Relative Value and Arbitrage

Interview preparation summary · HF track

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INT.HR.1.a · Relative value ideas and instruments

Explain the relative value idea, long a cheap instrument and short a related expensive one to profit from convergence rather than direction, and calculate the profit and loss of a hedged spread trade.

Relative value means taking a long position in an instrument that looks cheap and a short position in a related instrument that looks expensive, so that the gain comes from the gap between them closing and not from the direction of the market. The two legs share a main risk, such as the same company, the same sector or the same interest rate, so a market move hits both and largely cancels. What is left is the spread, and the trade is a view that the spread is wrong and will narrow. This is different from a long short equity pitch, where the short is usually a view on a weak company as well as a hedge (see Hedge Fund Stock Pitches). Three things define a good relative value idea: a reason the gap exists, a mechanism and a time that make it close, and a hedge ratio that removes the common risk. The usual weaknesses are a hedge that is only approximate, a spread that widens before it narrows, and a position that cannot be held long enough to see convergence.

WORKED EXAMPLE: TWO SHARE LINES OF ONE COMPANY

Pellham Group is an invented company with two share lines that have identical claims on dividends and assets. The ordinary line trades at 50.00 and the second line at 52.00, a premium of 4.0%. Historically the premium is about 1.0%. A fund buys 100,000 ordinary shares (5.0m) and sells short second-line shares of the same value. Work out the profit or loss if the premium falls to 1.0% when the market rises 10%, when the market falls 10%, and if the premium instead widens to 7.0% with the market flat.

Answer: The trade makes 158,654 if the market rises 10%, 129,808 if it falls 10% and about 144,231 if the market is flat, all as the premium falls to 1.0%. If the premium widens to 7.0% it loses 144,231. The profit depends on the spread and not on the market.

> **Interview tip:** Say that the profit comes from the change in the spread, show it is about the same whichever way the market moves, and then volunteer what happens if the spread widens. Naming the reason the gap should close shows you have thought about it.

INT.HR.1.b · Relative value ideas and instruments

Explain the main fixed income relative value trades (curve, swap spread, cash-futures basis, on-the-run against off-the-run) and size a trade so that it is neutral to a parallel move in yields.

Fixed income relative value trades compare related bonds, swaps and futures and are sized so that a parallel move in rates cancels. The common measure is DV01, the change in value for a one basis point move in yield. A curve trade, for example a steepener, goes long a short-dated bond and short a long-dated bond in equal DV01, and gains if the gap between long and short yields widens. A swap spread trade compares the fixed rate on an interest rate swap with the yield on a government bond of the same maturity; receiving fixed and selling the bond gains if the spread narrows. The cash-futures basis compares a bond with the bond future: the gross basis is the cash price less the futures price times the conversion factor, and the net basis is that figure after carry, which reflects the delivery options. The on-the-run bond is the newest benchmark, and it usually trades slightly rich to an older bond of similar maturity because it is more liquid; the trade buys the older bond and sells the newer one. Government bonds in these trades are financed in the repo market, so funding and balance sheet matter. Interest rates in general are covered in Markets, Macro and Current Affairs and Fixed Income Investing.

WORKED EXAMPLE: A DV01-NEUTRAL CURVE STEEPENER

A fund wants to trade a steepener in an invented government market. It buys 50m face of a 2-year bond with a DV01 of 190 per 1m face and sells a 10-year bond with a DV01 of 850 per 1m face. Size the 10-year leg so the trade is neutral to a parallel move, then work out the profit or loss if the 2-year yield falls 3bp and the 10-year yield rises 7bp, and if both yields rise 25bp.

Answer: Short 11.18m face of the 10-year bond. The trade makes 95,000 when the curve steepens by 10bp, and nothing when yields move in parallel.

Interview tip: Start with DV01 and say that equal face value is not neutral. Then say what shape or spread view you are expressing, and mention carry and financing, which interviewers often forget.

