Institutional investors: plans, policies and portfolios

Portfolio Construction

1 A story: two families, one pension promise

- Two families, equal savings, different safety nets
- A DB plan: the sponsor stands behind the promise
- Maya Okafor checks five things around the assets
- Funded, sponsor, link, plan design, members

IN THE LESSON

- Picture two families with equal savings and the same promise to pay a pension.
- The first has a rich uncle who will happily top up any shortfall.
- The second has a cousin with a shaky job, who loses work in exactly the years the savings fall.
- Same savings, very different room for risk.
- A defined benefit pension plan is like that.
- It promises members a pension, and the sponsor, the company behind it, stands behind the promise.
- Maya Okafor's first client is the Hartwell Engineering Pension Plan.
- Before she looks at a single investment, she checks five things around the assets.
- Together they tell her how much risk the plan can take.

2 The five factors in one picture

Room for risk

Funded status → Sponsor strength → Sponsor and plan assets

Cash and horizon

Plan design → Workforce

IN THE LESSON

- Here are the five factors as a picture.
- The top row is about room for risk.
- Start with funded status, which is plan assets divided by the present value of the promised benefits.
- More assets than liabilities is a cushion.
- Next, sponsor strength.
- A profitable company with little debt can top the plan up.
- The third box is the link between the two.
- If the sponsor earns less in exactly the years the plan's assets fall, contributions are needed when the sponsor is weakest.
- The bottom row is about cash and horizon.
- Plan design, such as early retirement or lump sum options, lets members take money out sooner.
- And a workforce with many retirees means large payments soon, which shortens the horizon.

3 Example 1: funded status against the sponsor

Plan assets 900m; liabilities 1,000m; sponsor worth 400m

Funded status	900 ÷ 1,000	**90%**
Deficit	1,000 − 900	**100m**
Deficit against sponsor value	100 ÷ 400	**25%**
Top-up over 7 years	100 ÷ 7	**14.3m**
Top-up against profit of 80m	14.3 ÷ 80	**17.9%**

IN THE LESSON

- Start with the numbers for the Hartwell Engineering Pension Plan.
- Its assets are nine hundred million, and the present value of its liabilities is one thousand million.
- Funded status is assets divided by liabilities, which is ninety per cent.
- So the plan has a deficit of one hundred million.
- Set that against the sponsor.
- Hartwell Engineering is worth four hundred million, so the deficit is a quarter of the company's value, twenty five per cent.
- Suppose the sponsor must close the gap over seven years.
- That is about fourteen point three million a year, which is seventeen point nine per cent of its yearly profit of eighty million.
- Manageable, but not small.
- The cushion is thin and the sponsor's help is limited.

4 Example 2: a bad year hits both

Equities 450m fall 25%; sponsor profit falls 40% to 48m

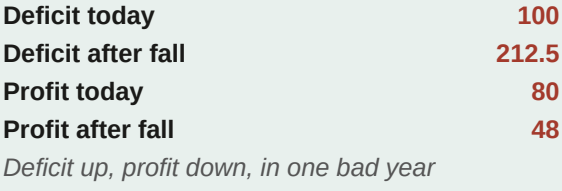
Loss on equities	450 × 25%	**112.5m**
Assets after the fall	900 − 112.5	**787.5m**
Funded status	787.5 ÷ 1,000	**78.8%**
Deficit now	1,000 − 787.5	**212.5m**
Top-up against profit of 48m	212.5 ÷ 7 ÷ 48	**63.2%**

IN THE LESSON

- Now a bad year.
- Maya Okafor asks what happens if equities fall twenty five per cent and the sponsor's profit falls forty per cent, to forty eight million, because both depend on the same economy.
- The plan holds four hundred and fifty million in equities, so it loses one hundred and twelve point five million.
- Assets drop to seven hundred and eighty seven point five million.
- Funded status falls to seventy eight point eight per cent, and the deficit more than doubles, to two hundred and twelve point five million.
- Spread over the same seven years, the top up is now sixty three point two per cent of the sponsor's profit.
- The money is needed exactly when the sponsor can least afford it.

