CHARTA LEARNING · LESSON NOTES

Factors, liabilities and goals

Asset Allocation

1 A story: the labels on the jars

- Labels say what a fund is called
- Factors say what drives its return
- Market, size, value, momentum, quality
- Also duration, credit and currency

IN THE LESSON

- Picture two jars in a shop.
- One is labelled organic honey, the other wildflower honey.
- They sound different, so you might buy both to be diverse.
- Then you read the ingredients, and both are mostly the same flowers.
- The label told you the name, the ingredients told you what is inside.
- Asset allocation has the same problem.
- Two funds with different labels can be driven by the same forces.
- Those forces are called investment factors: rewarded drivers of return that are shared by many securities, such as the market, size, value, momentum, quality, and also duration, credit and currency.
- Hana wants to look at the ingredients in the Calder Works plan.

2 Two uses of factors

Build: factors first

Choose factor exposures → Pick funds or derivatives → Count the costs

Analyse: holdings first

Regress returns on factors → Read the exposures → Spot the same bet

IN THE LESSON

- Factors help in two directions, and the exam wants you to know both.
- On the top row is building an allocation.
- You start from the factors, not the asset classes.
- You decide how much of each rewarded factor to hold, and each non market factor is expressed as a long short portfolio, for example buying cheap shares and selling expensive ones, which isolates its premium.
- Then you choose how to implement it, with index funds, factor funds or derivatives, and you count the costs.
- On the bottom row is analysing a portfolio you already own.
- You run a regression of its returns on factor returns, read the exposures, and find out whether two holdings are really the same bet.

3 Reading a portfolio through factors

R − Rf = α + β1 × F1 + β2 × F2 + ε

Alpha	Return left after the factors
Factor exposure	How strongly it leans on each
Factor return	Long short portfolio's return
Specific error	Noise from the holdings

IN THE LESSON

- This is the regression Hana runs.
- The portfolio's return above the risk free rate is explained by its exposure to each factor times that factor's return, plus alpha, plus an error.
- Each exposure, or beta, says how strongly the portfolio leans on a factor.
- Alpha is the part left over once the factors have been paid for, so it is the nearest thing to genuine skill.
- The error is noise specific to the holdings.
- The regression also reports how much of the variation the factors explain, the R squared.
- When it is high, most of what the manager delivers could be bought as factor exposure, and only a small part comes from stock picking.

4 Example 1: two managers, one bet

Fees 0.8% each. Premiums: market 5%, value 2%. R² 93% for both

Manager X	0.98×5% + 0.45×2%	**5.80%**
Manager Y	0.95×5% + 0.50×2%	**5.75%**
Manager fee	each charges	**0.80%**
Factor fund fee	market ≈1, value ≈0.5	**0.25%**
Fee saved	0.80 − 0.25	**0.55%**

IN THE LESSON

- Example one.
- The Calder Works plan pays two equity managers, X and Y, a fee of point eight per cent each.
- X calls itself deep value, Y calls itself dividend focused.
- Hana regresses both.
- The factors explain ninety three per cent of each manager's variance.
- Take a market premium of five per cent and a value premium of two.
- Manager X has a market exposure of point nine eight and a value exposure of point four five, so its factor return is four point nine plus point nine, which is five point eight per cent.
- Manager Y gives five point seven five.
- They are nearly the same portfolio.
- A value factor fund charging point two five per cent gives about the same exposures, a saving of point five five per cent a year.

5 Why factors diversify, and what they cost

- Factor returns can have low correlations
- So a mix of factors can diversify
- But shorting, gearing and turnover cost money
- Count the costs before claiming the premium

IN THE LESSON

- There is a reason to like factors beyond fees.
- Factor portfolios can have low correlations with each other, so a mix of several rewarded factors can diversify better than a mix of asset classes that all lean on the market.
- That is the case for building from factors.
- Now the trap.
- A factor premium on paper is not a premium in your pocket.
- Isolating a premium needs short positions, and often gearing, and the portfolios turn over, so there are borrowing costs, trading costs and shorting fees.
- A candidate who recommends a factor allocation without counting those costs has not finished the job.
- In Hana's report, the fee saving has to survive them.

