Fixed Income Investing

Interview preparation summary · HF track

IN THIS SUMMARY

- Bond mathematics and the yield curve
- Credit, portfolios and pitching a view

INT.HI.1.a · Bond mathematics and the yield curve

Price a bond from its yield, explain why price and yield move in opposite directions, and separate the clean price from the dirty price and accrued interest.

A bond is a set of fixed cash flows, so its price is the present value of the coupons and the face value discounted at the yield to maturity. When the yield rises the same cash flows are worth less, so the price falls, and the relationship is curved rather than a straight line. A bond priced at par has a yield equal to its coupon, a bond below par has a yield above the coupon, and a bond above par has a yield below it. Quoted prices are usually clean prices, which leave out the interest the seller has earned since the last coupon date. The buyer pays the dirty price, which is the clean price plus accrued interest, so the quote does not jump each time a coupon is paid. Accrued interest is the coupon times the fraction of the coupon period that has passed, using the day count of the market. Current yield (coupon over price) ignores the pull to par and the timing of cash flows, so yield to maturity is the better measure, but it assumes the coupons are reinvested at the same yield and that the bond is held to maturity. In an interview, state the formula in words, check the direction of any answer (a price below par means a yield above the coupon) and say whether a price is clean or dirty.

WORKED EXAMPLE: PRICING A FIVE-YEAR BOND AND FINDING WHAT A BUYER PAYS

Calder Utilities is an invented company with a five-year bond paying an annual coupon of 4 per 100 face. The market yield is 5% a year. Find the price on a coupon date, see what happens at yields of 4% and 6%, and find the invoice price for 50m face when the quoted (clean) price is that figure and 73 days of interest have accrued (actual over 365).

Answer: The price is 95.67 per 100 face at a yield of 5%. With 73 days accrued, the dirty price is 96.47, so the buyer of 50m face pays 48.235m, of which 0.400m is accrued interest.

> **Interview tip:** Say whether a price is clean or dirty, and check the sign: a yield above the coupon means a price below par.

INT.HI.1.b · Bond mathematics and the yield curve

Estimate a price change from modified duration, DV01 and convexity, and explain what makes a bond's duration longer or shorter.

Duration measures how sensitive a bond's price is to a change in yield. Macaulay duration is the weighted average time to the cash flows, in years, and modified duration is that figure divided by one plus the yield. Modified duration gives the approximate percentage price change for a one percentage point change in yield: a bond with a modified duration of 4.4 loses about 4.4% when its yield rises by 1%. DV01 is the money change in value for one basis point, which is market value times modified duration times 0.0001, and it is the figure risk limits and hedges use. Duration is longer when maturity is longer, the coupon is lower, or the yield is lower. Duration is only a first-order estimate. The price curve bends, so for large moves convexity matters: the estimate is minus duration times the yield change plus half of convexity times the yield change squared. Positive convexity helps the holder in both directions, because a fall in yield adds more than duration predicts and a rise in yield costs less. Callable bonds and mortgage-backed bonds can have negative convexity, so their prices rise less when yields fall. Duration also assumes a parallel move in yields, so a curve change needs a key-rate view.

WORKED EXAMPLE: ESTIMATING THE PRICE MOVE ON THE CALDER BOND

Use the Calder Utilities five-year 4% bond at a yield of 5% (price 95.67). Find its modified duration, DV01 on 50m face, and the estimated and exact price change for a rise in yield of 1%.

Answer: Modified duration is 4.40, so a 1% rise in yield costs about 4.40% on duration alone and 4.28% with convexity, against an exact 4.28%. DV01 on 50m face is about 21,049.

> **Interview tip:** Give the duration answer first, then say convexity corrects it for large moves and that it always helps the holder of a plain bond.

INT.HI.1.c · Bond mathematics and the yield curve

Read the yield curve: describe its shape, work out carry and roll-down, say which positions profit from steepening, flattening and a parallel shift, and link the curve to central banks and inflation.