5 The scissors: deficit up, profit down

Millions



Deficit up, profit down, in one bad year

IN THE LESSON

- Here are the same figures as bars, in millions.
- The vertical axis is millions, and each bar is labelled underneath.
- The first red bar is the deficit today, one hundred.
- The second red bar is the deficit after the bad year, two hundred and twelve point five.
- Now the green bars.
- The sponsor's profit today is eighty.
- After the bad year it is forty eight.
- Notice the scissors.
- The red bars rise while the green bars fall, in the very same year.
- A plan holding cyclical industrial shares, close to the sponsor's own business, makes this worse.
- The rule is to avoid assets that move with the sponsor's fortunes.

6 Reading the plan: all factors together

Hartwell Engineering Pension Plan: the factors read together

Factor	Reading
Funded status 90%	Thin cushion
Deficit 25% of sponsor	Limited help
Sponsor and assets	Move together
Design and workforce	Cash soon

IN THE LESSON

- Now read all of it together, which is what the exam asks.
- Funded status is ninety per cent: a thin cushion, not a generous one.
- The deficit is a quarter of the sponsor's value, so the sponsor can give only limited help.
- The sponsor and the plan's assets move together, so help may not arrive when it is needed.
- Finally, plan design and workforce: lump sum options and many retirees mean cash is needed soon.
- Read down the table and every row points the same way.
- So Maya's recommendation, proposed and defended, is a modest return seeking portfolio, a bigger share in bonds that match the liabilities, no cyclical industrial shares, and enough liquid assets for the payments.
- Each part of the advice ties back to a factor, and that earns marks.

7 Example 3: plan design and the workforce

Hartwell plan: assets 900m, bonds are 30% of assets

Pensions paid each year		**70m**
Lump sums taken each year		**40m**
Total cash out	110 ÷ 900 = 12.2% of assets	**110m**
Bonds held	30% of 900	**270m**
Years of payments covered	270 ÷ 110	**2.5**

IN THE LESSON

- Plan design and workforce shape the cash the plan needs.
- In the Hartwell plan, retirees are owed seventy million of pensions every year, and members who choose a lump sum at retirement take another forty million out.
- Total cash going out is one hundred and ten million a year, which is twelve point two per cent of the nine hundred million in assets.
- The plan holds thirty per cent in bonds, two hundred and seventy million.
- That covers about two and a half years of payments, two hundred and seventy divided by one hundred and ten.
- Lump sums do not change what is owed in total.
- They change when the money is wanted, and they shorten the horizon.

8 A story: the ship's chart

- A chart must fit the ship, the cargo and the crew
- An institutional IPS is the chart for the money
- Judging it means testing that the parts agree
- A complete IPS can still be a bad one

IN THE LESSON

- Think of a ship's chart.
- It names the destination, the cargo, the harbours the ship can reach and who is steering.
- But a chart is only useful if all of that fits together.
- A chart that sends a slow barge across an ocean in a week is complete, and still wrong.
- An investment policy statement is the chart for an institution's money.
- Maya Okafor now moves from the pension plan to the Hartwell College endowment's policy statement.
- Her job is not to admire it.
- Her job is to test whether its parts agree: whether the return it wants can be earned with the allocation it chooses, whether the cash is there when money must be paid, and whether the rules match the law and the liabilities.

9 What a good policy statement contains

What the money is for

Mission and objectives → Return and risk → Constraints

How it is run

Allocation, ranges, benchmark → Rebalancing and governance → Reporting and review

IN THE LESSON

- Here is what a good institutional policy statement contains, in the order it is built.
- The top row says what the money is for.
- First, the mission and objectives: why the institution exists and what the portfolio must support.
- Then the return target and the risk tolerance.
- Then the constraints, which are liquidity, time horizon, legal and regulatory rules, tax, and any unique circumstances, such as a ban on certain investments.
- The bottom row says how it is run.
- The strategic allocation, with ranges around each weight and a benchmark to judge it against.
- A rebalancing policy and clear governance, meaning who decides what.
- And finally reporting and review, so the whole thing is checked on a schedule.
- Missing parts matter, but mismatched parts matter more.

