sunsets, ALCO sign-offs	Risk/FO

Expand to full list per auditor's request letter. Use `tabularx` *if the table needs wrapping.*

7.1.6 Close calendar (illustrative)

- **T − 5 to T − 1 (pre-close):** position cleanse; dispute resolution; preview Schedule DB map; freeze data sources.
- **T (lock/close):** final valuations and locks; snapshot hedges for VM-21 (RILAs); capture all collateral movements.
- **T + 1 to T + 3:** GL tie-outs; P&L and attribution bridges; exception log update; management review.
- **T + 4 to T + 8:** Schedule DB draft, regulator Q&A prep, auditor PBC fulfillment.

7.1.7 Practical tips (to avoid last–mile friction)

- Keep a **one-page map** from desk systems to ledger accounts to Schedule DB lines.
- Maintain a **standing archive** of daily surfaces/curves and end-of-day position CSVs with checksums.
- Pre-agree with Actuarial how **modeled hedge** equals **booked hedge** at VM-21 locks (naming, netting sets, signs).
- For FIAs, open each close pack with the sentence: *"Reserves are formula-based under SNFL/SVL; hedges affect earnings and surplus, not reserve level."*

Key Takeaway

Most "asks" boil down to three proofs: *(i)* trades exist and are within the DUP, *(ii)* books/records agree (trade → valuation → ledger → Schedule DB), and *(iii)* for RILAs, the VM-21 model used the same hedge book that was actually booked at lock; for FIAs, earnings attribution explains results while reserves remain formula-driven.

7.2 Timelines

This section consolidates *when* things happen: market-data & hedge locks, attestation/approval cadences, and prospectus/SEC touchpoints that can impose trading blackout windows (especially for RILAs).

7.2.1 Locks (definitions & use)

Desk market lock (daily). End-of-day snapshot used for pricing, Greeks, and P&L. Captures: close prices, curves (OIS/funding), dividends/borrows, and implied vol surfaces. *Governance:* timestamp, data-source hashes, maker/checker sign-off.

VM-21 reserve lock (RILAs; monthly/quarterly as defined). As-of set used by Actuarial to run stochastic projections (CTE). Must include *actual hedge positions* and any *rules-based* rebalancing policy that the firm recognizes. *Governance:* lock memo, position extracts, data lineage, model version IDs. *Desk action:* freeze material changes around the lock window or pre-announce rebalances.

Close lock (accounting; QE/YE). GL valuation/fx cut; final positions and collateral balances for statutory close. *Desk action:* reconcile end-of-period positions, margin balances, and Schedule DB maps; coordinate with Actuarial on VM-21 lock equality (RILAs) or SNFL reserve proofs (FIAs).

7.2.2 Attestation & approval cadence (governance clock)

- **Daily:** Market lock; delta check; exception log updates (if any).
- **Weekly:** Vega/tenor ladder review; stress-ladder checkpoint vs KPI bands; counterparty exposure ladder review.
- **Monthly:** ALCO pack (KPIs, attribution, budget); model/data change log attestation (no unauthorized changes); Schedule DB draft tie-out preview; VM-21 lock package if applicable.
- **Quarterly (QE):** Full GL tie-outs; auditor PBC set; VM-21 vs booked hedge equality (RILAs); FIA earnings bridge.
- **Annual (YE):** DUP re-approval; limits appendix refresh; model validation reports; archival attestations (surfaces/curves/locks); counterparty framework review (rating floors, CSA terms, downgrade playbooks).

7.2.3 Prospectus/SEC touchpoints affecting calendars (RILAs)

RILAs are registered; disclosure controls can constrain trading calendars.

- **Annual prospectus update:** Coordinated with legal/compliance. *Desk implication:* brief blackout or heightened change-control around effective dates to avoid misalignment between disclosures and hedge posture.
- **Supplements/material updates:** Product term changes (e.g., adding indices, buffers/floors) may require supplements. *Desk implication:* pre-hedge only after the disclosure is final & approved; coordinate go-live dates for new payoffs.
- **Sales literature/marketing reviews:** Ensure hedging descriptions in public materials match DUP and practice. *Desk implication:* avoid strategy shifts during review windows unless pre-approved & disclosed.
- **FINRA/filing review windows (as applicable):** Periods where communications are under review. *Desk implication:* treat as soft blackouts for strategy changes; document rationale for any material trades.