The yield curve plots yields against maturity. It is normally upward sloping, because investors want more for lending longer, flat when the market sees little difference, and inverted when short rates are above long rates, which often reflects expected rate cuts or a slowdown. Short-dated yields follow the central bank's policy rate and its expected path, while long-dated yields also reflect expected inflation, growth and a term premium. A steepening means the gap between a long and a short maturity widens, and a flattening means it narrows. A bull move means yields fall and a bear move means yields rise, so a bull steepener is a fall in short yields by more than long yields, which is typical when the central bank cuts. A flattener is long the long end and short the short end, weighted by DV01 so that it is neutral to a parallel shift. Carry is the income from holding a bond less the cost of financing it. Roll-down is the price gain as a bond with an upward sloping curve ages and is priced off a lower yield on the curve. Together they are the return if the curve does not move, so a trade with positive carry and roll-down has a cushion before a view is tested. The forward rate is the yield implied for a future period, and a view is a view that rates will end up above or below it.

WORKED EXAMPLE: CARRY AND ROLL-DOWN ON A FIVE-YEAR BOND

An invented curve is 1-year 3.0%, 2-year 3.4%, 3-year 3.7%, 4-year 3.9% and 5-year 4.0% (annual compounding, illustrative). A manager buys a five-year bond with a 4% annual coupon, priced at par, financed at the 1-year rate of 3.0%, and holds it for one year with the curve unchanged. Find the carry, the roll-down and the excess return over financing, and the one-year forward rate one year ahead.

Answer: Carry is 1.0%, roll-down is about 0.36%, so the excess return over financing is about 1.36% if the curve does not move. The one-year forward rate one year ahead is 3.80%, and a view that rates will be lower than that favours owning the longer bond.

> **Interview tip:** Say that carry plus roll-down is the return on an unchanged curve and the cushion before the view is tested. Then name the forward rate the view is against.

INT.HI.2.a · Credit, portfolios and pitching a view

Analyse credit risk: split a spread into expected loss and compensation for risk, use default probability, recovery and spread duration, and contrast investment grade with high yield.

The credit spread is the extra yield a corporate bond pays over a government bond of similar maturity. It pays for the chance of default, for the loss when a default happens, for the risk that spreads widen and for lower liquidity. Expected loss each year is the probability of default times the loss given default, and the loss given default is one minus the recovery rate. The spread is usually larger than expected loss, and the gap is a premium for bearing risk and illiquidity that is earned on average but is lost in a bad year. Spread duration measures the price change for a change in the spread: a spread duration of 4 means a widening of 100 basis points costs about 4%. Investment grade bonds carry ratings in the top part of the scale, have lower default risk and spreads that move in a narrower range, and are held by many regulated investors. High yield bonds carry lower ratings, pay more, and have prices that behave more like equity in a downturn. A bond that falls from investment grade to high yield, a fallen angel, can fall further than the rating change alone suggests because some holders must sell. Credit analysis in outline asks about the business, leverage and interest cover, cash flow, the maturity of its debt, the bond's ranking and covenants, and the price against the spread of similar companies.

WORKED EXAMPLE: HOW MUCH OF A SPREAD IS REAL COMPENSATION

Marlow Chemicals is an invented company with a five-year senior bond that pays a spread of 180 basis points over the government yield. You estimate a 2% a year probability of default, a recovery rate of 40% and a spread duration of 4.5. How much of the spread is expected loss, how much is left, and how far can spreads widen before a year of that remainder is lost?

Answer: Expected loss is 120 basis points of the 180, leaving 60 basis points of premium. A widening of about 13 basis points removes a year of that premium, so the bond is only attractive if I believe default risk is lower than 2% or spreads will tighten.

Interview tip: Split the spread into expected loss and the rest, then use spread duration to say how little widening the rest can absorb.

INT.HI.2.b · Credit, portfolios and pitching a view

Position a bond portfolio against its benchmark: set duration, curve and credit tilts, estimate tracking error, weigh carry against roll-down and liquidity, and describe the main sectors and performance attribution in outline.

