Weekly Meeting Notes

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Overview:

- XVA trading has come into question now that Credit Suisses is in the final stages of closing out the whole Archegos situation
- A strong proponent of payment for order flow has now changed their story on how they feel about the business
- Breakeven rates are meant to be forward looking expectations of inflation
- Risk parity looks tactically allocation rather than find the best constituents of a portfolio
- Stochastic gradient descent is a type of optimization algorithm used in machine learning

News: XVA traders want more

- Credit Suisse to a $5.5bn hit closing out the Archegos management total equity swaps
- XVA traders are asking for more power such as
    - Veto laws
    - Wide spreads
- Although it seems that most of the problems were in the prime brokerage side XVA traders want more
- The law firm that investigated what happened with the Archegos' positions determined that there should be more XVA trading
- Some people in the industry speculate that if an XVA were given the right tools and power they could've avoided the trades

CREDIT SUISSE

ARCHEGOS
CAPITAL MANAGEMENT

News: Payment for Order Flow

- Citadel Founder Ken Griffin recently said in an interview that he is fine not having payment for order flow
- Payment for order flow
    - This is the practice when a high frequency trader pays a brokerage firm to review their clients order before they hit the market
    - It is usually the case that most high frequency traders will find an arbitrage opportunity
- The practice has been controversial
    - Although payment for order flow wasn't the source of the trading halt on Robinhood platform it became a big question after that
    - The SEC is looking into revising the model
    - Congress is reviewing the business practice

Finance: Breakeven Rates

- Interest rates that are primarily used (Nominal) can be expressed as a combination of real yield and inflation expectation

- The real yield is the interest rate accounting for inflation, this is very similar to things such as real GDP

- TIPS - Treasury Inflationary Protected Securities: this is supposed to be real yield (not always the case)

- Breakeven rates = nominal yield - breakeven yield

- We can end up making a breakeven curve that represents what future inflation looks like

Largest Breakevens	
1) US Breakeven 2 Year	2.65
2) US Breakeven 6 Year	2.62
3) US Breakeven 7 Year	2.57
4) US Breakeven 4 Year	2.57
5) US Breakeven 3 Year	2.56
6) US Breakeven 5 Year	2.56
7) US Breakeven 8 Year	2.51
8) US Breakeven 9 Year	2.46
9) US Breakeven 10 Year	2.39
10) US Breakeven 20 Year	2.30
11) US Breakeven 30 Year	2.29

The breakeven rate uses:

- The breakeven is good at tracking what market participants think at the moment

- It's usually a sign that if breakeven rates are negative then investors are expected deflation

- Pros and Cons

    - Pro: breakeven rates can't really be skewed by people looking to hedge or speculate like derivatives

    - Cons: fixed income markets tend to not look that far out (price in) information so in terms of long term indicators they are questionable

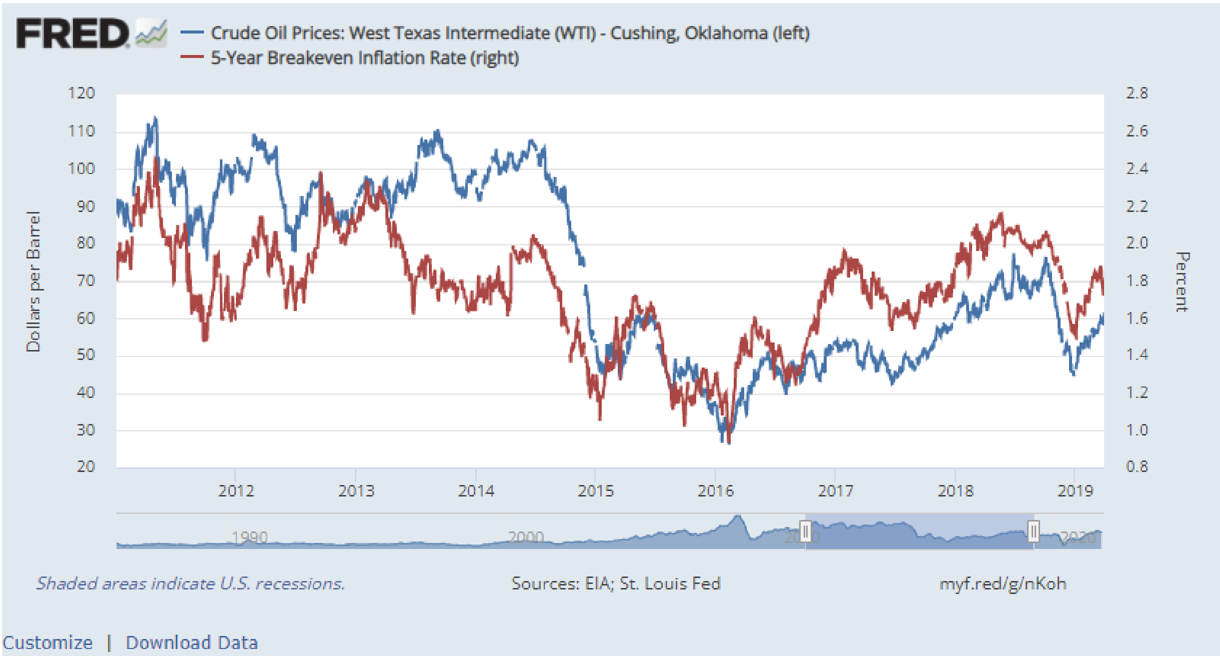
Breakeven rates and oil:

- The St. Louis Federal Reserve (FRED) noticed that breakeven rates movement seemed to coincide with oil movements

- Their thinking was that a drop in oil prices would increase would decrease global demand

- A paper published in Dec of 2009 goes more into this.