Rule of thumb: If a change would alter how the product's risk/return is represented externally, treat the surrounding window as a **blackout** unless Compliance gives a green light.

7.2.4 Illustrative close & lock calendar (quarter)

When	What the desk does
T−10 to T−5 (pre-close)	Clean positions; resolve margin disputes; freeze data-source configs; preview Schedule DB maps; pre-wire VM-21 lock (RILAs).
T−1 (lock eve)	Confirm daily market lock; finalize intended hedge set at lock; exception-ready if liquidity blocks changes.
T (lock/close)	Capture VM-21 lock (RILAs) and GL close snapshots; archive surfaces/curves/dividends/borrows; export booked hedge set.
T+1..3	GL tie-outs; attribution packs (Markets/Hedges/Assumptions/Other); exception log updates with sunsets.
T+4..8	Schedule DB support; regulator/auditor PBC fulfillment; ALCO/budget updates.
Month-end (non-QE)	Mini-close: market lock, Greeks/stress KPIs, budget report, counterparty ladder attestations.
Annual windows	Prospectus update coordination; DUP re-approval; model validations; counterparty framework review.

7.2.5 Blackout conventions (practical rules)

- **Hard blackouts:** Accounting lock cut; prospectus effective date day; known regulatory filing timestamps.
- **Soft blackouts:** Marketing & supplement review periods; model-governance changes awaiting approval; system/data incidents.
- **Exception path:** If a limit breach occurs in blackout, open an exception with (i) metric breached, (ii) root cause, (iii) minimal safe action, (iv) proposed sunset; obtain Risk/ALCO concurrence.

7.2.6 Runbook checklist (who signals whom)

- **Actuarial** → Desk: VM-21 lock date/time; model version/floor settings; position format required.
- **Finance** → Desk: GL cut; FX translation basis; collateral cut-off; Schedule DB draft due date.
- **Legal/Compliance** → Desk: prospectus/supplement calendars; blackout notices; approved language on hedging.
- **Desk** → All: hedge set at lock; exception logs; KPI/stress outcomes; budget usage; post-lock changes (if any) with rationale.

Key Takeaway

Timelines coordinate *locks, close cuts, and disclosures.* For RILAs, VM-21 locks and prospectus windows create explicit trading calendar constraints; for FIAs, deterministic reserves simplify locks but close cuts still govern tie-outs. Treat disclosure events as blackouts unless cleared; document every deviation via exceptions with sunsets.

Chapter 8

Reference & Templates

8.1 Mappings

This section provides reusable templates that *map* front-office artifacts to statutory and governance outputs: (i) **Term sheet → Hedge spec**, (ii) **Schedule DB** line-item mapping, and (iii) a **Counterparty limit** template suitable for your DUP appendix.

8.1.1 Term sheet → hedge spec (template)

Use this to convert product terms into an executable, auditable hedge spec. It doubles as a handoff to Actuarial (VM-21) and Finance (booking).

