

23rd Seminar on Current Issues in Retirement Benefits (23rd CIRB)

Income Drawdown research paper by advisory group



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Mr. Arpaan Begdai,

Member, Advisory group on Pensions, Other Employee Benefits & Social Security, IAI

- **Mr. Arpaan G. Begdai** is a Partner at KP Actuaries and Consultants LLP and has over a decade of experience in the employee benefits actuarial consulting domain. Having been part of the firm since its inception, he has played a key role in advising organizations on a wide range of employee benefit matters.
- His professional experience spans both Indian and UK employee benefits consulting, as well as participation in micro-insurance research initiatives, providing him with a broad perspective on retirement, social security, and workforce benefit programs.
- Known for his strategic approach and passion for innovation, Arpaan combines technical actuarial expertise with practical business insights to help organizations navigate complex employee benefit challenges.

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Hotel Sea Princess

RETIREMENT INCOME RESEARCH

Advisory Group on Pension, Employee Benefits, and Social Security

A Dynamic Safe Withdrawal Rate Framework for Retirement Income

Arpaan G Begdai, FIAI, FIA



Framework architecture, governance rules, and deterministic results

Two-layer architecture

Indian baseline calibration

Deterministic scenario analysis

What we will cover



01 Traditional rules: a foundation to build on

02 The DSWR proposition

03 Layer 1 — withdrawal estimation

04 Layer 2 — the execution engine

05 Base-case implementation

06 Scenario analysis

07 Governance parameter sensitivity

08 Benchmarking against established rules

01

Traditional rules: a foundation to build on



Where the four percent rule came from, and what it was designed to do

Origins of the four percent rule



BENGEN 1994

US equity–bond data, 1926–1992

METHOD

Rolling 30-year retirement horizons

RULE

4% of initial assets, then indexed to inflation

TRINITY STUDY 1998

Evidence supporting 4% as a sustainable withdrawal rate

4%

Became the de facto global benchmark — then travelled far beyond the single economy it was calibrated on.

Structural considerations

01

Single-economy origin

Calibrated on one country's history, applied in materially different settings.

02

Fixed at retirement

A policy set once, then carried through decades of changing conditions.

03

Assumption-dependent transfer

Portability rests on inflation, return and longevity assumptions that vary by economy.

04

No annual determination

The current portfolio position never re-enters the decision as a determinant.

A withdrawal policy set at retirement is a useful starting point — not a complete retirement income system.



What the dynamic literature added

CONTRIBUTION	ADVANCE	STARTING POINT
Guyton & Klinger (2006)	Guardrail decision rules; suspended inflation increases	Existing policy
Blanchett (2013)	Spending follows a lifecycle, not a constant real path	Existing policy
Pfau (2010, 2012)	Sustainable rates vary materially across countries	Existing policy
Milevsky & Robinson (2005)	Present value; lifetime as a random variable	Existing policy

The shared architectural characteristic: the withdrawal policy is specified outside the framework. The framework then evaluates, adapts or governs it.

02

The DSWR proposition



Inverting the problem: the withdrawal rate as an endogenous output



The withdrawal rate becomes an output

CONVENTIONAL

Rate in → adjustments applied

A policy is specified at retirement. The annual process governs that policy.

DSWR

Conditions in → rate out

The operative withdrawal is generated each year, then governed.

FOUR LIVE INPUTS AT EVERY ANNUAL DECISION POINT

- Current portfolio position
- Remaining retirement horizon
- Accumulated withdrawal experience
- Forward-looking inflation and return assumptions



Two integrated layers

LAYER 1 · WITHDRAWAL ESTIMATION

MWEPV

Survival probability weights every projected withdrawal

LAWR

Mortality sets the horizon over which withdrawals are valued

↓ BASE WITHDRAWAL ESTIMATE ↓

LAYER 2 · ANNUAL EXECUTION ENGINE

Path correction

Floor–ceiling corridor

Cushion accumulation
& release

Sustainability
constraints

Governance
monitoring



Operative annual withdrawal

Three principles behind every rule

01

Auditability

Every decision traceable to specified inputs, assumptions and rules.