10 The required return

Required return = (1 + spending) × (1 + inflation) × (1 + costs) − 1

Spending rate	Share paid out each year
Inflation	Keeps the buying power
Costs	Fees and running costs
Required return	Compounded, not added

IN THE LESSON

- An endowment promises to support its college for ever, so its first test is the required return.
- It has to cover three things: the spending it pays out, inflation, which erodes what the money can buy, and the costs of running the portfolio.
- These do not simply add up, because each is a percentage of a pot that has already changed by the others.
- So we compound them.
- Multiply one plus the spending rate, by one plus inflation, by one plus costs, and subtract one.
- Keep this one in memory, because the exam often offers the simple sum as a wrong answer.
- The simple sum is slightly too low, since it ignores the way the pieces build on each other.

11 Example 4: the college's required return

Spending 5%, inflation 2.5%, costs 0.5%

Spending and inflation	1.05 × 1.025 − 1	**7.63%**
Add costs	1.07625 × 1.005 − 1	**8.16%**
Simple sum of the three	5 + 2.5 + 0.5	**8.0%**
Gap from compounding	8.16 − 8.0	**0.16 points**

IN THE LESSON

- The Hartwell College policy statement sets spending at five per cent, expects inflation of two and a half per cent, and expects costs of half a per cent.
- Multiply one point oh five by one point oh two five, subtract one, and spending and inflation together need seven point six three per cent.
- Now multiply the one point oh seven six two five by one point oh oh five for costs, and subtract one.
- The required return is eight point one six per cent.
- Compare that with the simple sum, five plus two and a half plus a half, which is eight per cent.
- The difference, sixteen hundredths of a point, looks tiny.
- Still, it is the answer the curriculum wants, and over decades it adds up.

12 Example 5: can the allocation deliver it?

Allocation: equities 55%, bonds 35%, property 10%

Equities	55% × 7.0%	**3.85%**
Bonds	35% × 3.0%	**1.05%**
Property	10% × 6.0%	**0.60%**
Expected return	3.85 + 1.05 + 0.60	**5.50%**
Shortfall	8.16 − 5.50	**2.66 points**

IN THE LESSON

- Next, can the allocation deliver that eight point one six?
- The policy statement's strategic allocation is fifty five per cent equities, expected to earn seven per cent, thirty five per cent bonds at three per cent, and ten per cent property at six per cent.
- Weight times return gives three point eight five, one point oh five and point six.
- The expected return is five point five per cent.
- The shortfall against the requirement is two point six six points a year.
- Here is the sharper point.
- Even if the college put everything into equities, the expected return would be seven per cent, still below eight point one six.
- So no change of mix can close the gap.
- The target is out of reach, so the policy statement contradicts itself.

13 What a shortfall does in ten years

Chart: Real value (start 1.00) vs Years

- Earning 8.16%: stays at 1.00
- Earning 5.5%: ends near 0.78

IN THE LESSON

- Let us see what that shortfall does.
- The horizontal axis is years, nought to ten.
- The vertical axis is the real value of the endowment, its buying power compared with today, which starts at one.
- The grey flat line is the world where the endowment earns exactly the required eight point one six per cent: buying power holds at one.
- The red line is the real world, earning five point five.
- Each year it falls a little further behind, so the red line slopes down.
- After ten years it stands at about seventy eight per cent of where it began.
- That is a loss of more than a fifth of its buying power, even though the balance may look fine.

14 A checklist for any policy statement

Four questions to put to any policy statement

Check	Ask
Return	Reachable?
Liquidity	Cash for payouts?
Constraints	Fit the rules?
Governance	Who decides?

IN THE LESSON

- So here is a checklist for judging any institutional policy statement.
- Each row is a question about whether two parts agree.
- Return: can the allocation earn the required return?
- Liquidity: is there enough cash and short term paper to meet spending and benefits without selling at the worst time?
- Constraints: do they reflect the institution's own law, tax position and liabilities, rather than being copied from another institution?
- Governance: is it clear who decides, who monitors and who can change the ranges?
- In an answer, name the two parts that conflict, show the number, and say what the board could change: spending, the allocation, or its acceptance of lower real value.