Term Sheet Field	**Hedge Spec Entry (implementation-ready)**
Product type	RILA buffer / floor | FIA cap/participation
Index & return basis	S&P 500 *price* return (no dividends) → hedge underlyer = ES futures + listed options; dividend/borrow curves specified.
Tenor / reset	1-year point-to-point; monthly observation for barrier → hedge roll calendar T–5 to T+1; barrier monitoring frequency daily EOD.
Upside terms	Cap = 10% → long call @ ATM, short call @ 10% up (listed), strike clustering rules ±1% moneyness; tolerance $\leq$ 0.25% error.
Downside terms	Buffer = 10% → short put @ ATM, long put @ 10% down (OTC vanilla if listed liquidity insufficient); knock-in optionality *not* recognized.
Participation	120% par (if no cap) → delta scaling via futures; vega via laddered calls (1y/2y/3y) for RILAs.
Fees / rider charges	Model as drag in VM-21 and pricing; no hedge instrument; disclose in attribution as "carry."
Allocation & elections	Choice set: S&P/Nasdaq/Blend → separate hedge books per index family; basis risk caps between book and contract indices.
Rebalance policy (rules)	Daily delta band ±0.2% AUM (futures); monthly vega ladder review; add 2–5y vega when ΔCTE breaches yellow band.
Venue / instrument prefs	Listed first; OTC allowed for illiquid strikes/tenors within CSA zero-threshold; avoid digitals unless pre-approved in DUP.
Counterparty/clearing	Cleared where available; OTC only with A-/A3 floor; CSA zero-threshold, daily VM in USD; IA step-ups on downgrade.
Booking & tags	SSAP hedge designation memo at inception; DUP purpose = "hedging"; Schedule DB: instrument/purpose/counterparty coded at trade.
VM-21 linkage (RILAs)	Positions at lock exported; rehedge rules encoded; actuarial model uses same surface/curves as trading lock.
Controls	Gamma hot-zone: if $\lvert S - K\rvert < z\sigma$ then intraday delta trims allowed; stress ladder sign-off weekly.

Table 8.1: Term-sheet to hedge-spec mapping. Adapt fields per product (add ratchets, barriers, baskets as needed).

8.1.2 Schedule DB line items (mapping checklist)

Map each trade to its disclosure fields at *inception*, not at quarter-end. This prevents last–mile scrambles.

DB Field	What to capture (at trade time)	Source/System
Instrument type	Futures / Listed Option / OTC Option / Swap / TRS / Fwd	OMS/EMS
Purpose	Hedge / Replication / Income (must match DUP)	Trade ticket
Underlying & index family	Ticker, return basis (price vs total return), currency	Static data
Notional / delta eq.	Contract count, notional in USD, optional delta-equivalent	OMS + calc
Strike / tenor / expiry	Exact strikes, expiries, and calendars used	OMS
Counterparty / CCP	Legal entity; for cleared, CCP name; netting set ID for OTC	Legal/Static
Collateral terms	CSA/clearing; thresholds, eligible collateral, IA/IM flags	Collateral system
Fair value	End-of-period valuation; source and methodology reference	Valuation engine
Hedge designation	SSAP memo reference; effectiveness test method	Accounting
Cross-refs	Trade ID, GL account, VM-21 lock position ID (RILAs)	Reconciliation hub

Table 8.2: Schedule DB mapping essentials. Maintain a one-page key from systems to DB fields.

8.1.3 Counterparty limit template (DUP appendix)

Use ratings tiers, tenor buckets, and WWR flags. Values are placeholders — calibrate to appetite.

Tier	0–2y	2–5y	>5y	Per-CP Max	Notes / Conditions
AA-/Aa3+	\$X CE/PFE	\$1.5X	\$2X	\$3X	Prefer cleared beyond 5y; zero-threshold CSA; IA optional
A/A2	\$0.8X	\$X	\$1.2X	\$2X	Zero-threshold CSA; IA mandatory for OTC options >3y
BBB+/Baa1	\$0.4X	\$0.5X	\$0.6X	\$1X	New bilateral trades restricted; shorten tenor; novate/clear plan
Below BBB+	No new bilateral exposure				De-risk/novate per downgrade playbook

Table 8.3: Counterparty limit ladder (illustrative). Set \$X and multipliers per risk appetite and liquidity.

Aggregation rules (to paste into DUP).

- Exposures are measured per *legal netting set* as $\max(\text{CE}, \text{PFE}_{95\%})$, then aggregated to counterparty and firm level.
- Apply WWR add-on ($\geq$20%) where the underlyer correlates with counterparty credit (e.g., bank equity vs bank CP).
- Tenor multipliers: add +25% add-on for non-cleared option tenors >5y.
- Concentration caps: single-CP $\leq$ 25% of firm-wide PFE; index-family cap $\leq$ 40% of gross vega.