02

Adaptability

Calibrated to country-specific demographic and economic assumptions.

03

Governance

Explicit mechanisms to monitor, review and adjust over time.

The objective is operational clarity: assumptions, decision logic, parameters and outputs that can be independently implemented, reviewed and audited.

03

Layer 1 — withdrawal estimation



Two ways of bringing longevity into a present-value estimate

Two treatments of longevity

MWEPV

MORTALITY-WEIGHTED EXPECTED PRESENT VALUE

Each projected withdrawal is weighted by the probability the retiree survives to receive it.

Distant withdrawals contribute progressively less, so the estimate responds naturally to shortening expected lifetime.

$$SWR_{\text{base}} = \frac{p_{x,1} \cdot v}{\sum_{t=1 \rightarrow T} p_{x,t} \cdot v^t}$$

SHARED

Real discount rate from expected nominal return and inflation, so v^t is common to both. End-of-year withdrawals.

$$W_t = SWR_{\text{base}} \times P_{t-1}.$$

LAWR

LONGEVITY-ANCHORED WITHDRAWAL RATE

Mortality determines the retirement horizon; withdrawals are valued over that horizon.

No survival weighting is applied to individual withdrawals.

$$SWR_{\text{base}} = \frac{V}{\sum_{t=1 \rightarrow T} v^t}$$

DIFFERENT

Only the treatment of longevity — so any difference in the estimate is attributable to longevity alone.

Estimated once a year, every year



HELD CONSTANT

**The estimation method
chosen at retirement**

UPDATED ANNUALLY

**Portfolio value at the
valuation date**

UPDATED ANNUALLY

**Expected return, inflation
and remaining horizon**

Portfolio performance and changes in economic conditions are therefore reflected in the estimate itself — before any governance rule is applied.

The re-estimated rate is an assessment of capacity — not yet the amount the retiree receives.

04

Layer 2 — the execution engine



Execution rules, governance rules, and the annual decision sequence



The annual decision sequence is a control cycle

01	Re-estimate the base withdrawal Current portfolio, current assumptions, chosen method	SPECIFY	04	Route through the cushion Excess above ceiling accumulates; shortfalls may be supported	DEVELOP
02	Apply path correction Recognise cumulative withdrawal deficit, in controlled steps	DEVELOP	05	Test portfolio sustainability Constraints applied before the withdrawal is confirmed	DEVELOP
03	Apply the floor–ceiling corridor Constrain the withdrawal within permissible bounds	DEVELOP	06	Monitor and report Independent of the decision; feeds review, not the payment	MONITOR

SPECIFY → DEVELOP → MONITOR → SPECIFY

Step 06 feeds the following year's step 01. The loop, not the list, is what makes this a control cycle — and the professional, regulatory and economic environment sits outside it, where the parameters are set and reviewed. Fixed order, by design: identical inputs always produce identical recommendations.

The path correction mechanism



Each annual decision is not taken in isolation. The framework carries forward what was actually paid.

COMPARE

Cumulative withdrawals implied by the estimate

versus cumulative withdrawals actually implemented

IF DEFICIT

A controlled portion is added back this year

reducing the deficit progressively, avoiding abrupt increases

IF EQUAL OR ABOVE

No correction is applied

the mechanism is one-directional

Applied before the corridor — so every correction remains subject to the corridor, the cushion rules and the sustainability constraints.



The floor–ceiling corridor

CEILING

Upper limit, set by an age-dependent ceiling SWR schedule. Amounts above it are not forgone; they move to the cushion.

FLOOR

Minimum operative withdrawal, promoting continuity in the retiree's spending pattern.

THE FLOOR OPERATES IN TWO PHASES

Phase 1

Anchored to a rolling average of recent operative withdrawals — continuity first.

Phase 2

From the transition age, a withdrawal-rate corridor calibrated to the remaining horizon — utilisation first.

A minimum withdrawal rate applies in both phases. Continuously active — not a threshold that fires discrete adjustments.