15 Mistakes so far

- Reading funded status without the sponsor behind it
- Forgetting profits and plan assets fall together
- Adding the three pieces instead of compounding
- Accepting a target the allocation cannot deliver

IN THE LESSON

- Before we move on, here are the mistakes that cost marks so far.
- First, reading funded status alone, without asking who stands behind the plan.
- A well funded plan with a rich sponsor is very different from one with a weak sponsor, and an underfunded plan with a strong sponsor is different again.
- Second, forgetting that sponsor profits and plan assets can fall together, so that contributions arrive late.
- Third, adding spending, inflation and costs instead of compounding them.
- Fourth, accepting a return target that the allocation cannot plausibly deliver, which is the favourite trap.
- If you remember only one thing from these two outcomes, remember that every part must be tested against the others.

16 A story: a coat for the weather

- One portfolio can suit one investor, sink another
- Start with what is owed, and when
- Then look at what is held
- Four cases: DB plan, reserve fund, endowment, foundation

IN THE LESSON

- A coat that is perfect for a winter hillside is a poor choice for a summer beach.
- The coat is not good or bad.
- It is good or bad for the weather.
- Portfolios work the same way.
- Half the money in private funds is a sensible choice for one institution and a reckless one for another.
- So Maya Okafor always begins with what the institution owes and when, and only afterwards looks at what it holds.
- In this section she judges four Hartwell portfolios: the pension plan, the state reserve fund, the college endowment and the family foundation.
- The trap, which the exam loves, is to judge an allocation on its own, with no reference to liabilities or spending.

17 What each institution needs first

The first question for each Hartwell institution

Institution	Main need
DB pension plan	Hedge liabilities
Reserve fund	Cash when called
Endowment	Perpetual growth
Foundation	Fixed payout

IN THE LESSON

- Here is the question each institution answers first.
- The pension plan owes pensions, so its portfolio should hedge the interest rate risk in those liabilities, in proportion to its funded status and the sponsor's strength.
- The state reserve fund exists to be drawn on when the government's income falls, so it must stay liquid, with short duration assets.
- A savings fund for future generations can hold growth and real assets.
- The college endowment lasts for ever, keeps receiving gifts and smooths its spending, so it can hold substantial alternatives if its governance and liquidity allow.
- The foundation has a minimum yearly payout and no new money coming in, so it needs more liquidity and lower volatility than the endowment.

18 From needs cash to can lock money up

- Reserve fund
- Foundation
- DB plan
- Endowment
- Savings fund

IN THE LESSON

- Let us place the institutions on one line, from needs liquidity on the left to can lock money up on the right.
- Far left is the stabilisation or reserve fund, which may be called on within a month.
- Next comes the private foundation, with a payout due every year and no new gifts.
- Around the middle is the pension plan, whose liquidity need depends on how many members are retired.
- Further right is the college endowment, with an endless horizon, gifts coming in and smoothed spending.
- At the far right is a sovereign savings fund, with no withdrawals planned for decades.
- These are tendencies, not rules.

19 How much of the rate risk is hedged

Hedge ratio = BPV of bonds ÷ BPV of liabilities
BPV ≈ duration × value × 0.0001

Hedge ratio	Share of rate risk hedged
Bond BPV	Bonds' change per basis point
Liability BPV	Liability change per basis point
BPV	Duration × value × 0.0001

IN THE LESSON

- The pension plan's portfolio is judged by how much of the liability's interest rate risk it hedges.
- Liabilities behave like a long bond that the plan has sold.
- When rates fall, their present value rises.
- The basis point value, or B P V, is the change in value for a one basis point move in rates, and it is roughly duration times market value times point oh oh oh one.
- The hedge ratio is the B P V of the hedging bonds divided by the B P V of the liabilities.
- A ratio of one removes the interest rate risk completely.
- The right ratio is not always that high.
- It should rise when the plan is poorly funded or the sponsor is weak, and it can fall when there is a strong cushion.