8.1.4 Quick reference: term sheet → systems

Term Sheet Item	System of Record	Downstream Use
Cap / Buffer / Floor levels	Product spec DB	Hedge strikes (OMS), VM-21 payoffs (Actuarial)
Observation calendar	Product spec DB	Roll calendar (OMS), valuation day-counts (Valuation)
Index family	Static data	Underlyer matching, basis controls, Schedule DB underlyer field
Hedge policy (rules)	Limits & policy repo	VM-21 rehedge logic (RILAs), desk triggers (risk)
Counterparty rules	Credit/CSA store	OMS eligibility checks, exposure ladders, C-1 capital calc

Table 8.4: Data lineage: where term sheet fields live and how they flow to trading/stat systems.

Key Takeaway

Codify mappings *once*, reuse everywhere: the same table entries should drive trading (OMS), stat reporting (Schedule DB), and reserving/capital models (VM-21 for RILAs). Keeping these artifacts synchronized is the fastest way to avoid quarter-end surprises.

Appendix A

One-Page Timeline

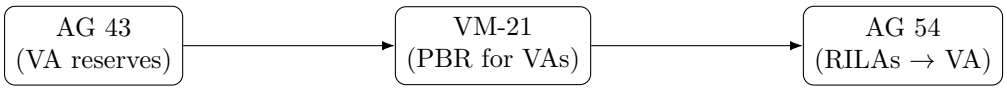

Figure A.1: Regulatory lineage that matters for RILA hedging recognition.

Appendix B

Hedge Desk Governance

B.0.1 Purpose & Scope

Hedge desk governance ensures trading activity aligns with the firm's risk appetite, liquidity constraints, statutory objectives (earnings, reserves, RBC), and regulatory obligations (DUP, Schedule DB, VM–21/SNFL). This section summarizes who decides what, which documents control behavior, and how performance and exceptions are escalated.

Note on CTE

Conditional Tail Expectation (CTE) is a risk measure used in principle-based reserving and capital frameworks (e.g., VM-21 for variable annuities). It is defined as the *average* of the worst $x\%$ of outcomes from a stochastic projection.

Formally, if L is the distribution of losses across scenarios, then

$$\mathrm{CTE}_x = \mathbb{E}[\, L \mid L \text{ is in the worst } x\% \,].$$

- In VM-21, reserves are typically set to CTE_{70}, i.e. the average of the worst 30% of scenario results.
- This captures not just the single worst-case (like VaR) but the *severity* of the tail, producing a smoother and more conservative measure.
- For hedgers, this means that hedge effectiveness is judged by how well positions reduce *tail losses across scenarios*, not just average performance.

Note on SSAP and AP&P

SSAP stands for **Statutory Statements of Accounting Principles**. These are the detailed accounting rules issued by the NAIC that govern how insurers must record assets, liabilities, revenues, and expenses in their *statutory* financial statements. Each SSAP is numbered (e.g., SSAP 86 covers derivatives, SSAP 26 covers bonds), and together they form the binding accounting framework for statutory reporting.

AP&P stands for the NAIC's **Accounting Practices and Procedures Manual**. This is the official compilation of all SSAPs, along with instructions, interpretations, and guidance. It is effectively the "GAAP manual" of the statutory world, and most states require insurers to follow it directly.

Hedge desk relevance.

- Derivative trades are booked according to SSAP 86 (or related SSAPs), which determines whether hedge accounting treatment is allowed and how unrealized gains/losses flow through statutory earnings or surplus.

- The AP&P Manual sets the official line auditors and regulators use when tying out the desk's trades to statutory results.
- For governance, Schedule DB disclosures, DUP compliance, and reserve/capital modeling must all be consistent with SSAP/AP&P accounting.

Note on ALCO

ALCO stands for **Asset–Liability Committee**. It is a senior management body (finance, risk, investments, actuarial) that oversees balance sheet risks and ensures that investment and hedging strategies align with risk appetite, liquidity, and capital objectives. For the hedge desk, ALCO is the forum where: (i) hedge targets, tolerances, and budgets are approved; (ii) performance against statutory KPIs (earnings, reserves, RBC) is reported; (iii) exceptions, stress results, and strategy changes are escalated.