6 A story: two promises

- Same value today, different behaviour
- Fixed and nominal: behaves like a bond
- Linked to pay or prices: moves with inflation
- Read the liability before you choose the hedge

IN THE LESSON

- Imagine two promises, each worth the same today.
- The first says: I will pay you a fixed sum on a fixed date.
- The second says: I will pay you a sum that grows with the price of bread, or with your salary, and only if you are still alive.
- Both have the same present value, yet they behave very differently when inflation moves, and they call for different assets.
- That is the idea behind this outcome.
- Before choosing a hedge, you read the liability.
- At Calder Works, the retired members hold the first kind of promise.
- The active members hold something closer to the second, because their benefits follow their final salaries.

7 Features that matter

Ask each question, then see what it points to

Fixed amount and date	**Nominal bonds**
Contingent on events	**Scenarios**
Sensitive to interest rates	**Duration**
Linked to prices or wages	**Linkers**
Quasi, like a spending target	**Softer**

IN THE LESSON

- Here are the features Hana checks, each paired with what it points to.
- First, is the liability fixed in amount and date, or contingent on events such as deaths or claims?
- A fixed one looks like a nominal bond.
- A contingent one cannot be treated as a bond, so you add scenarios.
- Second, how sensitive is it to interest rates?
- That is its duration, and convexity refines it.
- Third, is it linked to prices or wages?
- Then inflation linked bonds belong in the hedge.
- Fourth, is it a legal obligation or a quasi liability, such as an endowment's spending target?
- A quasi liability is softer, so there is more room to take risk.

8 How far a liability moves

$\Delta\text{Value} \approx -\text{Duration} \times \Delta\text{yield} \times \text{Value}$

Duration	Rate sensitivity of the piece
Change in yield	Rise in yield, as a decimal
Present value	Size of the piece today

IN THE LESSON

- To hedge a liability you need to know how much it moves when rates move.
- The rule of thumb is that the change in present value is about minus the duration times the change in yield times the present value.
- Duration is the sensitivity of value to a change in yield, so the longer the duration, the harder the value falls when yields rise.
- When a plan has several pieces, its overall duration is the average of the pieces' durations, weighted by their sizes.
- This is only a first order estimate.
- For large yield moves, convexity matters too.
- But this is enough to see whether a hedge matches.

9 Example 2: the hedge that failed

Inflation +1 pt, real rates flat. Retirees 600 (D 8), actives 400 (D 20)

Liability duration	(600×8 + 400×20) ÷ 1,000	**12.8**
Bond assets after	1,000 × (1 − 0.128)	**872**
Retiree liability	600 × (1 − 0.08)	**552**
Active liability	pay rise offsets yields	**400**
Surplus change	872 − (552 + 400)	**−80**

Fix: hold 400 in inflation linked bonds and the loss disappears

IN THE LESSON

- Example two, using the main Calder Works plan scaled to round numbers.
- Retirees' fixed pensions are six hundred, with a duration of eight.
- Active members' salary linked benefits are four hundred, with a duration of twenty.
- The weighted duration is six hundred times eight plus four hundred times twenty, over one thousand, which is twelve point eight.
- The plan holds one thousand of nominal bonds with that duration.
- Now inflation rises by one point, real rates are unchanged, and pay rises with inflation.
- Yields rise one point, so the bonds fall to eight hundred seventy two.
- The retiree liability falls to five hundred fifty two.
- The active liability stays at four hundred, because higher pay offsets the higher yield.
- Liabilities are nine hundred fifty two, and the surplus falls by eighty.

