CHARTA LEARNING · LESSON NOTES

The information ratio and the fundamental law

Portfolio Management

1 A story: two ways to beat the index

- Active return = fund return − benchmark return
- Active risk (tracking error) = how much the gap varies
- Big gap with a big wobble may be no more skilful
- Score the gap against the wobble in the gap

IN THE LESSON

- Picture two fund managers measured against the same index.
- Nadia hugs the index and beats it by a small, steady margin every year.
- Omar takes big bets and beats it by a larger margin, but some years he loses badly.
- Who is more skilful?
- Raw outperformance cannot tell us, because Omar's extra return came with extra danger.
- We need to divide the reward by the risk, but the right risk is not total volatility.
- It is the risk of straying from the index.
- Active return is the fund return minus the benchmark return.
- Active risk, also called tracking error, is how much that gap bounces around.

2 The information ratio

Information ratio = active return ÷ tracking error

Information ratio (IR)	Reward per unit of active risk
Active return (RA)	Fund minus benchmark, averaged
Active risk (tracking error)	Standard deviation of those gaps

IN THE LESSON

- Here is the information ratio.
- It equals active return divided by active risk.
- Look at the pieces.
- On top is the active return, the reward for straying from the index.
- On the bottom is the tracking error, the standard deviation of the active returns, the price paid for straying.
- So the information ratio is reward per unit of active risk.
- There are two versions.
- Ex post means looking backward: use the average of the active returns that actually happened, and their sample standard deviation.
- Ex ante means looking forward: use the expected active return and the expected tracking error.
- Same fraction, different inputs.
- A higher number is better.

3 Example 1: ex post, from five years

Fund 14, −8, 21, 6, 12; benchmark 12, −7, 18, 6, 11 (%)

Active returns	fund − benchmark	**2, −1, 3, 0, 1**
Mean active return	5 ÷ 5	**1.0%**
Deviations from mean	active − 1.0	**1, −2, 2, −1, 0**
Squared, added	1+4+4+1+0	**10**
Tracking error	√(10 ÷ 4)	**1.58%**

IN THE LESSON

- Let us work it.
- A fund and its benchmark had these returns over five years, in per cent.
- The fund: fourteen, minus eight, twenty one, six and twelve.
- The benchmark: twelve, minus seven, eighteen, six and eleven.
- These are made-up numbers.
- Subtract year by year and the active returns are two, minus one, three, zero and one.
- Their sum is five, so the mean active return is one per cent.
- The deviations from that mean are one, minus two, two, minus one and zero.
- Squared they add to ten.
- Divide by four, since this is a sample, and take the square root: the tracking error is one point five eight per cent.
- That is our measure of active risk.

4 Example 1 continued: the ratio

Risk-free rate 2%; sample standard deviations

Information ratio	1.0 ÷ 1.58	**0.63**
Fund Sharpe	(9 − 2) ÷ 10.9	**0.64**
Benchmark Sharpe	(8 − 2) ÷ 9.4	**0.64**
The trap	1.0 ÷ 10.9	**0.09**

IN THE LESSON

- Now divide.
- The mean active return of one per cent over the tracking error of one point five eight gives an ex post information ratio of zero point six three.
- The fund earned about two thirds of a point of active return for every point of active risk.
- Now compare the Sharpe ratio, which divides excess return over the risk-free rate by total volatility.
- The risk-free rate is two per cent.
- The fund averaged nine, so its excess return is seven, and its volatility is ten point nine, giving zero point six four.
- The benchmark averaged eight, excess six, volatility nine point four, also zero point six four.
- The Sharpe ratios cannot tell the fund from the index.