B.0.2 Roles & Responsibilities (at a glance)

- **Board / Board Risk Committee (BRC):** Approves risk appetite, major policies (e.g., DUP), and limit frameworks; receives periodic risk reports.
- **ALCO (Asset–Liability Committee):** Sets actionable tolerances and budgets; approves hedge targets, benchmarks, and rebalancing rules; reviews attribution and exceptions.
- **CRO / Enterprise Risk:** Owns the limit framework; independent monitoring, stress testing, and challenge; oversees model governance tie-ins.
- **Actuarial (Reserving/Capital):** Runs VM–21 or SVL/SNFL; provides reserve/capital sensitivities and CTE/standard scenario outputs for hedge target calibration.
- **Finance/Accounting (Stat/GAAP):** Ensures booking is consistent with SSAP/AP&P; tie-outs: trade blotter $\rightarrow$ ledger $\rightarrow$ Schedule DB; earnings attribution.
- **Compliance/Legal:** Validates adherence to the DUP, prospectus representations (RILAs), counterparty documentation, and regulatory filings.
- **Hedge Desk (Front Office):** Executes within limits; produces daily Greeks, stress ladders, and attribution; manages exceptions within escalation protocol.
- **Internal Audit:** Independent effectiveness reviews of controls, data lineage, and policy adherence.

B.0.3 Core Governance Documents

- **Derivative Use Plan (DUP):** Purpose, permissible instruments, counterparty/CSA standards, limits, monitoring, and escalation.
- **Risk Appetite & Limits:** VaR/CTE bands (RILAs), earnings-vol bands (FIAs), tenor/skew concentration limits, counterparty ladders.
- **Model Governance (SR 11-7–style principles):** Model inventory, validation cadence, change control, input quality (surfaces, dividends, funding).
- **Reporting Policies:** Contents and cadence for ALCO/BRC packs; Schedule DB preparation; quarter-end/year-end close procedures.

B.0.4 Cadence & Pack Contents

Monthly (ALCO): KPI dashboard (delta/vega bands, CTE impacts for RILAs, earnings-vol for FIAs), option budget vs usage, stress ladder results, top exceptions, counterparty exposures, attribution (market vs hedge).
Quarterly (BRC/Board): Limit utilization, breaches & remediation, capital/reserve stability, backtesting of hedge effectiveness, notable market/liq events.
Annual: DUP re-approval, limit recalibration, model validation summaries, playbook refresh.

B.0.5 Controls & Exception Management

- **Pre-trade**: limit checks; purpose tagging (hedge/replication/income per DUP); eligible instrument check.
- **Daily**: P&L explain; Greeks vs bands; stress ladder (1d/10d shocks); reconciliations to positions and valuations.
- **Monthly/Quarterly**: Tie-outs to ledger and Schedule DB; reserve/capital attribution (VM–21 CTE for RILAs; earnings-vol for FIAs); counterparty WWR review.
- **Exceptions**: Document root cause, temporary waivers, mitigation plan, ALCO sign-off, and sunset date; log for audit trail.

B.0.6 Where Governance Touches the Desk (Checklist)

- Targets reflect **stat metrics**: CTE/standard scenario (RILAs) or earnings-vol bands (FIAs).
- **Data hygiene**: surfaces, dividends, funding curves; documented controls and peer checks.
- **Hedge design**: liquidity-aware; tenor laddering for vega; cap/strike clustering to manage gamma near boundaries.
- **Attribution**: reserve/capital (RILAs) or earnings (FIAs) move explained by market vs hedge; reconcile to policy features.
- **Documentation**: trade rationales, exception logs, DUP alignment, Schedule DB mapping.