20 Example 6: the pension plan's portfolio

Liabilities 1,000m (duration 12); bonds 270m (duration 6)

Liability BPV	12.0 × 1,000 × 0.0001	**1.2**
Bond BPV	6.0 × 270 × 0.0001	**0.162**
Hedge ratio	0.162 ÷ 1.2	**13.5%**
Liabilities if rates fall 1 point	1,000 × (1 + 12%)	**1,120**
Funded status falls to	916.2 ÷ 1,120	**81.8%**

IN THE LESSON

- Back to the Hartwell Engineering plan.
- Its liabilities are one thousand million with a duration of twelve, so the liability B P V is one point two million per basis point.
- Its bonds are two hundred and seventy million with a duration of six, so their B P V is point one six two.
- The hedge ratio is point one six two divided by one point two, only thirteen point five per cent.
- Suppose rates fall one percentage point.
- Liabilities rise about twelve per cent, to one thousand one hundred and twenty.
- Bonds gain about six per cent, so assets reach nine hundred and sixteen point two.
- Funded status falls from ninety per cent to eighty one point eight.
- With a thin cushion and limited sponsor help, the hedge ratio should rise, so Maya moves money from equities into longer bonds.

21 Example 7: the reserve fund

Fund 500m: shares 40%, property 25%, bonds 25%, cash 10%

Draw in a bad year	15% × 500	**75m**
Cash on hand	10% × 500	**50m**
Shortfall	75 − 50	**25m**
Equities after a 30% fall	200 × 0.7	**140m**
Share of equities sold	25 ÷ 140	**17.9%**

IN THE LESSON

- Now the Hartwell State Reserve Fund, a stabilisation fund of five hundred million.
- The government may draw up to fifteen per cent within a month, which is seventy five million.
- The fund holds forty per cent in listed equities, twenty five per cent in private property funds, twenty five per cent in bonds and ten per cent in cash.
- Cash is fifty million, so the fund is twenty five million short, and property cannot be sold in a month.
- Suppose the same crisis has cut equities by thirty per cent.
- The two hundred million of equities is now worth one hundred and forty, and the fund must sell nearly eighteen per cent of it, at low prices.
- For a reserve fund this allocation is wrong: it needs more cash and short bonds.
- A savings fund could hold this mix.

22 Example 8: the college endowment

Spend 5% of the 3-year average; last payout 10.0

Average of last three values	(200 + 200 + 140) ÷ 3	**180**
Smoothed payout	5% × 180	**9.0**
Payout on latest value only	5% × 140	**7.0**
Fall from 10.0, smoothed	(10 − 9) ÷ 10	**10%**
Fall from 10.0, unsmoothed	(10 − 7) ÷ 10	**30%**

IN THE LESSON

- Now the college endowment, which has the opposite strengths.
- It lasts for ever and takes in gifts, and it spends a fixed share of the average of its last three year end values, to smooth the payout.
- The spending rule is five per cent.
- Last year it paid ten, which is five per cent of two hundred.
- Suppose the last three values are two hundred, two hundred and one hundred and forty, after a market fall.
- The average is one hundred and eighty, so the smoothed payout is nine.
- If it had used only the latest value, it would pay seven, a cut of thirty per cent.
- With smoothing, the cut is ten per cent.
- That calm spending, plus gifts, lets an endowment hold more private funds.

23 Example 9: the foundation copies the endowment

Foundation 160m: private 45%, equities 40%, bonds and cash 15%

Payout due each year	160m × 5%	**8m**
Bonds and cash	160m × 15%	**24m**
Years of payouts covered	24 ÷ 8	**3**
Equities after a 30% fall	64 × 0.7	**44.8m**
Locked in private funds	160m × 45%	**72m**

IN THE LESSON

- Last, the Hartwell Family Foundation, with one hundred and sixty million in assets.
- Its trustees want to copy the endowment's allocation: forty five per cent in private funds, forty per cent in listed equities, and fifteen per cent in bonds and cash.
- But the foundation must pay out five per cent every year, eight million, and it receives no new gifts.
- Bonds and cash are twenty four million, only three years of payouts.
- If equities fall thirty per cent, its sixty four million of equities become forty four point eight million, and that is the next thing it must sell.
- Meanwhile seventy two million sits in private funds that cannot be sold in time.
- The endowment can carry this mix.
- The foundation cannot.