10 From bond like to growth linked

- Retirees' fixed pensions
- Indexed annuities
- Salary linked benefits
- Endowment spending target

IN THE LESSON

- Here is a line to place liabilities on.
- On the left are those that behave like bonds, on the right those that move with growth, wages and markets.
- Retirees' fixed pensions sit on the far left, and nominal bonds of matching duration are their natural hedge.
- Next come indexed annuities, which rise with prices, so inflation linked bonds hedge them.
- Further right are salary linked benefits for active members, where linkers form the core of the hedge, with some growth assets alongside because wages track the economy over time.
- At the far right sits an endowment's spending target, a quasi liability tied to the market value of the endowment, which can sensibly be backed by growth assets.

11 Three ways to allocate against liabilities

Three families, from flexible to fully joint

Surplus optimisation	mean variance on surplus	**Flexible**
Hedge and return seek	may be partial, rising	**Simple**
Integrated asset liability	both sides together	**Banks**

IN THE LESSON

- Now we turn to methods.
- There are three families.
- Surplus optimisation takes ordinary mean variance analysis and applies it to the surplus, assets minus liabilities, so it accounts for how assets and liabilities move together.
- It is flexible, but it inherits the weaknesses of mean variance optimisation, such as sensitivity to expected return forecasts.
- The hedging and return seeking approach splits assets into a portfolio matched to the liabilities, often duration matched bonds or swaps, and a second portfolio that seeks growth.
- It is simple to explain.
- A variant is the partial or conditional hedge, which raises the hedge as funding improves.
- Finally, the integrated approach chooses assets and liabilities together, which only banks and insurers, who control both sides, can do.

12 Surplus optimisation: the rule

$$U = E(Rs) - 0.005 \times \lambda \times \sigma^2 s$$
$$\sigma^2 s = \sigma^2 A + \sigma^2 L - 2 \times \rho \times \sigma A \times \sigma L$$

Surplus return	Expected return of the surplus
Risk aversion	Dislike of surplus variance
Surplus variance	Risk the plan actually bears
Correlation	Assets against liabilities
Volatilities	Of assets and liabilities

IN THE LESSON

- This is the objective that surplus optimisation maximises.
- Utility equals the expected surplus return, minus point zero zero five times lambda, the risk aversion coefficient, times the variance of the surplus return.
- Percentages are entered as whole numbers, which is why the constant is point zero zero five.
- The second line is what makes it a liability relative method.
- The surplus variance is the asset variance, plus the liability variance, minus two times the correlation times both volatilities.
- We write it for a fully funded plan, where assets equal liabilities.
- The higher the correlation between assets and liabilities, the more the last term cancels, and the lower the surplus risk.

13 Example 3: asset only against surplus

λ = 4. X: 7%, vol 12, corr 0.3. Y: 5.5%, vol 10, corr 0.9

X, assets only	7 − 0.02 × 144	**4.12**
Y, assets only	5.5 − 0.02 × 100	**3.50**
X, surplus	3 − 0.02 × 172	**−0.44**
Y, surplus	1.5 − 0.02 × 20	**1.10**
Best on surplus	Y wins	**Y**

Liabilities: grow 4%, volatility 10

IN THE LESSON

- Example three, a fully funded Calder Works plan with risk aversion of four.
- Liabilities grow four per cent with volatility ten.
- Portfolio X expects seven per cent, volatility twelve, correlation point three with the liabilities.
- Portfolio Y expects five and a half, volatility ten, correlation point nine.
- Judged on assets alone, point zero two times the variance is deducted.
- X scores seven minus point zero two times one hundred forty four, which is four point one two.
- Y scores three point five.
- X wins.
- Now the surplus.
- X has a surplus variance of one hundred seventy two and a surplus return of three, so its utility is minus point four four.
- Y has a variance of just twenty and a return of one and a half, so its utility is one point one.
- Y wins.