5 Information ratio against Sharpe ratio

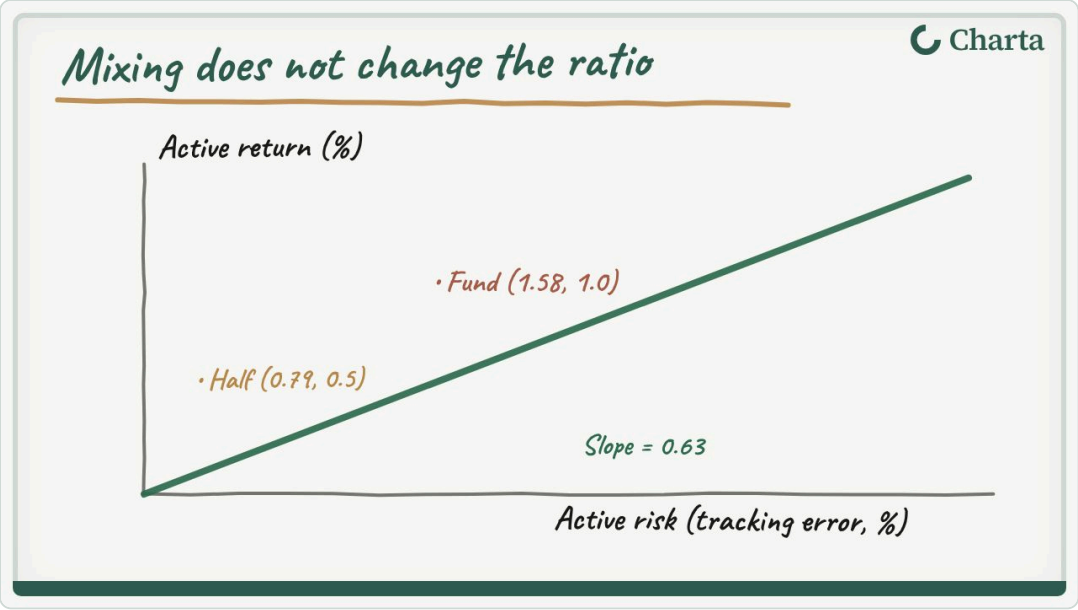
Same idea, different yardstick

Information ratio	Sharpe ratio
Top: return − benchmark	Top: return − risk-free
Bottom: tracking error	Bottom: total volatility
Judges skill vs the index	Judges reward for risk
Trap: 1.0 ÷ 10.9 = 0.09	Trap: using it for skill

IN THE LESSON

- Put the two ratios side by side.
- The information ratio measures skill relative to a benchmark.
- Its top is the return above the benchmark and its bottom is the tracking error.
- The Sharpe ratio measures reward for taking risk at all.
- Its top is the return above the risk-free rate and its bottom is total volatility.
- A fund that simply holds the index has a tracking error near zero, an information ratio that is meaningless, and a perfectly good Sharpe ratio.
- The exam trap is mixing the parts, for example dividing active return by total volatility.
- In our example that gives zero point zero nine, which understates the skill badly.

6 Mixing does not change the ratio



IN THE LESSON

- Here is a useful property, drawn.
- Active risk runs along the bottom, and active return up the side.
- The benchmark sits at the corner where both are zero.
- Our fund sits at tracking error one point five eight and active return one.
- The straight line from the corner through the fund has a slope of zero point six three, which is the information ratio.
- Now put half the money in the fund and half in the index.
- Active return halves to zero point five, and tracking error halves to zero point seven nine.
- The new point slides down the same line.
- Scaling the bet up or down changes how far along the line you are, never the slope.

7 Example 2: ex ante

Expected active return 2%, expected tracking error 4%

Ex ante information ratio	2 ÷ 4	**0.50**
Wrong: use total volatility	2 ÷ 12	**0.17**

IN THE LESSON

- Now look forward.
- A different manager is expected to beat her benchmark by two per cent a year, with an expected tracking error of four per cent.
- The ex ante information ratio is two over four, which is zero point five.
- This is the number a client would use when choosing a manager, because it uses forecasts instead of history.
- The forward-looking ratio is only as good as the forecasts behind it, a point we return to at the end.
- And the trap again: if her total volatility were twelve per cent, dividing the two per cent by twelve would give zero point one seven, a figure that tells you nothing about skill.

8 Where does skill come from?

- Information coefficient (IC): skill, forecast vs outcome
- Breadth (BR): independent bets per year
- Transfer coefficient (TC): share the rules let through
- Active risk: how aggressively we run the bets

IN THE LESSON

- So where does a high information ratio come from?
- Think of a fisherman.
- Three things matter.
- First, how good he is at reading the water: that is skill.
- Second, how many separate spots he fishes in a season: that is the number of independent chances.
- Third, whether the harbour rules let him actually fish where his instinct points: that is the constraints.
- The fundamental law gives these names.
- The information coefficient is the correlation between forecast and realised active returns, our measure of skill.
- Breadth is the number of independent active decisions per year.
- The transfer coefficient says how much of each forecast survives the constraints.

9 The fundamental law

IR = TC × IC × √BR

Information ratio (IR)	Ratio the strategy can deliver
Transfer coefficient (TC)	0 to 1: how much passes the rules
Information coefficient (IC)	Skill, small, e.g. 0.05
Breadth (BR)	Independent decisions per year

IN THE LESSON

- Here is the law.
- The information ratio equals the transfer coefficient, times the information coefficient, times the square root of breadth.
- Each piece has a job.
- The information coefficient is skill, usually a small number like zero point zero five, because forecasting is hard.
- The square root of breadth is the benefit of making many separate bets.
- Why a square root?
- Independent bets add their expected returns, but their risks only add in quadrature, so the ratio grows with the root, not the count.
- The transfer coefficient, between zero and one, trims the result when constraints such as a ban on short selling block the forecasts.
- With no constraints it is one.