- They found similar results in that paper



Resources:

NASDAQ: Breakeven Rates (here)

The Relationship between Oil Prices and Breakeven Inflation Rates Robin L. Lumsdaine (here)

Methods for calculating:

- The equations we want to maximize
  - Maximize expected returns
  - Minimize risk for those returns
  - Keep in mind our money constraint
- The most common method is to use a monte carlo simulation (5 stock example)
  - Generate 5 numbers less than 1 that sum to 1 and then apply returns and risk
  - Do that a couple thousand time and then find the best portfolio
- The method that Markowitz used was Lagrangians

Future questions:

- What is the best way that we should update the portfolio?
- When is the best time to update the portfolio?
- What is the best number of stocks for this model?
- Is expected returns or the way we calculated expected returns the best way?
- Is it always worth it to optimize a portfolio given a set of outcomes?
- Is there a better way to calculate our risk, or covariance matrix.

Finance: Risk parity

- Risk parity is another firm of portfolio optimization
- Rather than optimizing a portfolio by changing what's in it
  - Optimize allocations
  - Hold securities the same
- Risky parity "trading" should most involve changing the allocation sizes of a set group of securities
- A lot of risk parity strategies are more on the global macro side because economic factors allow them to offset their risk
- In economics terms it should be impossible for stock, bonds, commodities, and currencies to all go down together on a long enough timeline

Bridgewater associates founder Ray Dalio first started with this model

BRIDGEWATER

Comparing it to the 60/40 portfolio:

- 60/40 portfolio says to hold 60% stocks and 40% bonds
  - Good economy: get into risk debt and risky stocks
  - Bad economy: get into safe debt and safe stocks
- Risk Parity portfolio
  - Good economy: increase equity allocation decrease fixed income allocation
  - Bad economy: increase fixed income allocation decrease equity allocation

Future research:

- The portfolio optimization technique usually involves building a NP hard covariance matrix
- Workarounds involve using machine learning to build better covariance matrices
- Other areas of research involve incorporating different modeling techniques in the portfolio
  - Generalized Autoregressive Conditional Heteroskedasticity Model (GARCH)
  - Fractal based modeling
  - Tail risk and Convexity

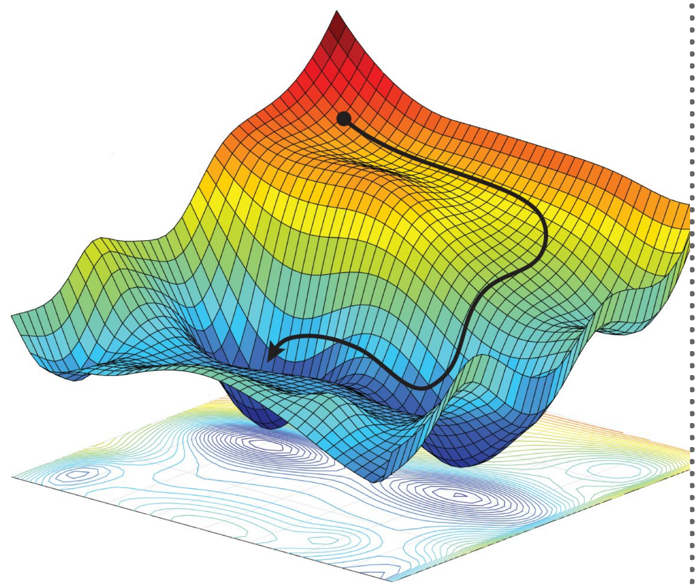
Computer Science: Stochastic Gradient Descent

At the heart of machine learning we are trying to optimize a function

- One of the most famous methods for optimization is stochastic gradient descent the other one used is Adam

- What is optimization
  - We are trying to minimizing or maximize a function
  - We are given a special set of constraints and or functions
  - In this case we are trying to minimize the objective function

Example of Stochastic Gradient Descent



Easy Method

- In this case we start at step k and then move at step length and in the direction of the negative gradient

$$x_{k+1} = x_k + \alpha_k p_k$$

Line Search (Armijo)

- The algorithm will chose a direction that could be the steepest part of the gradient descent

- Then it searches along the direction for a new iteraterate

$$\min_{\alpha>0} f(x_k + \alpha p_k).$$

Stochastic gradient descent notebooks here here

Mathematics: Stochastic Gradient Descent

The objective function

- We are using an optimization function and we want to find the best parameters
- To do that we want to use the gradient
- Gradients will allow us to find the best step

Learning rates

- A key part to how good a machine learning algorithm is dependent on the learning rate
- There are many different kinds
- In this case stochastic gradient descent iterates through points going down the gradient

Stochastic Gradient Descent

We first start with the objective function

$$Q(w) = \frac{1}{n}\sum_{i=1}^{n} Q_i(w)$$

In this case w is trying to minimize $Q(w)$. Each Q_i is an observation of the data.

We are using sum minimization techniques which are similar to certain estimators like the least squares and maximum-likelihood estimation.

Now we want to minimize the function (to each batch if we batch) via the gradient descent method

$$w := w - \eta \Delta Q(w) = w - \frac{\eta}{n}\sum_{i=1}^{n} \nabla Q_i(w)$$

See full math paper [here]

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