CHARTA LEARNING · LESSON NOTES

Heuristics, rebalancing, constraints and taxes

Asset Allocation

1 A story: the recipe on the packet

- Rules of thumb: simple, but they know nothing about you
- Client: Tamsin Hale, 45, personal portfolio 6m
- Also: a family foundation and a small family insurer
- Adviser: Nadia Brandt at Larkspur Advisers

IN THE LESSON

- Think of the recipe on the back of a soup packet.
- It is quick, everyone understands it, and it works for most kitchens.
- But it knows nothing about your guests, their allergies or how hungry they are.
- Asset allocation has its own packet recipes, called heuristics, which are simple rules of thumb.
- Meet Nadia Brandt, an adviser at the made up firm Larkspur Advisers.
- Her client is the Hale family office.
- It looks after Tamsin Hale, aged forty five, who has a personal portfolio of six million, plus a family foundation and a small family insurer.
- Over this lesson Nadia will test the rules, set rebalancing bands, respect real limits and count the cost of tax.
- First, the rules of thumb.

2 Five rules of thumb and their catch

Each rule and the assumption it hides about the client

120 minus age	Age only
60/40 mix	Same for all
Endowment model	Needs scale
Risk parity	Needs leverage
1/N equal weights	Ignores views

IN THE LESSON

- Here are the five rules the exam likes, each with its catch.
- The first takes one hundred and twenty minus your age as your percentage in equities.
- Its catch is that age is the only thing it looks at.
- Sixty forty puts sixty percent in equities and forty in bonds.
- It is a long standing balanced default, but it gives everyone the same mix.
- The endowment model puts a large share in private and alternative assets to earn an illiquidity premium, which means being paid for locking money away.
- It needs scale, a long horizon and access to good managers.
- Risk parity gives every asset the same share of total risk, and usually needs borrowing.
- Equal weighting, called one over N, ignores forecasts altogether.
- All five are transparent and easy to explain, and that is why they last.

3 The 120 minus age rule

Equity % = 120 − age
Bonds % = 100 − equity %

Equity share	Tamsin: 120 − 45 = 75%
Investor's age	Tamsin is 45 years old
Bond share	The rest: 25% in bonds

IN THE LESSON

- Let us look at the first rule closely.
- Take one hundred and twenty and subtract the investor's age.
- The answer is the percentage to hold in equities, and whatever is left goes to bonds.
- Tamsin is forty five, so the rule gives her seventy five percent in equities and twenty five percent in bonds.
- People like the rule because it lowers risk as the investor ages, and a shorter horizon does call for less risk.
- But look at what it leaves out: wealth, income, goals, risk tolerance and human capital.
- Human capital means the present value of the earnings an investor still expects to make.
- Two forty five year olds with very different jobs and savings get exactly the same answer.

4 Example 1: testing the age rule on Tamsin

Tamsin, 45. Equity vol 16%, bond vol 5%, correlation 0.2

Age rule at 45	120 − 45	**75% equity**
Volatility of 75 / 25	two-asset formula	**12.3%**
Tamsin's risk target	her own statement	**8%**
Equity weight giving 8%	solve the same blend	**about 43%**
Rule overshoots by	75 − 43	**about 32 points**

IN THE LESSON

- Example one.
- Nadia tests the rule on Tamsin.
- Equities have a volatility of sixteen percent, bonds five percent, and the correlation between them is point two.
- As a reminder, volatility is the usual measure of risk, and the two asset formula combines it with the weights and the correlation.
- The rule gives seventy five percent equities.
- Put that mix through the formula and the portfolio volatility is twelve point three percent.
- But Tamsin has told Nadia she wants about eight percent.
- Solving the same blend for eight percent gives an equity weight of about forty three percent.
- So the rule overshoots her stated risk by about thirty two points of equity.
- The rule is easy to use, but it does not suit her.

5 Five rules, five answers for one client

Equity weight (%)

Age rule	**75**
60/40	**60**
1/N	**25**
Risk parity	**23.8**
Fits 8% risk	**43**

Four classes for 1/N; risk parity unlevered

IN THE LESSON

- Look at how far apart these answers are, all for the same client.
- Read the bars from left to right.
- The age rule gives seventy five percent in equities, and it would give that to every forty five year old.
- Sixty forty gives sixty, and never looks at age at all.
- Equal weighting across four asset classes gives a quarter each, so twenty five percent in equities.
- Risk parity, with no borrowing, gives twenty three point eight, because equities are so much more volatile than bonds.
- The last bar is the equity weight that actually fits Tamsin's eight percent risk target, about forty three.
- None of the rules lands on it by design.
- Each is a starting point to be tested, not an answer.