10 From ratio to active return

RA = IR × active risk = TC × IC × √BR × σA

Active return (RA)	Expected active return
Information ratio (IR)	Information ratio
Active risk chosen	Aggressiveness dial

IN THE LESSON

- The information ratio is a rate of exchange.
- It tells you how many points of active return you earn per point of active risk.
- So to find the expected active return, multiply the ratio by the active risk you choose to run.
- Active risk is the aggressiveness dial, and it is a decision, not a fact of nature.
- Turn it up and both the expected active return and the danger rise together, along the line we drew earlier, but the ratio stays put.
- Written out in full, expected active return is the transfer coefficient, times the information coefficient, times the square root of breadth, times the active risk.

11 Example 3: a long-only stock picker

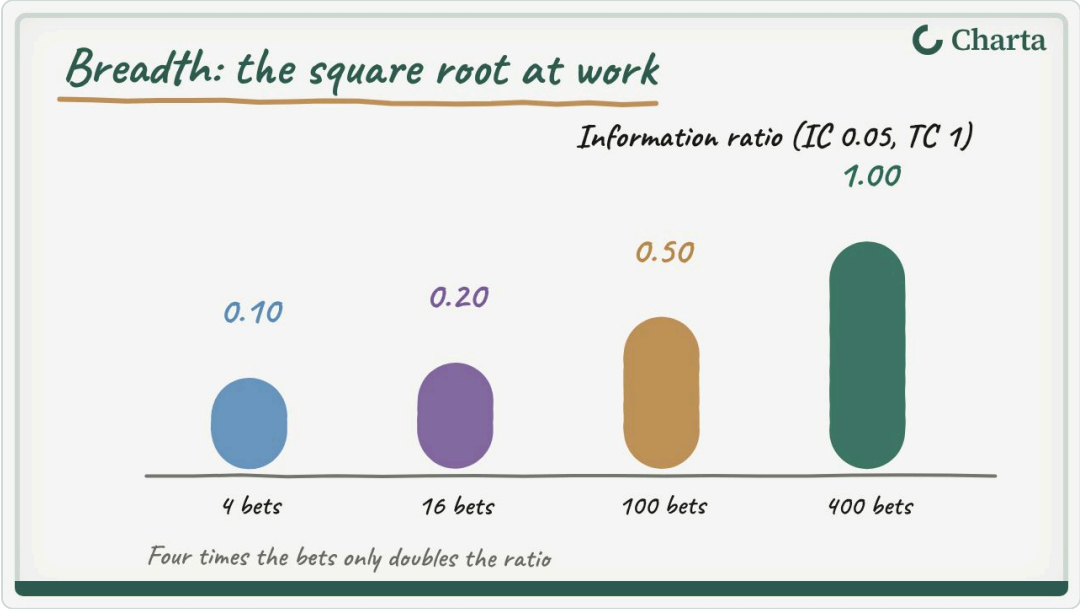
IC 0.05, breadth 100, TC 0.6, active risk 4%

Unconstrained IR	0.05 × √100	**0.50**
Constrained IR	0.6 × 0.50	**0.30**
Expected active return	0.30 × 4%	**1.2%**
The trap: no square root	0.6×0.05×100×4%	**12%**

IN THE LESSON

- A stock picker is made up for us.
- Her information coefficient is zero point zero five.
- She makes one hundred independent decisions a year.
- A long-only rule gives a transfer coefficient of zero point six, and she targets four per cent active risk.
- First, the square root of one hundred is ten.
- Skill times the root of breadth is zero point zero five times ten, which is zero point five: the information ratio she could reach with no constraints.
- The constraint cuts that by forty per cent, to zero point three.
- Multiply by four per cent active risk and she should expect one point two per cent a year over the benchmark.