14 Why the ranking flips

Variance (%²)

X assets	**144**
Y assets	**100**
X surplus	**172**
Y surplus	**20**

IN THE LESSON

- Here is the reason in a picture.
- The vertical axis is variance, in per cent squared.
- The first two bars are the asset variances.
- X has one hundred forty four and Y has one hundred, so X looks only a little riskier.
- The next two bars are the surplus variances.
- X has one hundred seventy two, higher than its asset variance, because it moves little with the liabilities and adds their risk on top.
- Y has just twenty.
- Its volatility is almost as big as the liabilities, yet it moves with them, so the surplus barely moves.
- A portfolio that looks risky on its own can be the safest one for the plan.

15 The two portfolio design and its variants

Hedging and return seeking

Hedge portfolio matches liabilities →
Return seeking portfolio for growth →
Raise hedge as funding improves

Integrated

Choose assets and liabilities together →
Only if you control both sides

IN THE LESSON

- Surplus optimisation is a one step calculation.
- Many sponsors prefer something they can explain in a sentence, and that is the hedging and return seeking design on the top row.
- The first box is the hedging portfolio, built to track the liabilities with duration matched bonds or interest rate swaps.
- The second box is the return seeking portfolio, which pursues growth with whatever the hedge leaves over.
- The third box is the conditional variant, in which the hedge ratio rises as the funded status improves, so gains are banked.
- On the bottom row is the integrated approach, in which assets and liabilities are chosen together, as banks and insurers can do because they control both sides.

16 Mistakes to avoid so far

- Different labels, same factor bet
- Factor premiums ignore shorting and turnover costs
- Nominal bonds alone hedge only nominal liabilities
- Contingent liabilities are not fixed cash flows
- A full hedge on an underfunded plan locks in the gap

IN THE LESSON

- Let us stop and collect the traps from the first three outcomes.
- One: treating two funds with different labels as diversified, when a factor regression shows the same exposures.
- Two: ignoring the shorting, gearing and turnover costs that factor implementation needs.
- Three: hedging with nominal bonds alone when the liabilities are linked to prices or wages, as the failed hedge in example two showed.
- Four: treating contingent liabilities as fixed cash flows, when scenarios are needed.
- Five: applying a full hedge to an underfunded plan, which locks in the deficit when the plan needs growth.
- Check each of these before you write an answer, and you will avoid most lost marks.

17 A story: the house and the mortgage

- Funded status: assets compared with liabilities
- Surplus: assets above the liabilities
- Deficit: liabilities above the assets
- Every design starts here

IN THE LESSON

- Think of a house worth one hundred ten with a mortgage of one hundred.
- You own ten of it outright.
- A homeowner with that cushion can afford to lock in the mortgage payments and still take a little risk.
- Another homeowner with a house worth ninety and the same mortgage cannot lock anything in, because the debt is bigger than the asset.
- The pension plan is the same.
- Everything starts with funded status, assets compared with liabilities.
- Calder Works has two schemes.
- The main plan holds one hundred ten against liabilities of one hundred.
- The small staff scheme holds ninety against one hundred.
- They need very different designs.

18 Example 4: the plan with a surplus

Main plan: assets 110, liabilities 100 (millions)

Surplus	110 − 100	**10**
Hedging portfolio	matches liability duration	**100**
Return seeking	the surplus only	**10**
Share in growth	10 ÷ 110	**9.1%**
Hedge ratio	100 ÷ 100	**100%**

IN THE LESSON

- Example four, the main plan, with assets of one hundred ten and liabilities of one hundred.
- The surplus is one hundred ten minus one hundred, which is ten.
- The basic two portfolio design puts one hundred into a hedging portfolio that matches the liability duration, and the surplus of ten into return seeking assets.
- That is about nine point one per cent of assets in growth, and the liabilities are hedged in full.
- Why does this work?
- Suppose growth assets fall sharply.
- The hedge still tracks the liabilities, so the plan can lose the surplus, but it cannot fall into deficit unless the return seeking part loses more than all of its ten.
- The sponsor's risk is small.