Cushion accumulation and release



ACCUMULATES FROM

- + A strategic allocation at retirement
- + A share of favourable investment experience above threshold
- + Withdrawal capacity above the ceiling

RELEASES THROUGH

- Support where the withdrawal would fall below the minimum
- A planned, progressive release from the transition age onward
- Invested conservatively; returns credited to the reserve

Governed independently of the annual withdrawal — its role is to move capacity across the horizon, not within a single year.

Withdrawal decomposition and monitoring



$$Y = G + R + S$$

G · Governed corpus withdrawal

Operative rate applied to the portfolio — the principal source throughout retirement.

R · Cushion support

Draws on the reserve where the governed withdrawal falls below the minimum.

S · Planned cushion release

Progressive distribution of the reserve from the transition age onward.

MONITORED SEPARATELY

Corridor position · portfolio sustainability · cushion accumulation and release · cumulative path deviation. Monitoring reports; it does not decide.

05

Base-case implementation



A reference run in which experience equals expectation

Base-case assumptions



DEMOGRAPHIC		PORTFOLIO		ECONOMIC (NOMINAL)	
Retirement age	60	Equity (NIFTY 50)	40%	Equity	9.65%
Terminal age · MWEPV	90	3Y & 10Y govt bonds	20% + 20%	3Y / 10Y bonds	7.50% / 7.80%
Life expectancy · LAWR	88	Gold	10%	Gold / Cash	13.50% / 6.00%
Indian Individual Annuitant's Mortality Table (2012–15)		Cash / FD	10%	Weighted portfolio return	8.75%
		Initial corpus ₹1 crore · initial cushion allocation 10%		Expected CPI inflation	6.00%

Reference assumptions drawn from historical Indian market data. Not forecasts. In the base case, realised experience equals expectation.



Governance parameters — base case

Age-dependent	Ceiling SWR schedule — the cap increases with age	30%	Path correction rate — share of deviation recognised per year
3%	Minimum withdrawal rate, applying in both phases	5%	Excess-return transfer proportion to the cushion
3-year	Rolling average of prior operative withdrawals — Phase 1 floor	80 MWEPV 78 LAWR	Cushion release trigger age · Phase 2 begins at life expectancy less 10 years

CUSHION RELEASE SCHEDULE

Age-banded from 60 to terminal age: the cushion target falls from 10% of opening portfolio toward zero, while the ceiling withdrawal rate widens as the remaining horizon shortens.