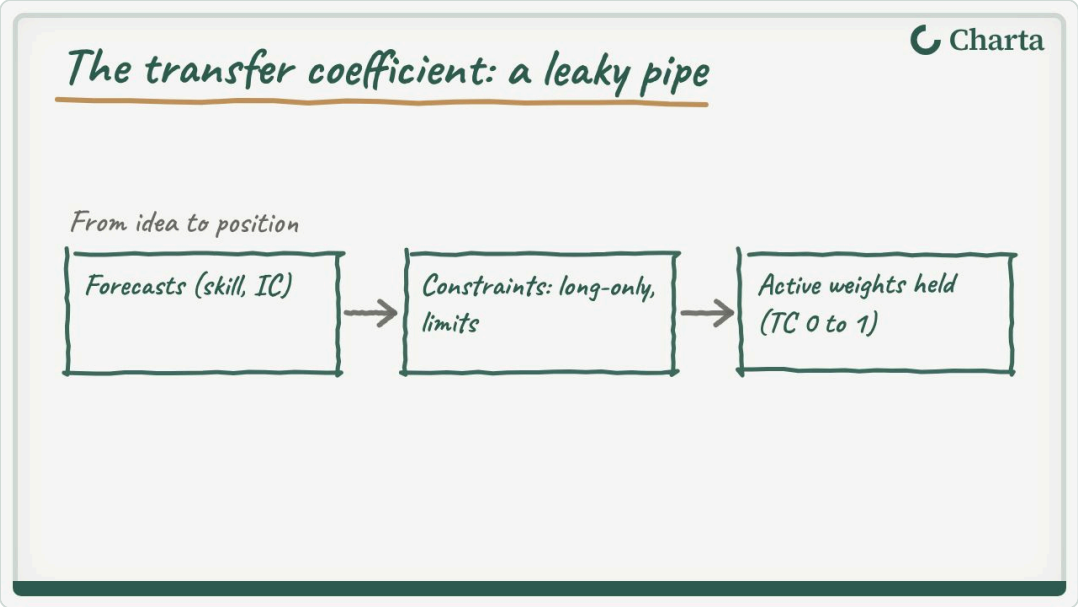
12 Breadth: the square root at work



IN THE LESSON

- Here is the square root in a picture.
- Keep the information coefficient at zero point zero five, with no constraints, and change only the number of independent bets.
- With four bets the information ratio is zero point one.
- With sixteen bets, four times as many, it is zero point two, just double.
- With one hundred bets it is zero point five.
- With four hundred it is one, which is again double the previous bar for four times the bets.
- To double your information ratio you need four times the breadth.
- This is why a manager cannot simply keep adding names to repair a weak skill level: each new bet helps less than the one before.

13 The transfer coefficient: a leaky pipe



IN THE LESSON

- Now the transfer coefficient, drawn as a pipe.
- On the left, the manager's forecasts, which carry whatever skill the information coefficient says.
- In the middle, the constraints: a ban on short selling, limits on the size of any one position, a cap on turnover.
- On the right, the active weights actually held in the portfolio.
- If the rules let everything through, the transfer coefficient is one.
- If a long-only rule stops the manager from acting on her bearish views, a large part of the signal is lost and the coefficient might be zero point six.
- It is not the share of forecasts that are right.
- It measures how faithfully ideas become positions.

14 Example 4: what the constraint costs

Benchmark Sharpe ratio 0.40

Best Sharpe, constrained	√(0.16 + 0.09)	**0.50**
Best Sharpe, unconstrained	√(0.16 + 0.25)	**0.64**
Cost of the constraint	0.64 − 0.50	**0.14**

IN THE LESSON

- The law also works for the whole portfolio.
- Suppose the benchmark has a Sharpe ratio of zero point four.
- If the manager blends her strategy with the benchmark at the best level of active risk, the best Sharpe ratio squared equals the benchmark Sharpe squared plus the squared information ratio.
- With the constrained ratio of zero point three, that is zero point one six plus zero point zero nine, which is zero point two five, and the square root is zero point five.
- Without the constraint, the ratio is zero point five, and we get zero point one six plus zero point two five, which is zero point four one, giving zero point six four.
- The long-only rule costs fourteen hundredths of Sharpe.
- That is a real price to pay.

15 Mistakes to avoid so far

- Divide by tracking error, not total volatility
- Use √BR, not BR
- TC measures leakage, not accuracy
- Compare on IR, not on active return alone
- Only independent decisions count toward breadth

IN THE LESSON

- Here are the usual slips.
- First, dividing active return by total volatility instead of tracking error.
- Second, multiplying by breadth instead of its square root, which here turned one point two per cent into twelve.
- Third, reading the transfer coefficient as a hit rate.
- It is not the share of calls that were right; it is how much of the signal survives the rules.
- Fourth, comparing managers on expected active return alone.
- A manager who simply runs more active risk will show more active return with no more skill.
- Fifth, counting a bet twice.
- If two decisions rest on the same view, they are one bet, not two.

16 Pick the chef, then choose the portion

- IR does not change with the scale of the bet
- Step one: choose the manager with the highest IR
- Step two: choose how much active risk to run
- Mix the fund with the index to reach that level

IN THE LESSON

- Now the second use of the ratio.
- Imagine choosing a chef for your restaurant.
- You judge the chef by the quality of the cooking, not by how big the portion happens to be, because you can always order a bigger or smaller portion.
- Active managers are the same.
- Their information ratio does not change with the amount of active risk, so it is the quality of the cooking.
- The size of the portion, the active risk, is a separate decision you make later.
- This separates the job into two steps.
- First pick the manager with the highest information ratio.
- Then set the active risk, by mixing the manager with an index fund, or by leveraging.

17 Why the highest ratio wins

SR^2 (best) = SR^2 (benchmark) + IR^2

Best achievable Sharpe	Best Sharpe ratio achievable
Benchmark Sharpe ratio	Benchmark Sharpe ratio
Information ratio (IR)	Manager's information ratio

IN THE LESSON

- Why does the highest information ratio win?
- Because when you combine a manager with the benchmark at the best level of active risk, and the active returns are uncorrelated with the benchmark, the best Sharpe ratio squared equals the benchmark Sharpe squared plus the information ratio squared.
- The benchmark part is the same whichever manager you pick.
- So the only thing that can lift your final Sharpe ratio is the information ratio, and the bigger it is, the better.
- Notice what is missing: the manager's expected active return, and the manager's own Sharpe ratio.
- Neither decides the matter.