19 Closing a gap with return

Required = (L × (1 + d)^T ÷ A)^(1/T) − 1
Growth share = (Req − Rh) ÷ (Rrs − Rh)

Required return	Return assets must earn
Liabilities grown	Liabilities rolled forward
Hedge return	Matches liability growth
Growth return	Expected return of growth

IN THE LESSON

- The staff scheme cannot use that design, so Hana asks how much return the assets must earn to close the gap.
- First, grow the liabilities forward at their discount rate for the time allowed.
- Then find the annual return that turns today's assets into that amount, which is the future liabilities over today's assets, to the power of one over the number of years, minus one.
- Second, split the assets between the two portfolios.
- The share in the return seeking portfolio is the required return minus the hedge return, over the return seeking portfolio's return minus the hedge return.
- This simply finds the mix whose average return equals the target.

20 Example 5: the plan with a deficit

Assets 90, liabilities 100 at 4%. Hedge 4%, growth 7%. Ten years

Liabilities in 10 years	100 × 1.04^10	**148.0**
Required asset return	(148.0 ÷ 90)^(1/10) − 1	**5.10%**
Growth share of assets	(5.10 − 4) ÷ (7 − 4)	**36.7%**
Allocation	33 growth, 57 hedge	**57% hedged**

IN THE LESSON

- Example five, the staff scheme.
- Assets are ninety, liabilities one hundred, discounted at four per cent.
- The sponsor cannot contribute now, and the trustees want full funding in ten years.
- The hedging portfolio earns four per cent, matching the liabilities, and the return seeking portfolio earns seven.
- In ten years the liabilities are one hundred times one point zero four to the power of ten, which is one hundred forty eight.
- To get from ninety to one hundred forty eight, the assets must earn five point one per cent a year.
- The growth share is five point one minus four, over seven minus four, which is thirty six point seven per cent of assets, or about thirty three.
- That leaves fifty seven in the hedge, so the plan hedges only fifty seven per cent of its liabilities.

21 A hedge ratio that rises with funding

Chart: Share hedged (%) vs Funded ratio (%): 80 to 120

- 80%: 40
- 90%: 57
- 100%: 75
- 110%: 100
- 120%: 100

IN THE LESSON

- A plan in deficit does not stay there, so Hana proposes a glide path.
- The horizontal axis is the funded ratio, from eighty to one hundred twenty per cent.
- The vertical axis is the share of liability risk that is hedged.
- The curve rises from left to right.
- At ninety per cent funded, the staff scheme's position, the hedge ratio is fifty seven per cent, the figure we just found.
- At one hundred per cent funded it is seventy five.
- At one hundred ten per cent, which is the main plan's funded ratio, it reaches a full hedge, as in example four, and it stays there at one hundred twenty.
- Each gain in funding is banked by moving assets into the hedge.

22 Defending the design

A defence has three parts

State hedge ratio: 57% →
Control surplus volatility →
Size growth from the gap

What could change it

Sponsor contributions →
Inflation linked liabilities → Funding rules

IN THE LESSON

- A proposal is only half the job, and the other half is the defence.
- The top row shows what a good defence contains.
- State the hedge ratio, for the staff scheme fifty seven per cent.
- Explain how surplus volatility is controlled, because it is the surplus the trustees care about, not the volatility of the assets alone.
- And link the size of the growth portfolio to the funding gap and the time allowed to close it.
- The bottom row shows what could change the answer.
- Sponsor contributions would lower the return needed and allow a bigger hedge.
- Inflation linked liabilities would add linkers to the hedge.
- Funding rules might limit how much deficit risk the plan may run.