Initial withdrawal estimates

MWEPV · HORIZON 90

5.49%

₹5,49,220 in year one

LAWR · HORIZON 88

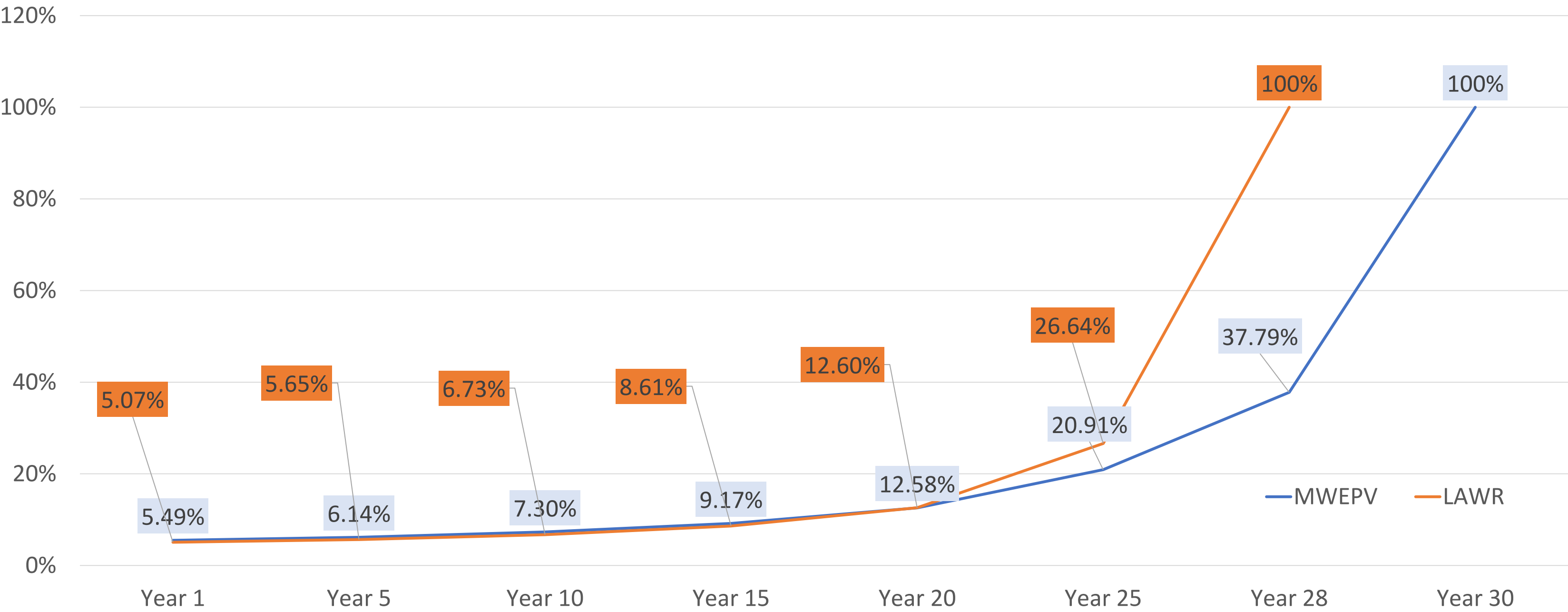
5.07%

₹5,06,850 in year one

Survival weighting lowers the present value of the projected stream, so MWEPV implies a higher rate on the same corpus. Both estimates then enter the same execution engine.

The withdrawal rate rises as the horizon shortens

SWR under both methods - Base case

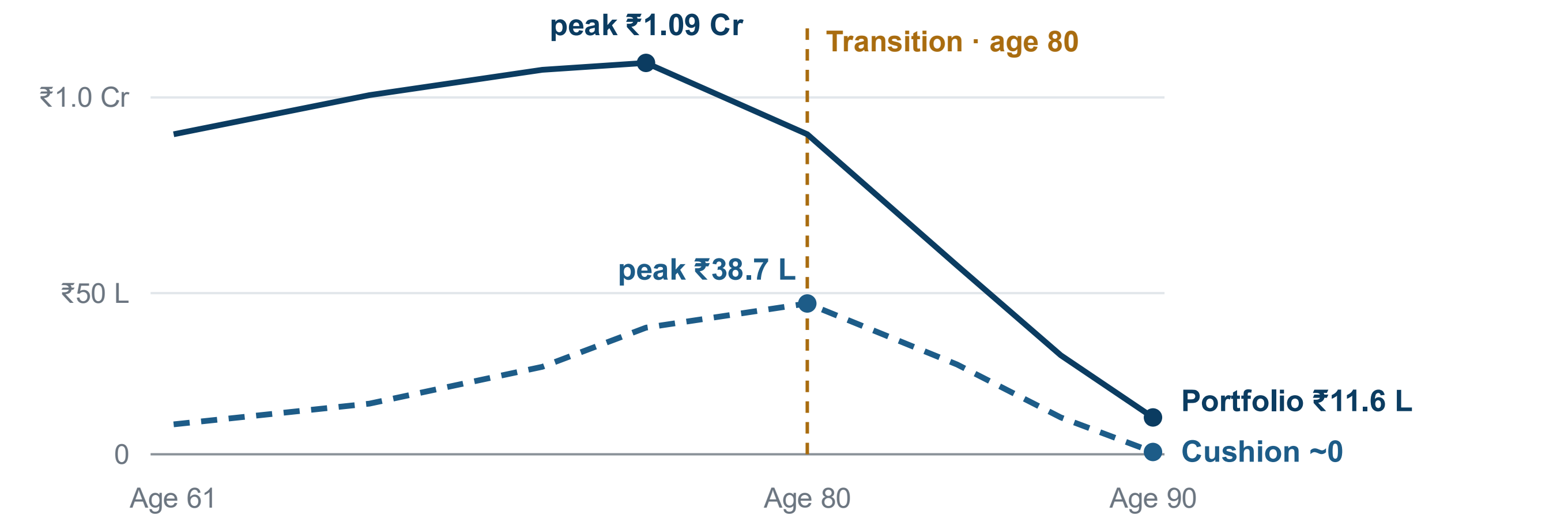


Operative withdrawal rate, base case. Operative equals estimated at every point shown — no governance constraint binds.