18 How much active risk to take

Optimal active risk = (IR ÷ SR of benchmark) × σ of benchmark

Active risk chosen	Optimal active risk to run
Information ratio (IR)	Manager's information ratio
Benchmark Sharpe ratio	Benchmark Sharpe ratio
Benchmark volatility	Benchmark volatility
Share of money in the fund	Optimal ÷ fund's own active risk

IN THE LESSON

- Once the manager is chosen, how much active risk should you run?
- There is a clean answer.
- The optimal active risk equals the manager's information ratio divided by the benchmark's Sharpe ratio, multiplied by the benchmark's volatility.
- Think about what this says.
- A skilful manager, with a high information ratio, deserves more active risk.
- A benchmark that already offers a high Sharpe ratio is a strong alternative, so you take less active risk.
- If the fund's own tracking error is higher than this optimum, you cannot run the fund at less than its own risk, so you put only part of your money in it: the optimal active risk divided by the fund's active risk, and the rest in the benchmark.

19 Example 5: choosing between two funds

Benchmark: Sharpe 0.50, volatility 16%

Fund A: IR	3.6 ÷ 12	**0.30**
Fund B: IR	4.0 ÷ 16	**0.25**
Best Sharpe with A	√(0.25 + 0.09)	**0.58**
Best Sharpe with B	√(0.25 + 0.0625)	**0.56**

IN THE LESSON

- A pension plan has a benchmark with a Sharpe ratio of zero point five and volatility of sixteen per cent.
- Fund A expects three point six per cent of active return at twelve per cent tracking error.
- Fund B expects four per cent at sixteen per cent.
- B promises more active return, so it is tempting.
- Look at the ratios.
- A is three point six over twelve, which is zero point three.
- B is four over sixteen, which is zero point two five.
- Now the best Sharpe ratios.
- For A, the square root of zero point two five plus zero point zero nine is zero point five eight.
- For B, the square root of zero point two five plus zero point zero six two five is zero point five six.
- A wins.

20 Example 5 continued: how much to hold

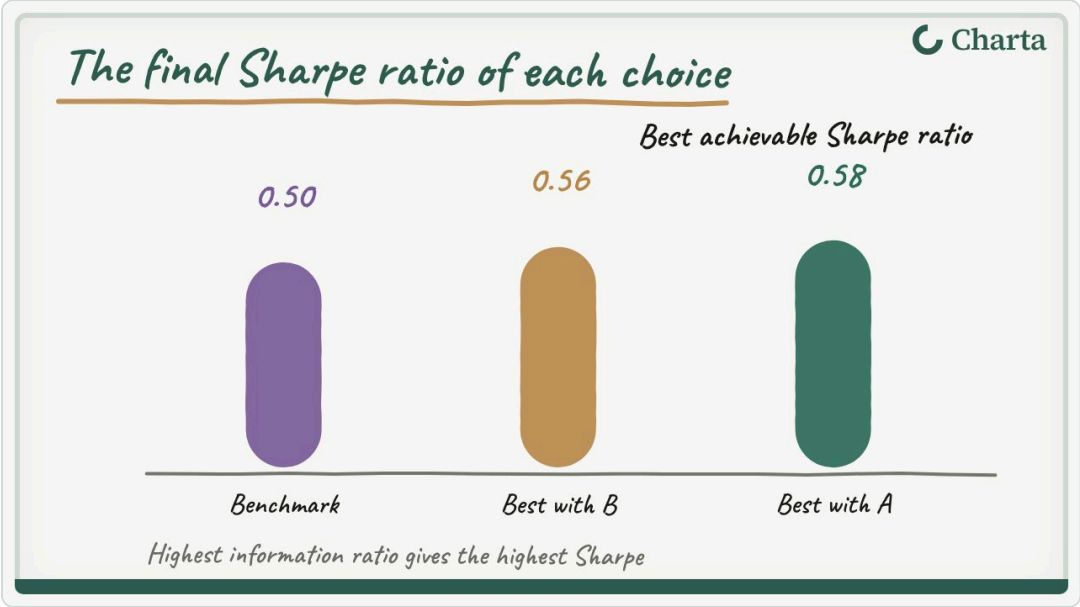
Fund A, information ratio 0.30

Optimal active risk	0.30 ÷ 0.50 × 16%	**9.6%**
Share in Fund A	9.6 ÷ 12	**80%**
Expected excess return	8 + 0.8 × 3.6	**10.88%**
Total risk	√(16² + 9.6²)	**18.66%**
Resulting Sharpe	10.88 ÷ 18.66	**0.58**

IN THE LESSON

- Now size the position.
- The optimal active risk for Fund A is its ratio of zero point three, divided by the benchmark Sharpe ratio of zero point five, times sixteen per cent.
- That is nine point six per cent.
- Fund A has twelve per cent tracking error, which is higher than that, so we cannot hold all of it.
- We put nine point six over twelve, which is eighty per cent, in the fund, and twenty per cent in the benchmark.
- Check the result.
- Expected excess return is eight per cent from the benchmark plus eighty per cent of three point six, or two point eight eight, giving ten point eight eight.
- Total risk is the square root of sixteen squared plus nine point six squared, eighteen point six six.
- The ratio is zero point five eight.
- That is the whole method in one example.