Most bond portfolios are run against a benchmark, so the risk that matters is the difference from it. The main tilts are duration (longer or shorter than the benchmark), the curve (overweight some maturities), credit (more or less spread risk, and which ratings and sectors) and security selection. Active duration times the expected move in yield gives the effect of a duration view, and the volatility of that return, together with that of the other tilts, gives the tracking error, the standard deviation of the portfolio return less the benchmark return. Tilts that look independent can fall together in a crisis: a short duration position loses when government yields fall as investors flee to safety, and an overweight in credit loses as spreads widen. Liquidity matters as much as yield, because corporate bonds can be hard to sell when many investors sell together, so portfolios hold some liquid government bonds and plan how to meet outflows by selling a slice of everything. The main sectors are sovereign bonds, corporate bonds (investment grade and high yield), securitised bonds backed by pools of loans, and inflation-linked bonds, whose principal rises with a price index. Performance attribution splits the active return into duration, curve, credit and selection effects, so the manager can see whether a view or luck produced it.

WORKED EXAMPLE: TRACKING ERROR AND A RISK-OFF SCENARIO

The invented Harlow Bond Fund has a modified duration of 5.2 against a benchmark of 6.0 and a spread duration of 4.0 against 3.5. Assume annual volatility of 0.80% for government yield changes and 0.60% for spread changes, and no correlation between them. Find the tracking error from these tilts. Then find the active return in a risk-off month when government yields fall 50 basis points and spreads widen 40 basis points.

Answer: Tracking error is about 0.71% a year. In a risk-off month the two tilts both lose, for an active return of about minus 0.60%, which is about three times the monthly tracking error of 0.20%, so the manager should size the tilts together.

Interview tip: Combine the tilts for tracking error, then ask what happens to each in a flight to safety. Independent risks on paper can be the same trade in a crisis.

INT.HI.2.c · Credit, portfolios and pitching a view

Pitch a fixed income view: state what the market prices, express the view in an instrument, size it by DV01 against a risk limit, and name the risks and the exit.

A fixed income pitch has the same shape as an equity pitch, with a rate or a spread in place of a share price. First say what the market prices: the forward rate on the curve for a rates view, the breakeven inflation rate for an inflation view, the spread for a credit view. Then say what you expect instead and why, with the evidence and the date it will show: central bank communication, inflation data, supply or flows. Next choose the instrument that isolates the view: a government bond or future for duration, a pair of bonds weighted by DV01 for a curve view, an inflation-linked bond against a nominal bond for inflation, a credit index or bond for spread. Then size it. Convert the loss you will accept in a stated adverse move into a DV01, and divide by the DV01 of a single bond to find the face amount. Describe the reward against the risk, the carry and roll-down while you wait, and the exit, such as a thesis-break rule or a level where the market has moved to your view. The common mistakes are to pitch a view that is already in the price, to ignore the cost of financing, and to size by the face amount instead of by risk.

WORKED EXAMPLE: PITCHING A RATES VIEW AND SIZING IT BY DV01

The fund (invented, NAV 400m) believes the central bank will cut more than the market prices. The market prices a one-year rate in a year of 3.80% (from the 1-year at 3.0% and 2-year at 3.4%); the manager expects 3.0%. The manager wants to buy the five-year 4% bond (DV01 about 0.0421 per 100 face at a yield of 5%, a figure used for illustration), losing no more than 0.25% of NAV if yields rise 30 basis points. How large is the position, and what is the gain if yields fall 40 basis points?

Answer: Buy about 79m face of the five-year bond. It loses about 1.0m if yields rise 30 basis points and gains about 1.33m if they fall 40 basis points, on a view that the one-year rate in a year will be 3.0% rather than the 3.80% priced in. Exit if the data shows the central bank is not cutting.

Interview tip: Size by DV01 and the loss you accept, not by face amount, and name the rate you expect against the forward rate the market prices.

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