Portfolio builds, then transfers to the cushion

Indicative anchors from the annual base-case output.

MWEPV



Under LAWR: portfolio peak $\approx$ ₹1.17 Cr, cushion peak $\approx$ ₹33.8 L.



A different start, a comparable total

BASE-CASE OUTCOME	MWEPV	LAWR
Initial base withdrawal rate	5.49%	5.07%
Cumulative withdrawal	₹3.64 Cr	₹3.66 Cr
Peak portfolio	₹1.09 Cr	₹1.17 Cr
Peak cushion	₹38.7 L	₹33.8 L
Withdrawal rate at year 25	20.91%	26.64%

Layer 1 sets the starting assessment. Layer 2 shapes the path. Neither method is universally preferable — both run on the same transparent architecture.

06

Scenario analysis



Six economic environments; retiree, portfolio and governance held constant

Six economic scenarios



SCENARIO	EQUITY	BONDS 3Y/10Y	GOLD	CASH	CPI	WTD. RETURN	PRINCIPAL FEATURE
S1 Base case	9.65%	7.50 / 7.80	13.50%	6.00%	6.00%	8.75%	Reference experience
S2 Favourable returns	12.50%	7.75 / 8.00	12.00%	6.25%	6.00%	10.00%	Stronger returns, lower inflation
S3 Adverse returns	5.00%	7.00 / 6.75	15.00%	5.75%	6.00%	6.75%	Weaker investment returns
S4 High inflation	9.65%	7.50 / 7.80	15.00%	6.00%	9.00%	8.75%	Elevated inflation, lower real returns
S5 Adverse sequence	time-dep.	time-dep.	time-dep.	time-dep.	6.00%	3.95→8.87%	Adverse experience early in retirement
S6 Combined stress	3.00%	5.50 / 5.75	14.00%	5.50%	9.00%	6.00%	Weak returns with elevated inflation

Weighted average portfolio return computed on the base 40/20/20/10/10 allocation (equity · 3Y · 10Y · gold · cash). Empirically grounded stress environments, not forecasts — demographics, portfolio, methodology and governance parameters unchanged throughout.

Adverse sequence: the damage is in the timing

PERIOD	EQUITY	BONDS 3Y/10Y	GOLD	CPI	WEIGHTED RETURN
Years 1–3	-10%	6.00 / 6.00	10%	6.00%	3.95%
Years 4–5	3%	6.50 / 6.50	12%	6.00%	5.58%
Years 6–10	9%	7.50 / 7.80	13.50%	6.00%	8.61%
Year 11 onward	9.65%	7.50 / 7.80	13.50%	6.00%	8.87%