21 The final Sharpe ratio of each choice



IN THE LESSON

- Here are the outcomes as bars, with the Sharpe ratio up the side.
- The first bar is the plain benchmark, a Sharpe ratio of zero point five.
- Anything an active manager does has to beat that bar.
- The second bar is Fund B, after being mixed with the benchmark in the best proportion: zero point five six.
- The third bar is Fund A, similarly mixed: zero point five eight.
- Fund B had the higher expected active return, but its information ratio was lower, so the best it can do is lower.
- Notice the lesson: choosing the manager with the largest raw outperformance, or the largest own Sharpe ratio, could have cost the plan some of this gain.

22 Two styles: the timer and the picker

- Timer: few calls, broad asset classes, small breadth
- Timer needs a high IC on each call
- Picker: many bets, modest IC per bet
- Different mixes of IC and breadth, same IR possible

IN THE LESSON

- Active managers play the game in two quite different ways.
- A market timer decides when to be in stocks and when in bonds or cash.
- She might make only a handful of calls a year, on broad asset classes.
- Her breadth is small, so every call has to be very accurate to give a good ratio.
- A security selector, the stock picker, chooses among hundreds of companies.
- Each individual forecast is only slightly better than a guess, a small information coefficient, but there are many of them, so breadth does the heavy lifting.
- The fundamental law shows that two styles that look nothing alike can reach the same information ratio.

23 Skill of a market timer

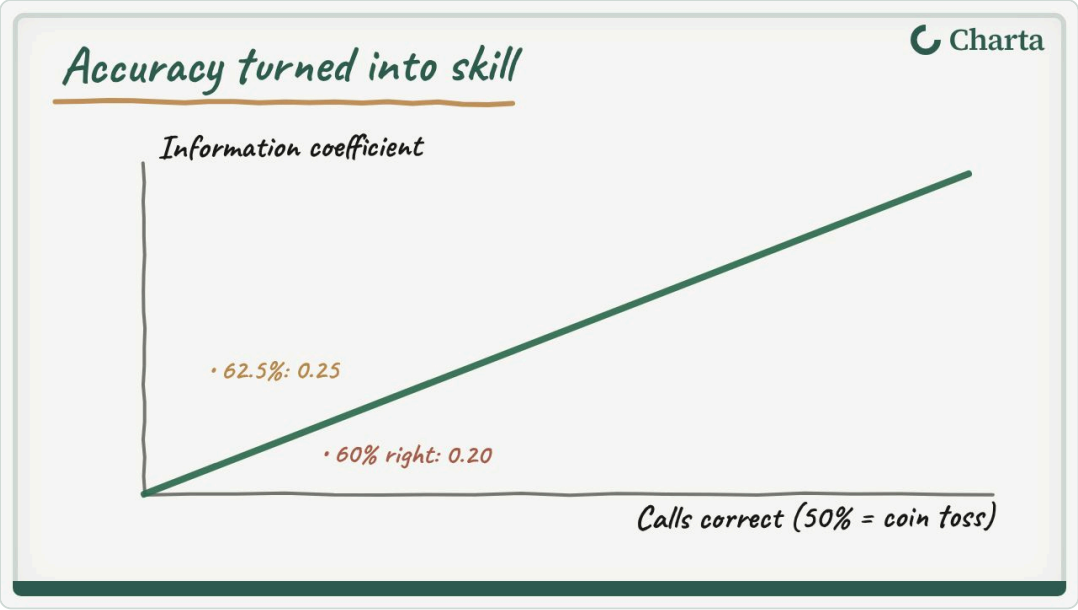
IC = 2 × (proportion correct) − 1

Information coefficient (IC)	Skill of a binary caller
Proportion of calls correct	Share of calls that were right
Coin toss: 50% gives zero	Right half the time: no skill

IN THE LESSON

- How do we measure the skill of a timer?
- For calls that are simply right or wrong, such as stocks will beat bonds this quarter or they will not, the information coefficient is two times the proportion of calls that were correct, minus one.
- Think of a coin.
- If she is right half of the time, she has no skill, and two times a half minus one is zero.
- If she is right every time, the coefficient is one.
- If she is right sixty per cent of the time, the coefficient is two times zero point six minus one, which is zero point two.
- Small differences in accuracy therefore move the coefficient a lot.

