Quant Interview Recommendations #1

Current Events: Libor, Repo rates, negative rates atm, FED rates, currency conversions (USD/EUR,GBP/YUAN)

- LIBOR to be replaced by a new secured overnight financing rate next year potentially —> SOFR
    - Based on the cost of borrowing overnight using U.S. government debt as collateral
        - More transparent, based on way more transactions to give a better idea of borrowing costs
        - LIBOR unsecured loans, SOFR secured by treasuries
    - Based on overnight reverse repurchase agreements that offer a deep and liquid market with far more transactions to use as a base.
        - Overnight REPOs
    - Trying to gradually replace LIBOR: CME launched SOFR based futures and Federal Home Loan issued a 6-month $4B SOFR bond
    - Still needs more liquidity
    - Swaps trading desks need to work hardest
    - SOFR used for adj rate mortgages, Fannie and Freddie will buy SOFR adj rate mortgages and sell them as bonds
    - SOFR doesn't account for risk of not being paid back
    - SOFR looks backwards, LIBOR is forward
        - ARRC is working on making more forward looking SOFR rates
            - This could be done using futures to help make more predictable payments
    - Other countries are developing their own rates
        - UK: SONIA - overnight lending rate
        - EU: EONIA - unsecured overnight rates
        - Japan: TONAR
- Repo Rate Spikes
    - More cash moved out; securities moved in. Not enough cash for everyone so rates spiked
    - FED kicked in with more cash
    - Seeing as SOFR is linked to overnight rates, need to ensure this doesn't happen again
    - Spike was due to no liquidity in the market
- Current Rates

    - 2.29% 30 Yr
    - 1.84% 10 Yr
    - 1.56 1 Yr
    - 1.54% 1 Mo
    - 1.55% overnight
- Currency Conversions
    - USD/GBP = 0.77
    - USD/EUR = .9
    - USD/CNY = 6.89
    - USD/JPY = 109.97

Fixed Income terms: Duration, convexity, various curves, duration hedging, bond math, credit spreads

- Yield to Worst (YTW): the lowest potential yield you may receive from a bond, assuming the issuer does not default.
- Current Yield: Annual Coupons/Current Price
- YTM: anticipated return on the bond if held to maturity
- Bond Valuation: PV of the cash flows
    - Clean Price
    - Dirty = Clean + Accrued Interest
    - AI = C*Day Count
- Knowing prices of ZCB nails prices of all bonds —> D(T) function
- Duration: “center of gravity for the bonds”
    - Years until investor is repaid the bond’s price by the cash flows
    - Effective duration of the bond
- Modified Duration
    - Present value of duration
- DVO1
    - $ change in the bond price/1 bp change in yield
    - Linear Approximation, works for parallel curve shifts and small yield changes
    - In reality P and y relationship is non-linear
- Convexity
    - 2nd order measure that measures the change in DV01
- Change in Bond Price
    - $\frac{\Delta P}{P} = \text{YTM} - MD * \Delta y * 100 + \frac{1}{2}\Gamma\Delta y^2 * 100$

- Carry: captures the passage of time
- Looks a lot like Ito's now: time, first order, second order

SSGA Fixed income team: what they do, strategies they have, read up on the people

- They have a series of fixed income ETFs offering various sets of fixed income assets (32 ETFs for Fixed Income)
  - JNK = junk bond ETF compared to the Bloomberg Barclays high yield index, basically matched the index
  - Does the sale of bond ETFs also go up during recessions like the bond market?
  - Does the fact that a lot of investment grade corporate debt (nearly 50% I think) is nearly junk bonds at all impact business and the performance of ETFs?
  - How does the switch from LIBOR to SOFR effect your business? Do strategies change given how SOFR moves differently than LIBOR (rate spikes)
  - How is alpha generated in fixed income?
    - Is it just projecting interest rates and credit spreads or is there a factor approach like in equities?
  - What do the clients look for with these ETFs? To generate alpha or to protect their money for future use?

Econometrics/Empirical: Time series, regression models, ARIMA models

- OLS: minimize sum of square residuals
  - Requires normally distributed error terms
  - Slope Coefficient: There is a b change in Y for unit change in X accounting for some sort of co-movement
  - If residuals are correlated with X we left money on the table
- MR: Multiple variables
  - Each slope coefficient is a b change in Y for unit change in X holding everything else constant → pure effect
  - Do a partial f test to see if adding the variables improved the model
- R^2 : tells how much of the variation of Y is captured by X
  - Accuracy is measured with SE
- AR Models: Time series data
  - Get an idea for the data's characteristics
  - Find the autocorrelation, determine which lags are significant

    - Check stationarity: check the roots after eyeballing it
    - Run a PACF to see where it cuts off
    - Pick some models, fit them to the training data then run out of sample predictions and see how it performs
        - Measure with MSE or some other metric
        - Can also use AIC and BIC and pick the one with the smallest value
- ML Estimation
    - More efficient and smaller SE, but biased with small samples
        - Requires a known distribution
    - Trying to find the parameter that gives the highest likelihood of observing the data we observed
- MA model:
    - Constrained version of an AR(infinity)
    - Average + shock – theta*lagged shock
- ARMA model:
    - If data comes from a latent process, we need to filter it out
    - Use MA to remove the noise