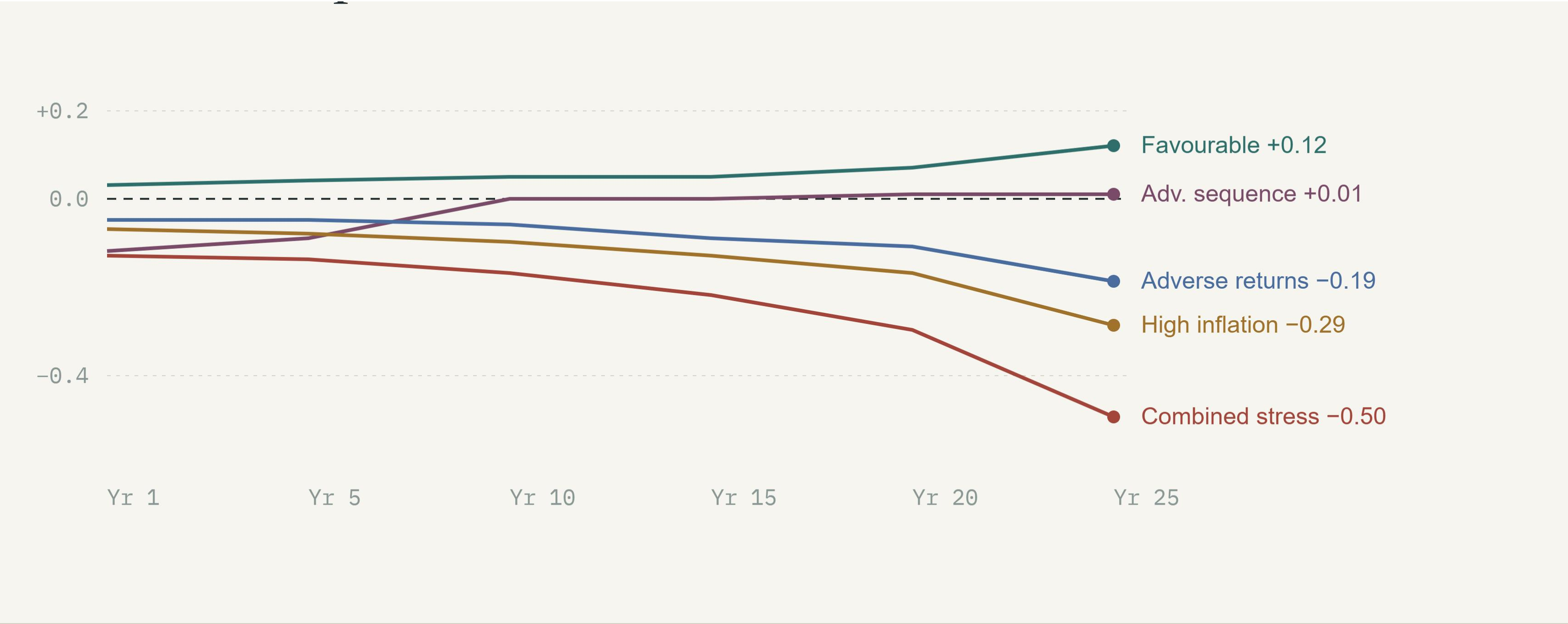
Adverse experience is concentrated where the corpus is largest, then followed by recovery and normalisation — isolating timing from severity.

Withdrawal rates under the six scenarios

OPERATIVE SWR	YR 1	YR 5	YR 10	YR 15	YR 20	YR 25
Base case	5.49%	6.14%	7.30%	9.17%	12.58%	20.91%
Favourable returns	5.52%	6.18%	7.35%	9.22%	12.65%	21.03%
Adverse returns	5.44%	6.09%	7.24%	9.08%	12.47%	20.72%
High inflation	5.42%	6.06%	7.20%	9.04%	12.41%	20.62%
Adverse sequence	5.37%	6.05%	7.30%	9.17%	12.59%	20.92%
Combined stress	5.36%	6.00%	7.13%	8.95%	12.28%	20.41%

Estimated rates are identical across scenarios by construction; all differentiation appears in the operative rate.