24 A story: the shop that borrows by the week

- A bank borrows short and lends long
- An insurer collects premiums now, pays claims later
- Assets only matter relative to liabilities
- Banks: rate gap, liquidity, capital. Insurers: claims

IN THE LESSON

- Imagine a shop that buys its stock with money borrowed by the week, but sells on terms that last for years.
- If the cost of borrowing jumps, the shop is squeezed, because its income is fixed while its costs reset.
- A bank is that shop.
- It funds itself with deposits and short term borrowing, and it lends for longer.
- An insurer is a different shop: it collects premiums now and pays claims later.
- Both must look at assets and liabilities together, because what they own only matters relative to what they owe.
- Banks watch the gap in interest rate sensitivity, liquidity and capital ratios.
- Insurers watch how long and how predictable their claims are.

25 When rates rise: a bank's chain

A bank with a positive gap

Rates rise → Assets lose more value → Equity shrinks

What the manager can do

Shorten the assets → Lengthen the liabilities → Hold more capital

IN THE LESSON

- Here is the chain for a bank whose assets are more sensitive to rates than its liabilities.
- Rates rise.
- Both sides lose value, because both are valued by discounting future cash flows, but the assets lose more, since they last longer and are larger.
- Equity is what is left after the liabilities are paid, so equity shrinks, and it shrinks by a lot because equity is a thin slice of the balance sheet.
- The second row shows what the manager can do: shorten the asset duration, lengthen the liability duration, or hold more capital as a buffer.

26 The leverage-adjusted duration gap

Gap = DA − (L ÷ A) × DL
Change in equity ≈ −Gap × A × Δy

Asset duration	Duration of the bank's assets
Liability duration	Duration of its liabilities
Liabilities ÷ assets	Leverage: liabilities share
Duration gap	Positive means equity falls
Change in yield	Parallel move in rates

IN THE LESSON

- The measure is the leverage adjusted duration gap.
- It is the duration of the assets, minus the ratio of liabilities to assets, times the duration of the liabilities.
- The ratio matters because liabilities are smaller than assets, so the liability duration counts for less than its face value.
- A positive gap means equity falls when rates rise.
- To size the damage, multiply the gap by total assets and by the change in yield, with a minus sign.
- Notice that the whole thing is multiplied by assets, not by equity.
- That is why a small gap can wipe out a large share of a thin equity cushion.

27 Example 10: Hartwell Bank

Assets 20bn (duration 4); liabilities 90% of assets (duration 3)

Liabilities	0.9 × 20bn	**18bn**
Equity	20bn − 18bn	**2bn**
Gap	4 − 0.9 × 3	**1.3**
Equity change, rates up 1 point	−1.3 × 20bn × 1%	**−260m**
Share of equity lost	260 ÷ 2,000	**13%**

IN THE LESSON

- Take Hartwell Bank, with assets of twenty billion and an asset duration of four.
- Liabilities are ninety per cent of assets, eighteen billion, with a duration of three, leaving equity of two billion.
- The gap is four, minus point nine times three, which is one point three.
- Now rates rise one percentage point.
- The change in equity is minus one point three, times twenty billion, times one per cent, a loss of two hundred and sixty million.
- Against equity of two billion, that is thirteen per cent of the bank's capital gone from a one point move in rates.
- A bank manager seeing this would reduce the gap, hold more capital, or hedge.

28 Example 11: the matched-durations trap

Same bank, both durations set to 4.0

Matched durations	both 4.0	**4.0**
Gap	4.0 − 0.9 × 4.0	**0.4**
Equity change, rates up 1 point	−0.4 × 20bn × 1%	**−80m**
Share of equity lost	80 ÷ 2,000	**4%**
Liability duration for zero gap	4.0 ÷ 0.9	**4.44**

IN THE LESSON

- Now the classic trap.
- The treasurer says: we have matched our durations, so we are safe.
- Set both durations to four.
- The gap is four, minus point nine times four, which is point four, not zero.
- A rise of one point costs minus point four, times twenty billion, times one per cent, which is eighty million, four per cent of equity.
- Smaller, but real, because there is more asset than liability.
- To get a gap of zero, the liability duration has to be four divided by point nine, about four point four four, which is longer than the asset duration.
- So if an exam says a bank has matched durations and high leverage, do not say it has no rate risk.