Brush up on MATLAB: Structures, basic syntax

Quant Interview Recommendations #2

Questions I was Asked

- **2 Half Hour Video Calls back to back with team members**
- Talk me through your resume, your background, why quant finance, why SSGA?
- Basic Finance understanding questions
    - What is convexity? What is negative Convexity? What assets demonstrate negative convexity
- Explain the assumptions of OLS
    - How do you detect multicollinearity or heteroskedasticity?
    - How do you handle the data in these cases, how would you run the regressions?
- When is OLS the MLE?
- How do you determine the number of pregnant women in the US?
- How would you write a function to take the square root of a number without the sqrt() function

- Explain the idea of vectorization in programming
- What packages do you work with the most? What have you found useful?
- What languages are you most comfortable with? (Mine were R and MATLAB, which is what they happened to rely on most too

Questions I asked them: can lead to a nice conversation and makes you memorable

- Asked about the switch from LIBOR to SOFR
- Their thoughts on the corporate debt bubble
- Their fixed income ETFs and how they work, how do they generate alpha in fixed income

Quant Interview Recommendations #3

Programming

1) Basics of OOPS - What is Polymorphism, Inheritance ...

2) What is Lambda function in python?

3) Packages used frequently and for what?

4) Monte Carlo Simulation and techniques used for improving results

Econometrics

1) Ways of detecting Multicollinearity. How to run a regression with such data. - LASSO & Ridge

2) Difference between CAPM & Single factor model - alpha = 0 in CAPM as market beta is 1

Finance

1) Different Types of Durations and their definitions

2) Carry trades definition

3) Price of bond doesn't change over 1 month. What is the PnL?

4) Price a cross currency swap and explain the different types of risks involved

5) Difference between Forwards and Futures.

6) Resume specific: Difference between Non- Deliverable CCS & CCS

Rolling Forward and Term Forwards hedges

Pricing Total Return Swaps

7) Main challenges for Systematic Fixed Income Field

8) ESG Investing and what you know about it?

9) Valuation methods - FCFF, DCF

10) Pricing real Options - M&A

Acquisition with Call and Put rights

Company A is buying 60% of Company B @ an EBITDA multiple of 10x.

Latest Twelve Months (LTM) EBITDA of Company B was $10 million.

1. What is the Implied valuation of Company B based on the EBITDA multiple?
2. How much is Company A is paying for a 60% stake of Company B?

Company A has the option to buy the remaining 40% in two years for $40 million.

3. Is this option valuable?
4. How will you price it?
5. What are the key drivers of this option value?

Company A has the option to buy the remaining 40% in two years for an EBITDA multiple of 10x using the LTM EBITDA in two years from now.

6. Is this option valuable?
7. How is it different from the call option above?

Company A has the option to buy the remaining 40% in two years for $40 million, but Company B has also the right to sell the remaining 40% to Company A for $40 million.

8. Has this changed things, how?

Quant Interview Recommendations #4

Where is market in 6 months, why?

Recommend a stock

Question about current finance news, whether you follow the news

What programming language you use?

What do you think of excel?

What do you do in a market downturn?

How is private equity payoff different from public?

What valuation methods would you use

What is IRR, how is it used in real estate?

Which FS do you look at, if only one?

How to obtain company data, private vs. public

How do you valuate a company?

What to do in market downturn?

What do you think our work environment is like?

Why do you want to work here?

Why not IB?

What do you do when instruction isn't clear?

Data accuracy vs. deadline

What to do when you're pressured to finish work

How often would you email your supervisor?

Are you comfortable with building things from ground up?

What is your favorite/least favorite class?

Explain stochastic calculus

Quant Interview Recommendations #5

1. Market timing in the credit market: you have to decide when to go long or short the credit market with CDX.NA.IG with the objective of beating cash returns (90-days T-Bills) during your holding periods. What research would you do to make your trading decisions? Please elaborate your research process.

   Think about comparing the current CDX spread relative to other credit market spreads such as agencies vs. treasuries, or BBB vs AAA corporates and see if the CDX seems wide or narrow relative to historical. Also test for mean reversion in the CDX spread. Does the CDX spread widen or narrow with corporate bond issuance in the market?

   Also, all the macro factors which affect the index- GDP, demand/supply and auction of treasuries, inflation etc.

2. Recovery value analysis: you are tasked with estimating recovery values of many distressed debts across industries. Without any legal knowledge, how would you go

about estimating the recovery value of each debt? What analyses would you do? How would you systematize the analytical process? Please elaborate.

Moodys and S&P put out studies every year of all of the defaulted debt and have historical data on what fraction of face value is recovered after default. There are extensive data sets on recovery rates available. Research the literature on recovery rates:

https://www.moodys.com/sites/products/ProductAttachments/DRD%20Documentation%20v2/DRDV2_FAQ.pdf

Also, compare accounting variables for companies to analyze recovery rates.

3. Concepts behind Security Market Line and Capital Market Line.
4. CAPM and Multi-factor models- basics
5. Uses of Lasso and Ridge- why and how are they used?
6. Which algorithm did you use to accomplish the XYZ task at ABC firm and why did you choose that over other algorithms?
7. Shortest path problem- how to get from one point to another in the shortest path/time? Write a short algorithm for it.
8. Probability Questions. E.g., Bacteria mutation problem, draw pair of sock problem etc.
9. Basic bond questions – concepts of duration, convexity etc.
10. Questions on the market. From 2019interview: opinion on value vs. growth strategies- why the shift from value to growth stocks, direction of the economy, any piece of news article you have read recently.
11. Blackrock Aladdin Risk System and Models.
12. Why UCLA? Why MFE? What expectations do you have from the internship? Why this firm and team?