6 Example 2: risk parity needs leverage

Risk parity on the same inputs; Tamsin wants 8% volatility

Weight in equities	5 ÷ (16 + 5)	**23.8%**
Weight in bonds	16 ÷ (16 + 5)	**76.2%**
Volatility of that mix	well below her 8%	**5.9%**
Leverage needed	8 ÷ 5.9	**1.36 times**
After leverage	equity 32.3, bonds 103.3	**borrow about 36%**

IN THE LESSON

- Example two.
- Risk parity sets the weights so that each asset contributes the same amount of risk.
- With two assets, that simply means weights in inverse proportion to volatility.
- Equities get five divided by sixteen plus five, which is twenty three point eight percent, and bonds get the other seventy six point two.
- That mix has a volatility of only five point nine percent, well below Tamsin's eight.
- To reach eight, Nadia must scale everything up by eight divided by five point nine, about one point three six times.
- Equities become thirty two point three percent and bonds one hundred and three point three percent of the portfolio, which means borrowing about thirty six percent.
- The rule never mentions that, and it ignores expected returns entirely.

7 When the endowment model and 1/N fit

- Endowment: needs long horizon, scale, manager access
- It harvests illiquidity premiums from private assets
- 1/N: no forecasts, so no estimation error to hurt it
- But it ignores risk, goals and the client's limits

IN THE LESSON

- Two more rules deserve a careful look.
- The endowment model earns its reputation from private assets, because patient investors are paid an illiquidity premium.
- But it only works with a long horizon, enough size to reach top managers, and staff able to pick them.
- Copying it without those ingredients is a classic exam error.
- Equal weighting is the opposite kind of rule.
- It needs no forecasts, so it cannot suffer from estimation error, which is the damage done when an optimiser trusts noisy inputs.
- That is why it often competes well with complicated methods.
- Yet it pays no attention to risk, to goals or to the client's limits.
- So for each rule, ask what it assumes, and whether this client matches.

8 Assessing a rule of thumb

Assessing a rule

Name its hidden assumption → Test it on this client → Check size, leverage, access → Keep, adjust or reject

IN THE LESSON

- Here is the routine Nadia follows for any rule, in four boxes, read from left to right.
- First, name the hidden assumption.
- For the age rule it is that age tells you everything; for risk parity it is that borrowing is allowed and expected returns do not matter.
- Second, test that assumption on this client: her wealth, income, goals and risk tolerance.
- Third, check size, leverage and access, because many rules quietly need them.
- Fourth, decide.
- Keep the rule as a starting point, adjust it, or reject it and say why.
- A rule that merely sounds sensible is never enough.
- The exam rewards the candidate who checks it against the client's own facts.

9 A story: the thermostat

- Rebalance: trade back when weights drift off target
- Band (corridor): the range where you do nothing
- Too narrow: costly trades. Too wide: risk drifts
- Tamsin: equities target 60%, band 55% to 65%

IN THE LESSON

- Think of a thermostat.
- If it switched the heating on and off for every tiny change in temperature, it would wear out and waste energy.
- If it waited until the room was freezing, you would be miserable.
- So it allows a comfortable range, and acts only outside it.
- A rebalancing band does the same job for a portfolio.
- Markets move, so weights drift away from target.
- The band, also called a corridor, is the range inside which Nadia does nothing.
- Tamsin's equity target is sixty percent, with a band of five points either side, so fifty five to sixty five.
- Too narrow a band means constant, costly trades.
- Too wide a band lets risk wander away from policy.