INT.HR.1.c · Relative value ideas and instruments

Explain convertible arbitrage and capital structure arbitrage, covering the bond floor, option value, delta hedge and gamma, and work out the floor, the hedge and the hedged profit and loss.

A convertible bond is a bond plus an option to exchange it for shares. Its bond floor is the value of the bond without the option, the present value of the coupons and principal at the yield of similar straight debt from the issuer. The rest of the price is the option value, and parity is the value of the shares received on conversion. In convertible arbitrage the fund buys the bond and sells short a number of shares equal to the conversion ratio times delta, which is the share of the option that moves with the stock. Because delta rises when the stock rises and falls when it falls, the hedged position gains from large moves either way; this is gamma. The cost is the time value of the option, paid for by the coupon, and the hedge must be adjusted as delta changes. The trade is often profitable when the option is bought at an implied volatility below what the stock actually delivers. Risks include a widening credit spread, which cuts the floor, a stock borrow that is withdrawn, and a squeeze in the shares. Capital structure arbitrage compares different instruments of one issuer, such as the bonds or credit default swaps against the shares, and trades the gap, for example long the credit and short the stock when the credit looks cheap.

WORKED EXAMPLE: THE KESTREL ROBOTICS CONVERTIBLE

Kestrel Robotics is an invented company. Its convertible has a par of 1,000, a 2% annual coupon, five years to maturity, and converts into 20 shares. Similar straight debt from the issuer yields 6%. The bond trades at 1,050 and the shares at 40.00, and the option delta is 0.55. Find the bond floor and the option value, set the hedge, and estimate the hedged profit per bond if the shares go to 44.00 (delta rising to 0.66) or to 36.00 (delta falling to 0.44).

Answer: The floor is about 832 and the option is worth about 218. The hedge is 11 shares short per bond, and a 4 point move in either direction earns about 4.4 per bond before carry and costs.

Interview tip: Give the three layers in order: floor, option, hedge. Then say the profit comes from gamma and cheap implied volatility, and be ready to say what hurts: a wider credit spread or a lost stock borrow.

INT.HR.2.a · Statistical trades, leverage and risk

Describe statistical arbitrage and pairs trading, covering the spread, mean reversion, the z-score and cointegration, and volatility arbitrage in outline, and calculate a z-score and an entry signal.

Statistical arbitrage trades many small relative value positions chosen by a model and not by a story. In a pairs trade the fund finds two securities that move together, defines the spread (a price difference or ratio, scaled by a hedge ratio from a regression), and buys the cheap leg and sells the expensive one when the spread is far from its average. The z-score is the spread minus its average, divided by its standard deviation, and typical rules enter at around 2, exit near 0 and stop out at a larger value. The idea relies on mean reversion, and a useful check is cointegration: two price series that each wander, but whose combination stays in a stable range. High correlation of daily returns is not enough, because the prices can still drift apart. The half-life says how quickly a gap closes, and it sets the holding period. Models fail when the relationship breaks, for example after a takeover or a change in business. Volatility arbitrage compares implied volatility in option prices with the volatility the trader expects, and buys or sells options delta hedged to capture the difference. More on factor and model building is in Quantitative Investing.

WORKED EXAMPLE: TWO BEVERAGE COMPANIES

Two invented drinks makers, Aldwick and Bramble, have a log price ratio (the natural log of Aldwick over Bramble) that averages 0.200 with a standard deviation of 0.050. Today it is 0.310. The rule is to enter at a z-score above 2 in either direction, exit at 0 and stop out at 3.5. Each leg is 1m. Work out the z-score, the profit if the spread returns to its average, and the loss if it reaches the stop. A regression shows deviations decay by 5% a day: what is the half-life?

Answer: The z-score is 2.2, so the trade is on: the profit at the average is about 110,000, the loss at the stop about 65,000, and the half-life is about 13.5 days.