23 A story: the envelopes

- Wealth split by what the money is for
- Each goal: amount, horizon, probability
- Each goal gets a module that fits it
- Leftover money is excess wealth

IN THE LESSON

- Some people keep money in labelled envelopes: rent, school fees, holiday, someone's inheritance.
- Each envelope has a purpose, and nobody invests the rent money the way they invest the inheritance.
- Goals based allocation does the same with a portfolio.
- Anya Petrova, the founder of Calder Works, has one point seven million of her own wealth.
- Hana lists each goal with its amount, its horizon and the probability of success the client requires.
- Then she matches each goal to a sub portfolio, or module, whose risk and return give that probability over that horizon.
- Any money left over after every goal is funded is called excess wealth.

24 Anya's three goals

Amount, horizon and required probability

Goal: amount, years	Probability
Living costs: 500,000 in 3	95%
Top up: 1,000,000 in 10	75%
Bequest: 2,000,000 in 25	50%
Total wealth	1,700,000

IN THE LESSON

- These are Anya's goals.
- The first is living costs: five hundred thousand needed in three years, with a required probability of ninety five per cent.
- It is urgent and essential, so she wants near certainty.
- The second is a top up for retirement: one million in ten years, at seventy five per cent.
- The third is a bequest: two million in twenty five years, at fifty per cent, an aspiration where she accepts even odds.
- Her total wealth is one million seven hundred thousand.
- Notice the pattern.
- The nearer and more important the goal, the higher the probability she requires, and the more conservative the module that should serve it.

25 How much to set aside

Capital = Goal ÷ (1 + r)^T
e.g. 1,000,000 ÷ 1.04^10 = 675,564

Capital today	Set aside today
Goal amount	Amount the goal needs
Module return	Return reliably earned
Years to goal	Horizon in years

IN THE LESSON

- To fund a goal, set aside its present value.
- Divide the goal amount by one plus the module's return, raised to the number of years.
- The key is which return.
- It is not the module's average expected return.
- It is the return the module can be relied on to reach with the required probability over that horizon.
- That is lower than the average whenever the goal must be more likely than not, and the higher the required probability, the lower the return.
- As a check, one million in ten years at four per cent needs six hundred seventy five thousand five hundred sixty four today.
- A lower return means more capital now.

26 Example 6: funding the three goals

Module returns fit each probability: 2%, 5%, 7%

Living costs	500,000 ÷ 1.02^3	**471,161**
Top up	1,000,000 ÷ 1.05^10	**613,913**
Bequest	2,000,000 ÷ 1.07^25	**368,498**
Set aside in all	sum of the three	**1,453,572**
Excess wealth	1,700,000 − 1,453,572	**246,428**

IN THE LESSON

- Example six.
- The returns the three modules can reliably deliver at each probability and horizon are two per cent, five per cent and seven per cent.
- Living costs: five hundred thousand over one point zero two cubed gives four hundred seventy one thousand one hundred sixty one.
- The top up: one million over one point zero five to the power of ten gives six hundred thirteen thousand nine hundred thirteen.
- The bequest: two million over one point zero seven to the power of twenty five gives three hundred sixty eight thousand four hundred ninety eight.
- In all, Hana sets aside one million four hundred fifty three thousand five hundred seventy two, which leaves excess wealth of two hundred forty six thousand four hundred twenty eight.

27 Longer horizon, lower confidence, more risk

Chart: Module return (%) vs Goal horizon (years): 0 to 25

- 3 yrs, 95% sure: 2%
- 10 yrs, 75% sure: 5%
- 25 yrs, 50% sure: 7%

IN THE LESSON

- This picture shows the pattern behind those three returns.
- The horizontal axis is the goal horizon in years.
- The vertical axis is the module return, in per cent.
- The curve rises.
- Living costs, three years away at ninety five per cent confidence, sits low at two per cent, a conservative module.
- The top up, ten years away at seventy five per cent confidence, sits at five.
- The bequest, twenty five years away at fifty per cent confidence, sits at seven, a growth module.
- The longer the horizon and the lower the confidence required, the more risk the module can take and the higher the return that goal is discounted at.