10 Choosing the width: a cost-benefit trade

Chart: Cost each year vs Width of the band

- Trading cost
- Cost of drift
- Total cost
- Best width

IN THE LESSON

- Here is the trade off as a picture.
- The horizontal axis is the width of the band, from narrow on the left to wide on the right.
- The vertical axis is cost each year.
- The green curve is trading cost.
- A narrow band means frequent trades, so cost is high on the left and falls as the band widens.
- The red curve is the cost of drift, meaning the risk and lost discipline that come from letting weights wander.
- It is small for a narrow band and rises as the band widens.
- The gold curve adds the two together, and it is a bowl shape.
- The lowest point of the bowl is the best width.
- Anything that makes trading dearer slides the green curve up and pushes that point to the right.

11 What pushes the band wider

Wider band

High trading costs → High risk tolerance → High correlation

Also wider

Taxable investor → Illiquid asset → Belief in momentum

IN THE LESSON

- Now the factors, in the order the exam lists them.
- The top row is the first group, all pushing the band wider.
- High trading costs make every rebalancing trade dearer, so you trade less often.
- A higher risk tolerance means drift matters less to the client, so a wider band is acceptable.
- And higher correlation between the asset and the rest of the portfolio means the two tend to move together, so their weights drift apart less.
- Take care here, because correlation is the one candidates reverse.
- The second row is also wider.
- A taxable investor faces tax when trading, so the true cost is higher.
- An illiquid asset is hard and slow to trade.
- And a belief in momentum says winners keep winning, so trading against a trend early is costly.

12 What pushes the band narrower

- High volatility of the asset or the rest: narrower
- Low correlation with the rest: narrower
- Belief in mean reversion: narrower, act early
- Trade back to target, or only to the band edge

IN THE LESSON

- The other direction is shorter.
- Higher volatility of the asset, or of the rest of the portfolio, means the weight can move a long way fast, so the band should be narrower.
- Lower correlation with the rest of the portfolio also argues for a narrower band, because the two can drift far apart.
- A belief in mean reversion, the idea that prices return towards fair value, says that selling after a rise and buying after a fall is rewarded, so you act earlier.
- There is one more choice, beyond the width.
- When the weight breaks the band, you can trade all the way back to target, or only back to the edge of the band.
- The first controls risk better; the second trades less and costs less.

13 Example 3: why correlation widens the band

Sleeve 20 of a 100 portfolio rises 20%; the rest, 80, moves

Sleeve after the rise	20 × 1.20	**24**
Rest, high correlation	80 × 1.18	**94.4**
Weight, high correlation	24 ÷ (24 + 94.4)	**20.3%**
Rest, low correlation	80 × 0.98	**78.4**
Weight, low correlation	24 ÷ (24 + 78.4)	**23.4%**

IN THE LESSON

- Example three shows why correlation works the way it does.
- A portfolio holds twenty in one equity sleeve and eighty in everything else.
- The sleeve rises twenty percent, to twenty four.
- Suppose the rest is highly correlated and also rises eighteen percent, to ninety four point four.
- The sleeve's weight is twenty four divided by twenty four plus ninety four point four, which is twenty point three percent, barely moved from twenty.
- Now suppose the rest is uncorrelated and falls two percent, to seventy eight point four.
- The weight becomes twenty four divided by twenty four plus seventy eight point four, twenty three point four percent.
- The same gain moves the weight less than half a point in one case and over three points in the other.
- High correlation, wider band.

14 Example 4: setting bands for three assets

Illustrative bands around each target weight

Private real estate	costly, illiquid	**±7 points**
Listed infrastructure	cost and volatility middling	**±5 points**
Listed global equities	cheap to trade, volatile	**±3 points**
Same asset, taxable account	gains are taxed	**wider still**

IN THE LESSON

- Example four puts the factors to work.
- Nadia sets illustrative bands around each target weight.
- Private real estate is costly to trade and illiquid, so it gets the widest band, plus or minus seven points.
- Listed global equities are cheap and liquid to trade but very volatile, so they get the narrowest, plus or minus three.
- Listed infrastructure sits between, at plus or minus five.
- Then comes tax.
- If the same asset sits in a taxable account, every trade can realise a gain, so its band is wider still.
- Notice that Nadia is not applying a formula here.
- She is weighing costs against drift, one factor at a time, and she can defend each choice in a sentence.