24 Accuracy turned into skill



IN THE LESSON

- Here is the relation, drawn.
- The proportion of calls that are correct runs along the bottom, from one half, a coin toss, to one.
- The information coefficient is up the side.
- The line starts at the bottom left, at a half and zero, and rises in a straight line to the top right corner, at one and one.
- A timer who is right sixty per cent of the time sits at a coefficient of zero point two.
- One who is right sixty two and a half per cent sits at zero point two five.
- Two and a half points of extra accuracy is worth five hundredths of coefficient, which, for a timer with few calls, is a very large jump in the ratio.

25 Example 6: timer against picker

Timer 4 calls, 60% right; picker 100 bets; both 5% risk

Timer's IC	2 × 0.60 − 1	**0.20**
Timer's IR	0.20 × √4	**0.40**
Picker's IR	0.5 × 0.05 × √100	**0.25**
Active return: timer	0.40 × 5%	**2.0%**
Active return: picker	0.25 × 5%	**1.25%**

IN THE LESSON

- Let us compare them.
- A timer makes four independent calls a year on stocks against bonds and is right sixty per cent of the time.
- Her coefficient is zero point two, and with no constraints her information ratio is zero point two times the square root of four, which is zero point four.
- A picker has a coefficient of zero point zero five on one hundred independent bets, but a long-only transfer coefficient of zero point five.
- Her ratio is zero point five times zero point zero five times ten, which is zero point two five.
- At five per cent active risk, the timer expects two per cent, the picker only one point two five.
- The two styles end up quite close.

26 Example 7: judging a change of strategy

Picker starts at IR 0.25 (TC 0.5, IC 0.05, breadth 100)

Allow shorting: TC 0.8	0.8 × 0.05 × 10	**0.40**
Double the breadth	0.25 × √2	**0.35**
Monthly on a slow signal	still 100 bets	**0.25**
Timer to reach IR 0.50	0.50 ÷ √4	**IC 0.25**

IN THE LESSON

- To judge a change in strategy, ask what it does to each term.
- First, let the picker short sell, lifting the transfer coefficient from zero point five to zero point eight.
- The ratio rises in proportion, by sixty per cent, to zero point four, level with the timer.
- Second, add one hundred new stocks whose forecasts are truly independent.
- Breadth doubles, so the ratio rises by the square root of two, about forty one per cent.
- Third, rebalance monthly on a signal that changes slowly.
- That does not create twelve times the bets, because the new information arrives only once a year, so breadth stays at one hundred and nothing improves.
- Fourth, what would the timer need to reach one half?
- An information coefficient of one half over the root of four, which is zero point two five.
- Each change moves a different term.

27 Where the fundamental law is useful

- Shows the sources of active return
- Compares unlike strategies on one footing
- Prices the cost of constraints
- Tells clients which questions to ask

IN THE LESSON

- The law is not a calculator that gives exact answers, but it is a superb way of thinking.
- It shows where active return comes from, and in what proportion.
- It lets us compare very different strategies, such as a timer and a picker, on a common footing.
- It puts a price on constraints: we saw that a long-only rule cost fourteen hundredths of Sharpe.
- And it tells a client what to ask a manager: how good is your skill, how many truly separate decisions do you make, and what stops your ideas reaching the portfolio?
- Those questions alone separate serious managers from salespeople.

28 Where the law falls short

What the law assumes against what happens

The law assumes	In practice
IC is known and stable	Noisy estimate that drifts
Bets are independent	Shared factors, slow signals
No trading costs	Turnover eats the ratio
TC is a fixed number	Varies with markets

IN THE LESSON

- Now the limits, and they matter on the exam.
- The information coefficient is an ex ante idea, but we estimate it from a noisy track record, and it can change as markets change.
- Breadth assumes the decisions are independent, yet forecasts for stocks that share a factor move together, and monthly bets on a slow signal repeat the same view, so naive counting overstates breadth.
- The law ignores transaction costs, which a high turnover strategy pays in full.
- And it treats the transfer coefficient as a fixed number, when it varies with holdings and markets.
- The trap is treating the result as a precise forecast rather than a guide.