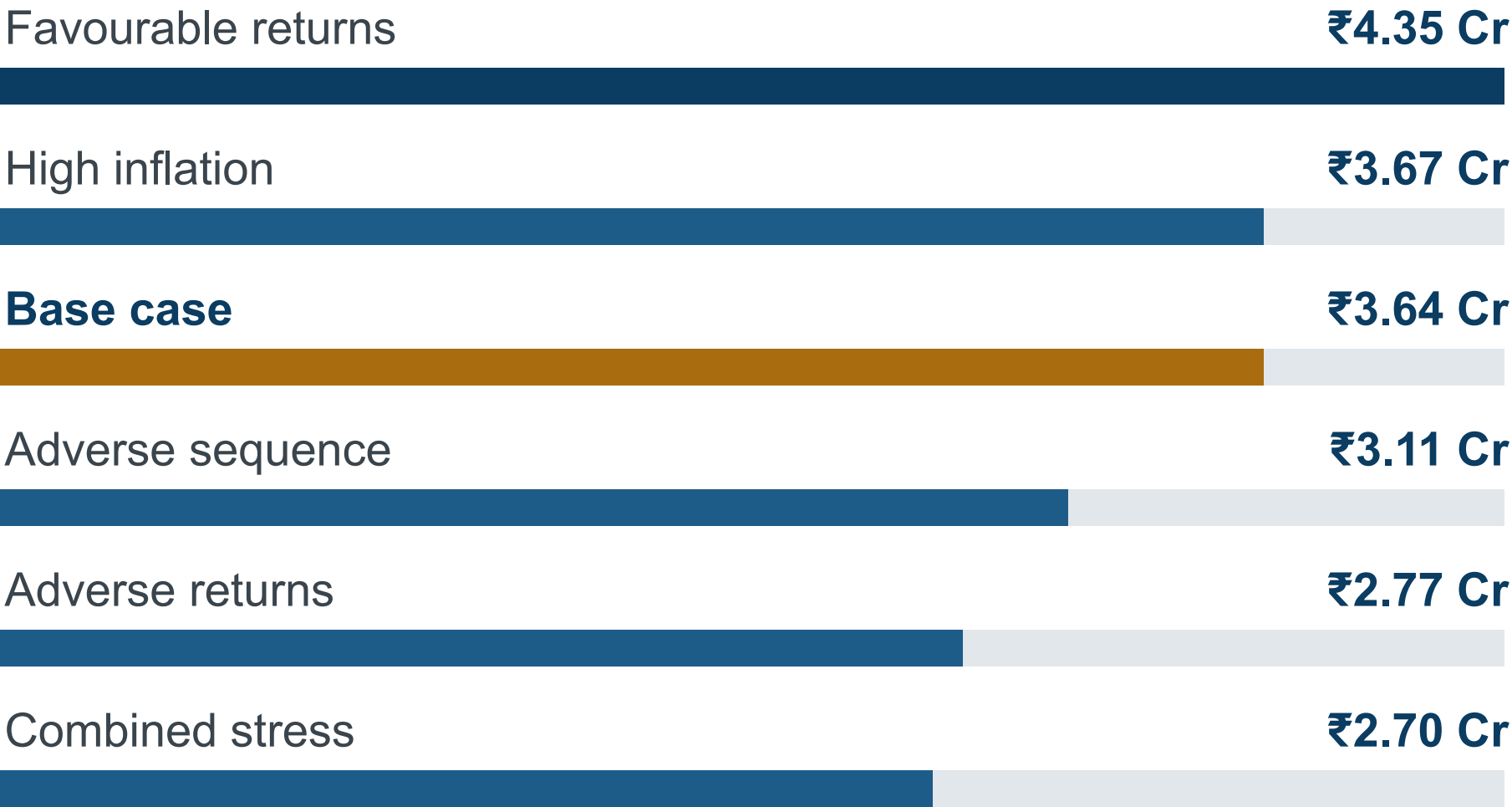
Deviation of operative withdrawal from base case



Percentage points versus base case. Base case is the zero reference line.

Under LAWR the same pattern widens: +0.16 pp to -0.63 pp by year 25.

Small annual differences, large lifetime gaps



₹1.65 Cr

spread in total operative withdrawal across scenarios

₹0.45 Cr

cushion transition contribution in most scenarios; zero deficit transfer throughout

07

Governance parameter sensitivity



Not a search for optimal settings — a test of behavioural role



What was varied, and what was not

TESTED

±25% SWR ceiling schedule	78 / 80 / 82 Transition age	0 / 5 / 10% Reinvestment proportion
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NOT PRESENTED AS STANDALONE

Rolling-average period (±2 years) produced no change in the withdrawal path

Run on the MWEPV implementation, with a limited LAWR comparison to confirm the effects are not specific to the estimation method.