15 Example 5: back to target or to the edge

Target 60%, band 55% to 65%, portfolio 6.0m, equities at 66%

Equities now	66% of 6.0m	**3.96m**
Sell back to target	6% of 6.0m	**360,000**
Sell back to band edge	1% of 6.0m	**60,000**
Trading cost at 0.25%	on 360,000 and on 60,000	**900 and 150**
Risk left by the cheaper route	stays 5 points over target	**more risk**

IN THE LESSON

- Example five.
- Tamsin's portfolio is six million, with equities targeted at sixty percent and a band from fifty five to sixty five.
- After a strong year, equities are at sixty six percent, which is three million nine hundred sixty thousand.
- That breaks the band.
- If Nadia trades all the way back to target, she sells six percent of six million, three hundred sixty thousand.
- If she trades only back to the edge of the band, she sells one percent, sixty thousand.
- At a trading cost of a quarter of one percent, the first costs nine hundred and the second one hundred and fifty.
- Going only to the edge is cheaper but leaves equities higher, so more risk stays on.

16 Mistakes so far

- Adopting a rule of thumb without testing it on the client
- Calling 1/N, 60/40 or inaction neutral: they are choices
- Reversing correlation: high correlation allows wider
- Believing that doing nothing is free: risk drifts off policy

IN THE LESSON

- Before we move on, here are the mistakes this lesson has covered so far.
- First, adopting a rule of thumb without testing it on the client.
- Every rule hides an assumption, and the exam will hand you a client who breaks it.
- Second, calling a rule neutral.
- Equal weighting, sixty forty and doing nothing all look neutral, but each one is a decision with consequences.
- Third, reversing correlation.
- Higher correlation with the rest of the portfolio allows a wider band, because the weights drift apart less.
- Fourth, believing that doing nothing is free.
- Letting a portfolio drift saves trading costs, but it lets risk wander away from the policy the client agreed.

17 A story: the straight line on the map

- An optimiser draws the straight line; real life has rivers
- Size: access, minimums, market impact
- Cash flow and liquidity: spending, benefits, emergencies
- Horizon, regulation, mandate: risk capacity, hard limits

IN THE LESSON

- Imagine drawing a straight line on a map from your house to a beach.
- It is the shortest route.
- But the map has a river with no bridge, a nature reserve and a border.
- The straight line is useless until you route around them.
- An optimiser is the straight line.
- It assumes the investor can buy anything, in any size, sell at any time and hold forever.
- Real investors meet rivers.
- Portfolio size can open doors or close them.
- Cash flow needs limit how much can be locked away.
- The time horizon changes how much risk the investor can bear.
- And regulation and mandates draw hard borders.
- Back to the Hale family, who meet all four.

18 Each investor has its own binding limit

Institutions

Insurer: capital charges →

Pension plan: funding rules →

Endowment: spending policy

Others

Sovereign fund: political mandate →

Individual: tax and legal limits

IN THE LESSON

- This picture shows which limit typically binds for each kind of investor.
- Start with the top row, the institutions.
- An insurer must hold capital against its assets, and riskier assets use up more of that capital, so capital charges cap its risk.
- A pension plan faces funding rules and needs to match assets to its liabilities.
- An endowment has a spending policy that sets a regular cash outflow.
- In the bottom row, a sovereign wealth fund may have a political mandate that rules some investments in or out.
- An individual meets tax and legal restrictions.
- The Hale family office will meet several at once: a foundation with spending, an insurer with capital charges, and Tamsin as an individual.

19 Example 6: size limits what is possible

Hale Foundation: 12m of assets; trustee wants 30% private equity

Private equity target	30% of 12m	**3.6m**
Typical fund minimum	assumed for illustration	**1.0m**
Funds it can afford	3.6 ÷ 1.0	**3**
Funds wanted to spread risk	assumed for illustration	**10 or more**
Investment staff	at the foundation	**none**

IN THE LESSON

- Example six.
- The Hale Foundation holds twelve million.
- One trustee wants it to copy a famous university endowment and put thirty percent in private equity.
- Thirty percent of twelve million is three point six million.
- Suppose, for illustration, each private fund asks for a minimum of one million.
- Then the foundation can afford only three funds.
- Good practice would spread across ten or more, across managers and years.
- And the foundation has no investment staff to pick managers.
- A very large endowment has the opposite problem: its trades move prices in small markets, and it can only absorb so much in any niche.
- Size cuts both ways.
- Here it cuts against the foundation, so the endowment model does not fit.