29 Example 8: an honest breadth count

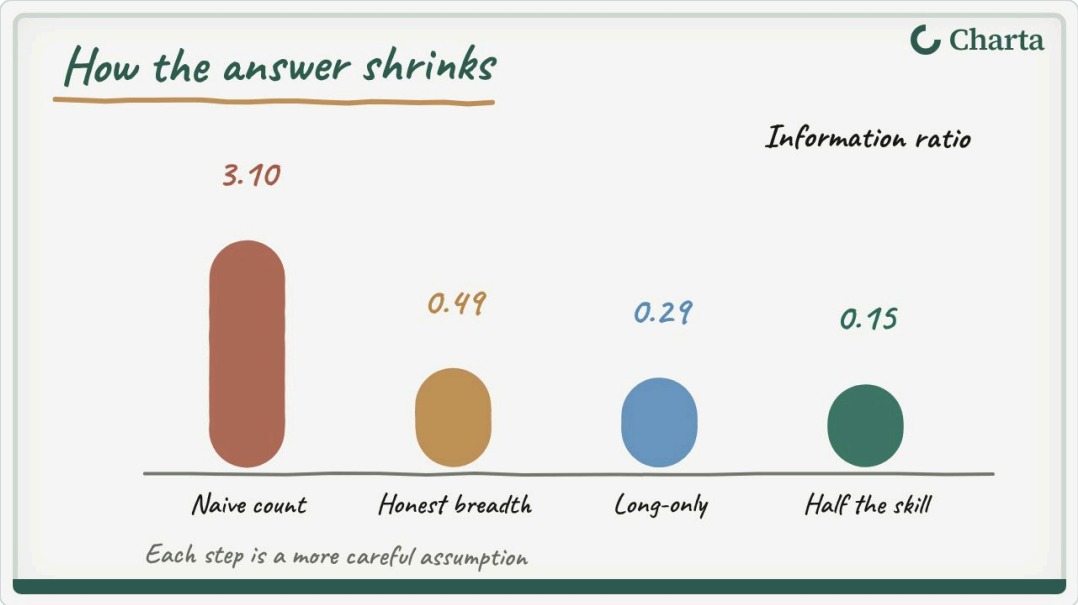
IC 0.04 from a backtest; TC 0.6

Naive IR	0.04 × √6000	**3.10**
Honest breadth 150	0.04 × √150	**0.49**
With long-only TC 0.6	0.6 × 0.49	**0.29**
If true IC is 0.02	0.6 × 0.02 × √150	**0.15**

IN THE LESSON

- Here is a stress test.
- A manager covers five hundred stocks and rebalances monthly.
- Her backtest shows an information coefficient of zero point zero four.
- Counted naively, breadth is five hundred times twelve, which is six thousand, and the root of that gives an information ratio of three point one.
- That is wildly implausible.
- But her forecasts come from a few slow-moving factors, and an honest count is one hundred and fifty independent bets.
- The unconstrained ratio becomes zero point zero four times the root of one hundred and fifty, about zero point four nine.
- With a long-only transfer coefficient of zero point six it is zero point two nine, before costs.
- If the true coefficient is only zero point zero two, it is zero point one five.
- Trading costs would lower it further still.

30 How the answer shrinks



IN THE LESSON

- Here are those four answers side by side, with the information ratio up the side.
- The first bar, the naive count, towers at three point one.
- The second bar uses an honest count of independent bets and drops to about zero point five.
- The third bar adds the long-only constraint and falls to about zero point three.
- The fourth bar halves the uncertain skill estimate and falls to about zero point one five.
- Same manager, same data.
- The only thing that changed was how careful we were with the inputs.
- So use the law to understand and compare, and be humble about the number it produces.

31 Recap

- IR = active ÷ tracking error (Sharpe uses total vol)
- IR = TC × IC × √BR; RA = IR × active risk
- Pick highest IR, then set optimal active risk
- Timer: few calls, high IC. Picker: many bets
- Law is a guide: noisy IC, correlated bets, costs

IN THE LESSON

- Let us pull it together.
- The information ratio is active return divided by tracking error, either from past returns or from forecasts, and it is not changed by scaling the bet.
- The Sharpe ratio instead uses total volatility.
- The fundamental law says the ratio equals the transfer coefficient times the information coefficient times the square root of breadth, and active return is that ratio times active risk.
- Choose the manager with the highest ratio, then set the active risk at the ratio over the benchmark Sharpe ratio, times benchmark volatility.
- Timers need accuracy, pickers need many bets, and the law is a guide with real limits, not a forecast.

32 Quick check

1. Mean active return 1.5%, tracking error 3%. IR?
   Answer: 1.5 ÷ 3 = 0.50
2. IC 0.04, 50 bets, TC 0.5, active risk 6%. Active return?
   Answer: 0.5×0.04×√50 = 0.141; × 6% = 0.85%
3. IR 0.30, benchmark SR 0.60, vol 10%. Optimal active risk?
   Answer: 0.30 ÷ 0.60 × 10% = 5%

IN THE LESSON

- Question one.
- A fund's mean active return is one point five per cent and its tracking error is three per cent.
- What is the ex post information ratio?
- One point five over three is zero point five.
- Question two.
- A manager has an information coefficient of zero point zero four, fifty bets a year, a transfer coefficient of zero point five, and runs six per cent active risk.
- What is the expected active return?
- The root of fifty is about seven point zero seven, so the ratio is zero point five times zero point zero four times that, about zero point one four, and times six, it is about zero point eight five per cent.
- Question three.
- A manager has an information ratio of zero point three, the benchmark Sharpe ratio is zero point six, and its volatility is ten per cent.
- What is the optimal active risk?
- Zero point three over zero point six, times ten, gives five per cent.
- That is the amount of risk to run.