> **Interview tip:** Define the spread, the z-score and the exit before you quote numbers. Mention that correlation is not cointegration and that you would check why the relationship might have broken.

INT.HR.2.b · Statistical trades, leverage and risk

Explain why relative value strategies use leverage, how financing costs, repo and haircuts work, and calculate the return and the loss on capital at a given level of leverage.

Relative value spreads are usually small, perhaps a fraction of one percent of the value of the position, so a fund that held the positions unlevered would earn little on its capital. Leverage scales the profit: if capital is a tenth of the position, a gain of 1% of the position is 10% of capital. Leverage scales the loss in the same way, and a spread that widens by 1.5% of the position takes 15% of capital. The position is usually financed by borrowing against the securities, for example in the repo market, where the lender gives cash worth less than the collateral. The difference is the haircut, and the fund pays it from its own capital. The cost of financing is the interest on the borrowed cash and any fees. Financing is often short term while the assets are held for months, so a lender can raise the haircut or refuse to roll the funding, which forces the fund to sell or post cash. Because of this, the useful measures are not only the expected return but also the loss per unit of adverse spread move, the margin that can be called, and the funding terms. Position sizing is covered in Risk and Portfolio Construction.

WORKED EXAMPLE: THE SAME TRADE AT DIFFERENT LEVERAGE

A fund runs a convergence trade that earns 1.4% of the notional position a year in expected convergence and carry, and the net cost of financing it is 0.3% of notional a year. Capital is 100m. Find the return on capital at 10 times leverage, the loss on capital if the spread moves against the fund by 1.5% of notional, and how long the net income would take to earn it back. Compare with 5 times leverage.

Answer: At 10 times leverage the return is 11.0% a year and a 1.5% adverse move costs 15% of capital, about 1.36 years of income. At 5 times the figures are 5.5% and 7.5%.

> **Interview tip:** State the return and the loss together, because leverage multiplies both. Say that haircuts and funding terms can change in a stress, which turns a paper loss into a forced sale.

INT.HR.2.c · Statistical trades, leverage and risk

Explain liquidity risk, crowding and tail risk in convergence trades, describe how a relative value pitch is built and risk-managed, and size a position from a stress loss.

A convergence trade can diverge. A spread that is too wide can widen further, and a leveraged fund may be forced to close before it narrows if lenders raise haircuts, margin is called, a loss limit is hit or investors redeem. Several past episodes, described here in general terms, show the pattern: a fund with a high leverage and many positions that looked unrelated lost on all of them at once because they depended on the same thing, the willingness of others to provide liquidity. Crowding adds to it, because many funds hold similar trades and forced selling by some pushes prices against all. Such losses are rare but large, so the return distribution has a fat left tail and a sample of calm years understates the risk. A good pitch states the mispricing and why it exists, the mechanism and date by which it should close, how the hedge removes the common risk, how the trade is financed, the expected gain, a stress loss, the size, and the rule that closes it. Position size comes from the stress loss and the loss limit, not from the expected profit. See also Risk and Portfolio Construction and Investment Judgement.

WORKED EXAMPLE: SIZING A SPREAD TRADE FROM THE STRESS LOSS

A fund with 400m of capital allows a loss of 1% of capital on one trade in a stress. A spread trade on 100m face has a spread DV01 of 400 per 1m face per basis point. The expected gain is 30bp of tightening, and a stress case is a widening of 120bp. Find the expected gain and stress loss on 100m, the largest size the loss limit allows, the gain at that size, and the probability of the stress at which the trade has zero expected value.

Answer: The size is limited to about 83.3m face, with a gain of about 1.0m if it works, and the trade only pays if a stress of that size is less likely than 20%.

> **Interview tip:** Size from the loss you can accept in the stress, not from the gain you expect. Name the mechanism that makes the spread close and the date or event, and say what would make you exit before then.

Summary of the Charta interview-preparation topic. Companies and figures in the examples are invented. Draft content, not yet expert reviewed.