20 Example 7: cash flow needs and liquidity

Foundation pays grants of 4.5% of 12m a year

Annual grants	4.5% × 12m	**540,000**
Reserve of three years	3 × 540,000	**1,620,000**
Reserve as a share	1.62 ÷ 12	**13.5%**
Trustees' ceiling on illiquids	assumed for illustration	**25%**
30% target against ceiling	30 − 25	**5 points over**

IN THE LESSON

- Example seven.
- The foundation pays grants of four point five percent of its twelve million every year.
- That is five hundred and forty thousand.
- Nadia insists on a liquidity reserve of three years of grants, held in cash and short bonds, so the grants never depend on selling something at a bad time.
- Three times five hundred and forty thousand is one million six hundred and twenty thousand, thirteen point five percent of the portfolio.
- The trustees, weighing this need for cash, set a ceiling of twenty five percent on illiquid assets.
- The thirty percent private equity wish breaks that ceiling by five points.
- The spending need, not the optimiser, decides how much can be locked away.

21 Example 8: a regulatory capital limit

Hale Mutual: 100m of assets, 10m of capital

Optimiser's mix	equity 20, corporate 50, gov 30	**in millions**
Capital needed	0.40 × 20 + 0.05 × 50	**10.5m**
Capital available	regulatory limit	**10m**
Equity limit	(10 − 2.5) ÷ 0.40	**18.75m**
Constrained mix	corporate 50, government 31.25	**equity 18.75m**

IN THE LESSON

- Example eight moves to the family's small insurer, Hale Mutual, with one hundred million of assets and ten million of capital.
- In this example, regulators charge capital of forty percent against equities, five percent against corporate bonds and nothing against government bonds.
- The optimiser wants twenty in equities, fifty in corporates and thirty in governments.
- The capital needed is point four times twenty plus point oh five times fifty, which is ten and a half.
- That is more than the ten available.
- Hold corporates at fifty, which uses two and a half.
- That leaves seven and a half of capital for equities, and seven and a half divided by point four is eighteen point seven five.
- So equities fall to eighteen point seven five and governments rise to thirty one point two five.
- The regulator, not the optimiser, set the limit.

22 Horizon: risk capacity changes with age

Chart: Share of total wealth vs Age of the investor

- Human capital
- Financial capital
- Tamsin

IN THE LESSON

- The last constraint is time horizon, and a picture helps.
- The horizontal axis is the investor's age, from young on the left to retired on the right.
- The vertical axis is each form of wealth as a share of the total.
- The red curve is human capital, the present value of future earnings.
- It is large when the investor is young and falls as working years are used up.
- The green curve is financial capital, the savings built up in the portfolio, and it rises.
- Where the investor is young, the large human capital acts like a big, steady asset behind the portfolio, so the investor may take more risk.
- As it is consumed, and as liabilities draw closer, risk capacity falls.
- Tamsin is somewhere in the middle.

23 A binding constraint beats the optimum

- A binding constraint beats the unconstrained optimum
- Work inside it, and state what it costs in return
- Risk capacity falls as human capital is used up
- Different investors, different binding limits

IN THE LESSON

- Now the lesson of all four examples.
- When a constraint binds, it overrides the unconstrained optimum, however attractive that optimum looked.
- Recommending the optimum anyway puts the client in breach, or leaves a trap for later, such as grants that cannot be paid.
- A good answer works inside the constraint and also states its cost.
- Hale Mutual gave up some expected return by holding fewer equities, assuming equities are expected to earn more than government bonds.
- That is the price of staying within the rules.
- Different investors face different binding limits, so always find out which one applies to the case in front of you.
- The common mistake is to ignore it and praise the optimiser.

24 A story: pay slip against take home pay

- Only the return kept after tax counts
- Interest, dividends and gains are taxed differently
- Optimise on after-tax return and after-tax risk
- Then choose each asset's account and how to rebalance

IN THE LESSON

- Imagine a friend boasts about a salary.
- What matters to you is not the headline number but what lands in the bank after tax.
- Investing is the same.
- A taxable investor keeps only the return left after tax, so Nadia must optimise on after tax returns and after tax risk, not the headline figures.
- This is harder than it sounds, because interest, dividends and capital gains are usually taxed at different rates and at different times.
- Tax also decides which account should hold which asset, and how often rebalancing is worth it.
- Tamsin has two accounts: a taxable account and a tax deferred retirement account, where no tax is paid until money is withdrawn.