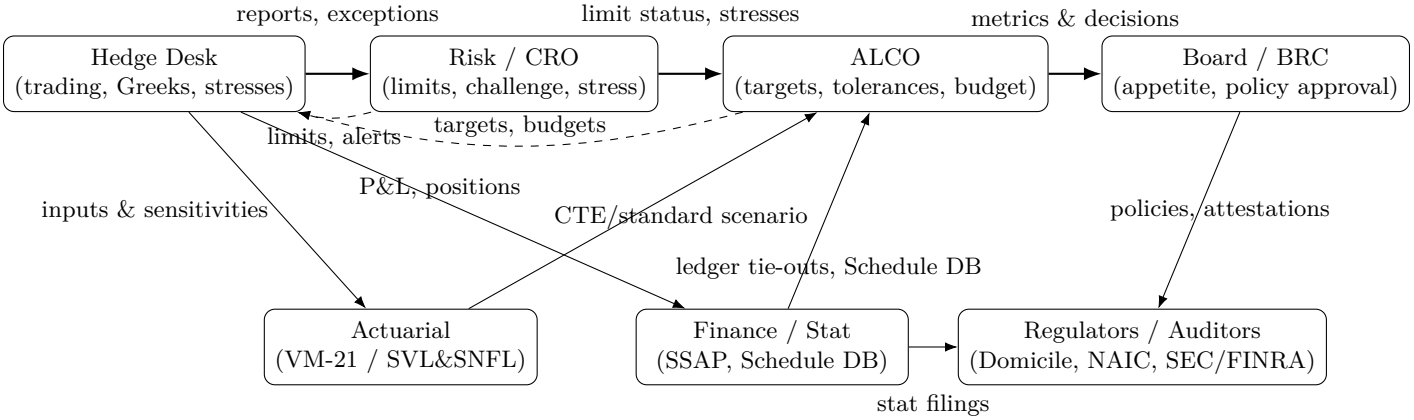

Figure B.1: Governance flow: the hedge desk reports through Risk to ALCO and the Board; Actuarial (VM-21 / SVL&SNFL) and Finance (SSAP, Schedule~DB) feed metrics and tie-outs; Regulators/Auditors receive external filings and attestations. Dashed arrows indicate feedback of targets/limits back to the desk.

Appendix C

Jurisdictional PBR Variations

C.1 New York PBR

Overview. "Principle-Based Reserving" (PBR) is the NAIC framework implemented through the *Valuation Manual* (e.g., VM–20 for life insurance, VM–21 for VAs/RILAs). In industry shorthand, *New York PBR* refers to the posture of the New York Department of Financial Services (NYDFS) to apply *additional conservatism, documentation, or floors* when approving company PBR frameworks. It is not a separate manual; rather, it denotes supervisory expectations that can lead to higher or more stable reserves than a strict "as-written" NAIC implementation.

How it differs from a baseline NAIC implementation

- **Conservative overlays:** NYDFS may require margins (on lapses, expenses, mortality, reinvestment spreads) that exceed those a company would otherwise adopt under NAIC minimums.
- **Retention of legacy floors:** Even when PBR allows a lower result, NYDFS may ask firms to compute and hold to a *secondary floor* (e.g., prior formula methods) where appropriate.
- **Documentation depth:** Stronger emphasis on *model governance, controls, and sensitivity testing* (e.g., challenger models, backtests, stress ladders).
- **Use of judgment:** Greater scrutiny of *management actions* and *clearly defined hedging strategies*; discretion that is not rules-based may be curtailed or disallowed for reserve credit.

Illustrative supervisory overlays (examples)

These examples are *illustrative* of industry experience and supervisory dialogue:

- **Behavioral assumptions:** Higher floors on dynamic lapses or constraints on lapse responsiveness in deep stress.
- **Discounting/earned spread:** Tighter bounds on Net Asset Earned Rate (NAER) decomposition (book yield, defaults, reinvestment), with sensitivity runs.
- **Scenario coverage:** Larger scenario sets or additional stresses beyond the minimum, to demonstrate tail stability of CTE metrics.
- **Legacy comparison:** Parallel calculation of a legacy statutory measure to ensure no unintended cliff effects versus PBR.