The ceiling binds locally



SWR CEILING ±25% · OPERATIVE RATE

YEAR	-25%	BASE	+25%
1	5.49%	5.49%	5.49%
5	5.63%	6.14%	6.14%
10	5.63%	7.30%	7.30%
15	7.50%	9.17%	9.17%
20	13.04%	12.58%	12.58%
25	21.94%	20.91%	20.91%

AGE-DEPENDENT CEILING SWR SCHEDULE

60–70	7.50%	81–83	22.50%
71–75	10.00%	84–85	25.00%
76–79	15.00%	86	50.00%
80	20.00%	87+	100.00%

A higher ceiling changes nothing — the path never reaches it.

Transition age and reinvestment proportion



TRANSITION AGE ±2 YEARS

MEASURE	78	BASE 80	82
Portfolio at transition	₹99.18 L	₹90.55 L	₹78.72 L
Cushion at transition	₹33.80 L	₹38.70 L	₹44.30 L
Cumulative withdrawal	₹3.59 Cr	₹3.64 Cr	₹3.70 Cr
Portfolio at end	₹11.62 L	₹11.62 L	₹11.62 L

Timing of the shift changes the split between pools and lifetime income — not the terminal portfolio.

REINVESTMENT · FAVOURABLE RETURNS

SETTING	PORTFOLIO AT END	EXCESS TO CUSHION
0%	₹15.70 L	—
Base 5%	₹15.36 L	₹2.04 L
10%	₹15.04 L	₹4.04 L

A clean allocation trade-off: more favourable experience into the reserve means less retained in the portfolio.

Governance parameters are components of an interacting mechanism — not independent determinants of the withdrawal rate. No single setting is universally optimal.

08

Benchmarking against established rules



Context, not a ranking

Outcomes under the same six scenarios



SCENARIO	DSWR · MWEPV		BENGEN 4%		GUYTON-KLINGER		FLAT 5%	
	WITHDRAWN	AT 90	WITHDRAWN	AT 90	WITHDRAWN	AT 90	WITHDRAWN	AT 90
Base case	3.64	0.12	3.39	1.79	2.65	3.26	3.31	0.00
Favourable returns	4.35	0.16	3.39	4.78	3.31	4.88	4.24	1.17
Adverse returns	2.77	0.07	2.62	0.00	1.91	1.81	2.08	0.00
High inflation	3.67	0.13	3.18	0.00	2.62	3.21	2.45	0.00
Adverse sequence	3.11	0.10	3.11	0.00	2.70	2.20	2.14	0.00
Combined stress	2.70	0.08	2.11	0.00	1.90	1.81	1.82	0.00

All figures in ₹ crore. 0.00 at age 90 means the portfolio was exhausted earlier — Bengen exhaustion ages 88, 85, 89 and 80; Flat 5% as early as 77 under combined stress. DSWR figures are total operative withdrawal and terminal portfolio plus cushion.

DSWR pays the most in every scenario and never exhausts — its low terminal balance is intended, not incidental: the corpus is deliberately utilised to the terminal age.

Sustainability is not the same as adequacy



GUYTON-KLINGER · BASE CASE

2.65

₹Cr withdrawn

3.26

₹Cr left at 90

More capital preserved than income delivered.

GUYTON-KLINGER · COMBINED STRESS

1.90

₹Cr withdrawn

1.81

₹Cr left at 90

Sustained through 18 capital-preservation adjustments.

A framework can preserve capital to a high degree while limiting what is available to consume — often in the earlier and middle years, when the ability and willingness to spend is greatest.

Different rules, different implicit weights



Bengen 4%

Simplicity, with greater vulnerability to adverse experience.

Flat 5%

Higher income in favourable conditions, earlier depletion otherwise.

Guyton–Klinger

Strong preservation via discrete cuts; lower income, large residual.

DSWR

Dynamic estimate plus experience adjustment, governance controls and a cushion.

The proposition is not that established rules are obsolete — it is that a withdrawal rule calibrated in one environment should be reassessed as inflation, returns, longevity, portfolio composition and objectives change.

THANK YOU

Discussion



Framework architecture

Governance rules

Deterministic results