25 After-tax return

After-tax return ≈ pre-tax return × (1 − t)

Pre-tax return	Example: 8% before tax
Tax rate	Example: 35% effective rate
After-tax return	8 × 0.65 = 5.2%

IN THE LESSON

- Here is the working rule.
- The after tax return is roughly the pre tax return times one minus the tax rate.
- Take an eight percent pre tax return taxed at thirty five percent.
- One minus point three five is point six five, and eight times that is five point two percent.
- Taxes do something else too.
- They also shrink risk.
- If the government takes a share of every gain and, through loss offsets, shares in every loss, the after tax return moves around less than the pre tax one, so after tax volatility falls by the same factor.
- And because assets are taxed differently, each has its own effective tax rate.
- That rate, not the headline one, goes into the formula.
- It is an approximation, but the one the curriculum uses.

26 Example 9: Tamsin's after-tax numbers

Taxable account: interest taxed 40%, equity returns 20% effective

Bonds after tax	5 × (1 − 0.40)	**3.0%**
Equities after tax	8 × (1 − 0.20)	**6.4%**
Equity volatility after tax	16 × (1 − 0.20)	**12.8%**
Equity advantage after tax	6.4 − 3.0 (3.0 pre-tax)	**3.4 points**

IN THE LESSON

- Example nine.
- In Tamsin's taxable account, bond interest is taxed at forty percent and equity returns face an effective twenty percent, because most of the return is capital gains that can be deferred.
- Bonds are expected to return five percent before tax, and five times point six is three percent after tax.
- Equities return eight percent, and eight times point eight is six point four.
- Equity volatility of sixteen percent also shrinks, to twelve point eight.
- Now compare.
- Before tax, equities offered three points more than bonds.
- After tax, the gap is six point four minus three, which is three point four points.
- An optimiser fed pre tax numbers would undervalue equities for this investor.

27 Before and after tax

Expected return (%)

Bonds before	**5.0**
Bonds after	**3.0**
Equities before	**8.0**
Equities after	**6.4**

Interest taxed at 40%; equity returns at 20% effective

IN THE LESSON

- Here are the same numbers as bars.
- The first pair is bonds.
- Before tax they return five percent.
- After a forty percent tax on interest, they keep three.
- The second pair is equities.
- Before tax they return eight percent.
- After a twenty percent effective tax they keep six point four.
- Notice what happened to the heights.
- Bonds lost two points, the most heavily taxed return.
- Equities lost one point six.
- So the order of the assets did not change, but the gap between them widened.
- This is why Nadia must run the optimiser on after tax inputs for a taxable client.
- Put pre tax inputs into a taxable client's model, and the answer will be wrong, even if the arithmetic is perfect.

28 Example 10: where each asset should sit

3m taxable, 3m tax-deferred; 3m bonds, 3m equities

A: bonds sheltered	3m × 5% + 3m × 6.4%	**342,000**
B: equities sheltered	3m × 3.0% + 3m × 8%	**330,000**
A as a return	342,000 ÷ 6m	**5.70%**
B as a return	330,000 ÷ 6m	**5.50%**
Worth of good location	A − B	**12,000 a year**

IN THE LESSON

- Example ten is asset location.
- Tamsin has three million in the taxable account and three million in the tax deferred account, and must hold three million of bonds and three million of equities.
- For simplicity, treat the deferred account as tax free.
- Option A shelters the bonds.
- Bonds earn five percent and the taxable equities earn six point four, for a total of three hundred and forty two thousand, or five point seven percent.
- Option B shelters the equities instead.
- The taxable bonds earn three percent and the sheltered equities earn eight, for a total of three hundred and thirty thousand, five point five percent.
- Good location is worth twelve thousand a year.

29 The after-tax band

After-tax band = pre-tax band ÷ (1 − t)

Pre-tax band	Tamsin: ±5 points
Tax rate	Tax on gains: 30%
After-tax band	5 ÷ 0.70 = ±7.1 points

IN THE LESSON

- Now rebalancing.
- Selling a winner in a taxable account realises a gain, so each trade costs more than it would in a tax free account.
- To stay equivalent, the band must widen.
- The after tax band equals the pre tax band divided by one minus the tax rate.
- Take Tamsin's band of five points and a thirty percent tax rate on gains.
- One minus point three is point seven, and five divided by point seven is seven point one.
- So her taxable band is about plus or minus seven point one points.
- Notice that you divide, which makes the band bigger, whereas the return formula multiplied, which made the return smaller.
- Mixing up multiply and divide here is an easy way to lose marks.