28 Example 7: the flat rate trap

Every goal wrongly discounted at 7%. Look at living costs

At the flat 7%	500,000 ÷ 1.07^3	**408,149**
At its own 2%	500,000 ÷ 1.02^3	**471,161**
Set aside too little	471,161 − 408,149	**63,012**
Share of the need	408,149 ÷ 471,161	**86.6%**

IN THE LESSON

- Example seven is the trap.
- Suppose Hana discounted every goal at seven per cent, the growth module's return, instead of each goal at its own return.
- For the living costs goal, five hundred thousand over one point zero seven cubed is only four hundred eight thousand one hundred forty nine.
- At its own rate of two per cent, the right figure is four hundred seventy one thousand one hundred sixty one.
- The flat rate sets aside sixty three thousand and twelve too little.
- That is only eighty six point six per cent of what the goal needs, for the goal where Anya wanted ninety five per cent certainty.
- The goal that most needs certainty ends up the most underfunded.

29 Defending the goals based plan

- Urgent goals: conservative module, high confidence
- Distant goals: growth module, lower confidence
- Excess wealth: new goals or a reserve
- Check the combined portfolio is still efficient

IN THE LESSON

- Hana's defence has four parts.
- First, urgent and essential goals sit in conservative modules with high confidence, and distant aspirational goals sit in growth modules with lower confidence.
- Second, each goal is funded at its own discount rate, never one rate for all.
- Third, the excess wealth is not wasted.
- It can fund new goals or be held as a reserve, and her proposal says which.
- Fourth, she steps back and checks the combined portfolio.
- If one module is long a market and another is short it, they offset, and paying for both is wasteful.
- If the modules add up to a total risk the client never agreed to, the plan is not efficient, however good each module looks alone.

30 Recap: the lesson in five lines

R − Rf = α + Σ β × F
U = E(Rs) − 0.005 × λ × σ²s
Capital = Goal ÷ (1 + r)^T

Factor exposure	Exposures, read by regression
Duration	Match it, then check wage links
Surplus variance	Surplus risk, not asset risk
Required return	Sizes the growth portfolio
Capital today	Each goal at its own rate

IN THE LESSON

- Let us pull the lesson together.
- Factors are rewarded return drivers.
- You can build an allocation from them, or regress a portfolio on factor returns to see its true exposures, remembering the costs of shorting, gearing and turnover.
- Liabilities differ in whether they are fixed or contingent, legal or quasi, and in their sensitivity to rates, prices and wages.
- Surplus optimisation maximises a utility of surplus return, and the two portfolio design splits a hedge from a growth sleeve.
- For a design, begin with funded status, state the hedge ratio, and size the growth portfolio from the gap.
- For goals, set aside each goal's present value at its own module return.

31 Try three quick questions

1. Market 0.9, value 0.6; premiums 5% and 2%. Factor return?
   Answer: 0.9×5 + 0.6×2 = 5.7%.
2. Assets 105, liabilities 100. Return seeking amount?
   Answer: Only the surplus: 105 − 100 = 5.
3. 300,000 in 4 years, module 3%. Set aside today?
   Answer: 300,000 ÷ 1.03^4 = 266,546.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A portfolio has a market exposure of point nine and a value exposure of point six.
- The market premium is five per cent and the value premium is two.
- What is its factor return?
- Point nine times five plus point six times two is five point seven per cent.
- Question two.
- A plan has assets of one hundred five and liabilities of one hundred.
- In the basic two portfolio design, how much goes into return seeking assets?
- Only the surplus, five.
- Question three.
- A goal needs three hundred thousand in four years, and its module reliably earns three per cent.
- What do you set aside today?
- Three hundred thousand over one point zero three to the power of four, which is two hundred sixty six thousand five hundred forty six.
- Well done.