Product lenses: Life, FIA, RILA/VA

- **Life (VM–20):** Expect conservative margins on mortality/lapse/expenses and possible retention of formula floors; robust asset adequacy demonstrations.
- **FIA (SVL/SNFL):** Deterministic reserves already dominate; NYDFS focus tends to be on minimum statutory interest rate application, credited rates, and governance over general account & index option programs (DUP, counterparty controls).
- **RILA/VA (VM–21):** Stronger scrutiny of *hedge recognition* (DUP alignment, rules-based rebalancing), policyholder behavior assumptions, and *stability of CTE tails*. Standard Scenario (SSA) compliance and reconciliation are emphasized.

Quick compare: baseline NAIC PBR vs. "New York PBR" stance

	NAIC PBR (baseline)	**"New York PBR" posture (illustrative)**
Assumption margins	Company-selected with prescribed floors/guardrails	Higher or more persistent margins; added sensitivity runs
Legacy floors	Use only if prescribed by manual	May request retention of a legacy formula floor as a check
Hedge recognition (VM–21)	Credit for clearly defined, rules-based strategies (DUP)	Tighter alignment to DUP; limits on discretion; audit trail required
Scenario coverage	Meets VM minimum standards	Larger scenario sets / extra stresses to stabilize CTE
Documentation/governance	Standard model governance and AO/AA testing	Enhanced documentation, challenger models, & backtesting expectations

Table C.1: Typical areas where NYDFS may expect additional conservatism relative to a baseline NAIC PBR implementation.

Implications for hedge desks and finance

- **KPIs and targets:** Statutory KPIs handed to the desk (reserve/CTE, C–3) may be higher or tighter than an NAIC-minimum build, affecting budgets and risk tolerances.
- **Hedge recognition discipline:** Rules-based rebalancing (bands, rolls, cash sweeps) must be *codified and executed* as documented, or recognition may be curtailed.
- **Attribution & stability:** Expect requests for *CTE attribution* and stability analyses (e.g., tail move explained, hedge P&L vs. reserve move, SSA binding behavior).
- **Counterparty controls:** Strong emphasis on DUP compliance, Schedule DB tie-outs, collateral/CSA terms, and concentration limits.

Practical checklist (for New York-domiciled filers)

- Validate that DUP language *exactly* matches modeled hedge rules and operational playbooks.
- Maintain challenger/benchmark runs (e.g., alternative lapse curves, earned-rate shocks) and keep *CTE stability* exhibits ready.
- Retain parallel *floor* calculations where requested (legacy or simplified formulas) and reconcile.
- Prepare Schedule DB *traceability*: trade → booking → model inclusion.
- Keep a monthly "why pack": reserve/CTE move, SSA binding checks, hedge effectiveness, and capital impacts.

Takeaway. New York PBR is best understood as *NAIC PBR plus supervisory conservatism*: deeper documentation, potential floors, and tighter hedge recognition standards. For desks, that translates to *more formal rules, stronger traceability, and heightened tail stability expectations*—with potential for higher reported reserves than an otherwise identical block domiciled under a less conservative jurisdiction.

C.2 Other Jurisdictional PBR Flavors

Overview. While New York's conservatism under NAIC PBR ("New York PBR") is the best-known U.S. variant, other domiciles—both U.S. states and offshore regimes—also apply principle-based reserving or equivalent frameworks with their own interpretations. This section provides a comparative reference.

United States (beyond NAIC baseline)

- **New York:** Extra-conservative posture (see §C.1).
- **Other states (e.g., CA, MN):** Occasionally request added sensitivity runs or assumption restrictions, but generally adhere to the NAIC Valuation Manual without formal overlays.

Bermuda (EBS / BSCR)

- **Framework:** Economic Balance Sheet (EBS) for liabilities + Bermuda Solvency Capital Requirement (BSCR).
- **Valuation:** Market-consistent, with stochastic scenarios for VA/RILA-like guarantees using option-implied volatilities.
- **Capital:** Similar in spirit to Solvency II but BMA-calibrated.
- **Hedge recognition:** Requires explicit documentation of strategy, rules-based execution, and backtesting. No Standard Scenario fallback.