30 Example 11: to trade, or not to trade

Taxable account, band ±5 pre-tax, tax rate on gains 30%

Pre-tax band	60 ± 5	**55 to 65**
Tax rate on gains	assumed for illustration	**30%**
After-tax band	5 ÷ (1 − 0.30)	**±7.1**
Taxable limits	60 ± 7.1	**52.9 to 67.1**
Equities at 66%	drifted up	**inside: hold**

IN THE LESSON

- Example eleven brings the strands together.
- In the tax deferred account, the band stays at plus or minus five, from fifty five to sixty five, and equities at sixty six percent are outside it, so Nadia rebalances there.
- In the taxable account the band widens to plus or minus seven point one.
- That gives limits of fifty two point nine to sixty seven point one.
- Equities at sixty six sit inside them, so Nadia leaves the taxable account alone.
- The same drift needs a trade in one account and not in the other, purely because of tax.
- Where she must fix the weight, she can use the deferred account, which has no tax cost, and keep the taxable account untouched.

31 Tax on the trade, loss harvesting and the trap

- Selling 360,000 at a 50% gain, 30% rate: tax 54,000
- Selling only 60,000 back to the band edge: tax 9,000
- Harvest: a 20,000 loss offsets gains, saving 6,000 of tax
- Trap: never treat after-tax and pre-tax allocations as equal

IN THE LESSON

- Why does tax make Nadia so careful?
- Suppose she did sell back to target, three hundred sixty thousand, in the taxable account, and fifty percent of the value sold was gain.
- Thirty percent tax on that gain is fifty four thousand.
- Selling only sixty thousand back to the edge would cost nine thousand.
- Tax loss harvesting helps.
- Selling a holding at a loss realises that loss, which offsets gains.
- A twenty thousand loss at thirty percent saves six thousand.
- And one trap remains.
- Never compare a taxable investor's after tax allocation with a pre tax or tax exempt one as though they meant the same thing.

32 Recap: four ideas to keep

- Rules of thumb: test each one against the client
- Wider: cost, tolerance, correlation, tax, illiquid, momentum
- Narrower band: volatility, mean reversion; target or edge
- Constraints: size, cash, horizon, rules; binding limit wins
- Tax: after-tax terms, location, band ÷ (1 − t), harvesting

IN THE LESSON

- Let us pull the lesson together.
- First, rules of thumb are simple and transparent, but each hides an assumption, so test it against the client's wealth, goals, risk tolerance and access before you adopt it.
- Second, rebalancing bands are a cost benefit choice.
- High costs, tolerance, correlation, taxes, illiquidity and a belief in momentum widen them; high volatility and a belief in mean reversion narrow them.
- Third, size, liquidity, horizon and regulation are constraints, and a binding one beats the optimiser.
- Fourth, taxes mean working in after tax terms, locating assets wisely, widening the band by dividing by one minus the tax rate, and harvesting losses where you can.

33 Try three quick questions

1. Age 55; business profits track equities. Age rule, and the flaw?
   Answer: 65% equity; ignores wealth, goals and human capital.
2. Higher correlation with the rest: wider or narrower band?
   Answer: Wider: the weights drift apart less.
3. Pre-tax band ±4 points, tax rate 20%. After-tax band?
   Answer: 4 ÷ (1 − 0.20) = ±5 points.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A fifty five year old runs a business whose profits swing with the stock market.
- What does the one hundred and twenty minus age rule give, and what is wrong with it?
- It gives sixty five percent equities, but it ignores wealth, goals and human capital, and he already holds equity like risk in the business.
- Question two.
- Does higher correlation with the rest of the portfolio widen or narrow the band?
- It widens it, because the weights drift apart less.
- Question three.
- A pre tax band is plus or minus four points and the tax rate is twenty percent.
- What is the after tax band?
- Four divided by point eight is plus or minus five.
- Well done, and keep practising.