29 Banks and insurers side by side

What shapes each balance sheet

Institution	Asset stance
Bank	Gap matched
Life insurer	Long bonds
Casualty insurer	Short, liquid
Shared rule	Liabilities first

IN THE LESSON

- Now insurers, and a comparison.
- A bank manages a gap and keeps liquid assets against sudden withdrawals.
- A life insurer writes long contracts such as annuities, where the claims are far in the future and fairly predictable.
- So it holds long bonds that match those liabilities.
- A property and casualty insurer covers storms, accidents and theft.
- Its claims are shorter and far less predictable, so it holds shorter, more liquid assets.
- Notice that all three share one rule: the liabilities come first and shape the portfolio.
- They do not all share a long horizon and a high tolerance for illiquidity, even though they are all institutional investors.
- A director who says they should follow similar approaches has fallen for an exam trap.

30 Example 12: why a casualty insurer holds cash

Casualty insurer, assets 800m, 15% in short liquid assets

Claims beyond premiums, normal		**60m**
Claims beyond premiums, storm	60 × 3	**180m**
Short liquid assets	15% × 800	**120m**
Shortfall in a storm year	180 − 120	**60m**
Liquid share to cover a storm	180 ÷ 800	**22.5%**

IN THE LESSON

- Here is why predictability matters, using Hartwell Mutual, a property and casualty insurer with eight hundred million of assets.
- In a normal year its claims run sixty million beyond the premiums it receives.
- In a storm year, claims beyond premiums are three times as high, one hundred and eighty million.
- Suppose it holds fifteen per cent in short liquid assets, which is one hundred and twenty million.
- That covers a normal year but is sixty million short in a storm.
- To cover a storm from liquid assets it would need one hundred and eighty over eight hundred, twenty two point five per cent.
- A life insurer's payments can be forecast decades ahead, so it can buy long bonds.

31 Recap: the lesson in five lines

- DB risk: funded, sponsor, link, design, workforce
- IPS: compound the return, then test the parts
- Portfolio: judge it against what is owed and when
- Hedge ratio = bond BPV ÷ liability BPV
- Bank gap = DA − (L ÷ A) × DL; matched is not immune

IN THE LESSON

- Let us pull the lesson together.
- First, a defined benefit plan's room for risk comes from five things: funded status, sponsor strength, the link between the sponsor and the assets, plan design, and the workforce.
- Second, judge a policy statement by testing whether its parts agree, starting with the compounded required return.
- Third, judge every portfolio against what the institution owes and when: the pension plan by its hedge ratio, the reserve fund by its liquidity, the endowment by its horizon and smoothing, and the foundation by its payout.
- Fourth, the bank gap is asset duration minus liabilities over assets times liability duration, and matched durations are not immunity.
- Fifth, insurers put liabilities first.

32 Try three quick questions

1. Spend 4%, inflation 3%, costs 1%. Required return?
   Answer: 1.04 × 1.03 × 1.01 − 1 = 8.19%.
2. Assets 50bn, DA 5, DL 4, L÷A 0.8. Rates +0.5pt: equity?
   Answer: Gap 5 − 0.8 × 4 = 1.8; −1.8 × 50bn × 0.5% = −450m.
3. Foundation 120m pays 5%, holds 18m safe. Years covered?
   Answer: Payout 6m; 18 ÷ 6 = 3 years.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A foundation spends four per cent, expects inflation of three per cent and costs of one per cent.
- What is the required return?
- Compounding gives about eight point one nine per cent.
- Question two.
- A bank has assets of fifty billion, an asset duration of five, a liability duration of four, and liabilities at point eight of assets.
- What happens to equity if rates rise half a point?
- The gap is five minus point eight times four, which is one point eight.
- Times fifty billion, times half a per cent, gives a loss of four hundred and fifty million.
- Question three.
- A foundation with one hundred and twenty million pays out five per cent a year and holds eighteen million in bonds and cash.
- How many years of payouts is that?
- The payout is six million, so eighteen divided by six is three years.