Canada (LICAT / IFRS 17)

- **Framework:** IFRS 17 for liability valuation; Life Insurance Capital Adequacy Test (LICAT) for capital.
- **Valuation:** Best estimate cash flows + risk adjustment (IFRS 17 basis).
- **Capital:** For seg funds (VA/RILA analogs), stochastic requirements apply, with tail calibration defined by OSFI.
- **Hedge recognition:** Stricter than NAIC; requires demonstration of *empirical hedge effectiveness* for capital credit.

Europe (Solvency II)

- **Framework:** Solvency II, covering EU insurers.
- **Valuation:** Technical provisions = best estimate liability + risk margin.
- **Capital:** Solvency Capital Requirement (SCR) = 99.5% one-year VaR.
- **Hedge recognition:** Strong; derivatives valued at market-consistent levels with full credit for admissible hedge overlays.

Asia (brief notes)

- **Japan:** More formula-driven, with gradual migration to stochastic methods for variable annuities.
- **Hong Kong / Singapore:** Hybrid systems; align partly with Solvency II or Bermuda-style EBS, but subject to local Monetary Authority rules for hedge credit.

Jurisdiction	Framework	Reserve Valuation	Capital / Hedge Recognition
NAIC (baseline)	VM–20 (life), VM–21 (VA/RILA)	Stochastic CTE (VM–20/21) or deterministic (SVL/SNFL)	C–3 = CTE tail (VM–21) or factor-based (FIAs); DUP governs hedge credit
New York	NAIC PBR + overlays	Same as NAIC but with extra floors/margins	Hedge recognition stricter, more documentation required
Bermuda	EBS + BSCR	Market-consistent, stochastic with implied vols	BSCR capital; hedge credit requires documented, rules-based execution
Canada	IFRS 17 + LICAT	Best estimate + risk adjustment	Stochastic seg fund capital; hedge credit requires empirical effectiveness
Europe	Solvency II	Best estimate + risk margin	SCR = 99.5% one-year VaR; hedges fully recognized

Table C.2: Comparison of jurisdictional approaches to PBR-style reserving and capital, with hedge recognition emphasis.

Takeaway. Outside the U.S., Bermuda, Canada, and Europe all operate with *principle-based or market-consistent regimes*, but each has its own hedge recognition rules. Compared to NAIC, these often require more stringent backtesting (Canada), strict market-consistency (Bermuda, Europe), or supervisory conservatism (New York). For hedge desks, the core question is always: *does the domicile credit our hedges in reserves/capital, and what governance does it demand in return?*

Appendix D

Refresher - Book Value vs. Market Value of Bonds

Overview. Bonds can be carried at different values depending on the accounting lens. For hedge desk purposes, it is important to distinguish the *market value* (fair value today) from the *book value* (amortized cost used in statutory accounting).

Market Value (Fair Value)

- Definition: The price the bond would fetch if sold in the open market today.
- Drivers: Prevailing interest rates, credit spreads, liquidity conditions.
- Behavior: Volatile. A bond purchased at par can trade below par if yields rise or above par if yields fall.
- Example: A 5% coupon bond issued at $100 par. If market rates rise, price may fall to $95; if rates fall, price may rise to $105.

Book Value (Amortized Cost)

- Definition: The carrying value on the statutory (or GAAP HTM) balance sheet.
- Method: Starts at purchase price, then premium/discount is amortized over the bond's life to bring value back to par at maturity.
- Example: If purchased at $102, the $2 premium is amortized down toward $100; if purchased at $98, the $2 discount is accreted up to $100.
- Behavior: Smooth; produces a yield equal to the purchase yield, without reflecting day-to-day market swings.

Terminology: Book vs. Amortized Value

- In statutory accounting, the two are often used interchangeably.
- Strictly: *Book value* means the general carrying value; *amortized cost* describes the specific method applied to bonds.

Takeaway.

- **Market value** = what it is worth if sold today (volatile).
- **Book / amortized value** = what it is carried at in statutory books, based on purchase yield and smooth amortization (stable).
- For bonds, "book value" and "amortized value" are effectively the same in statutory usage.