

MMF ASSET MANAGEMENT[©] GLOBAL MACRO PORTFOLIOS

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MOTIVATION

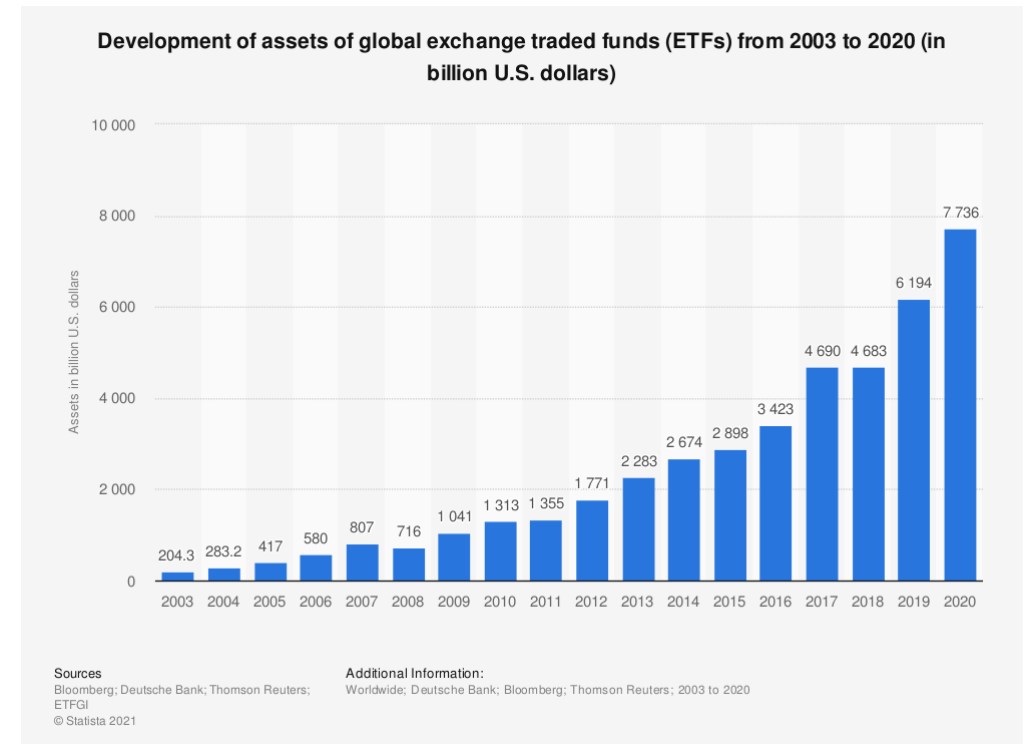
MOTIVATION

- Diversification is one of the most powerful concepts in finance
 - Passive “long humanity” position
- There are many areas open for diversification including:
 - Sector diversification (Industrials, Tech, Cyclical, ...)
 - Geographic diversification (USA, EMEA, APAC, ...)
 - Asset diversification (Equities, Fixed Income, Commodities, ...)
- Many retail investors and everyday people fail to understand the aphorism “Don’t put all your eggs in one basket”
 - DOGE, GME, AMC



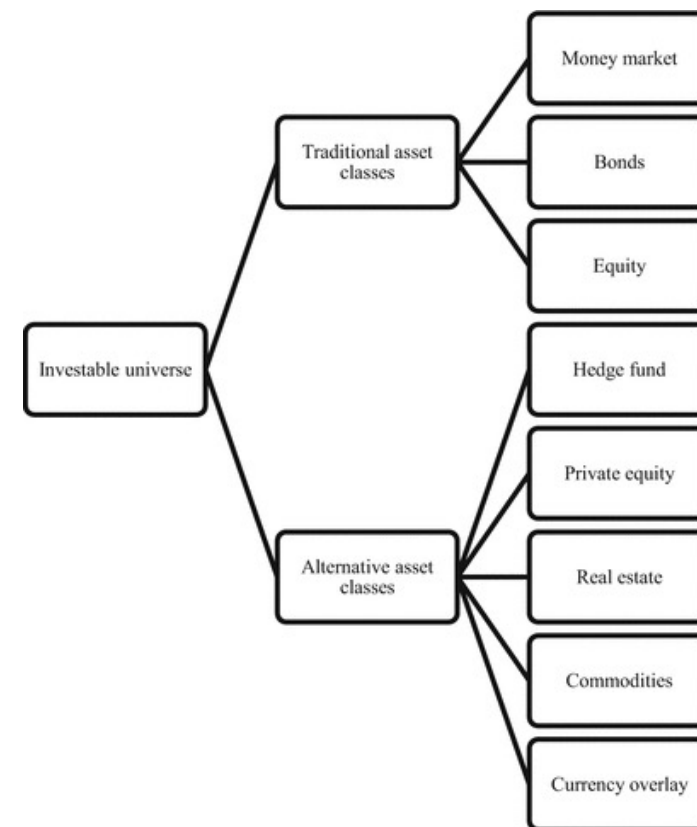
MOTIVATION

- Diversification is now cheaper and more accessible than ever thanks to the advent of Exchange-Traded Funds (ETFs)
- ETFs are baskets of stocks/bonds/commodities/etc. packaged into a single financial instrument
 - Two types: passive and active
- The usefulness of ETFs has been validated by rapid growth
- Growth introduces innovation, ultimately pushing costs down for investors



MOTIVATION

- The idea behind our strategy is to take advantage of all this innovation by packaging ETFs of all types into one easy-to-manage strategy
- This way, investors can get exposure to products that they could not otherwise trade (fixed income, credit, commodities)
- Moreover, they can also gain exposure to equity universes that may be seen as unconventional
 - Water ETFs
 - Psychedelics ETFs
 - Etc.



METHODOLOGY

METHODOLOGY

- We are mandated to have a 50/50 split of assets denominated in CAD/USD
- Take advantage by buying the lowest cost/more traditional ETFs in USD
 - Alternative/niche ETFs in CAD
- 78 Canadian-listed ETFs
- 56 American-listed ETFs



Canadian ETFs include:



- iShares Global Water Index ETF
- Horizons S&P Green Bond Index ETF
- Horizons Global Hydrogen Index ETF



American ETFs include:

- iShares Global Water Index ETF
- Horizons S&P Green Bond Index ETF
- Horizons Global Hydrogen Index ETF

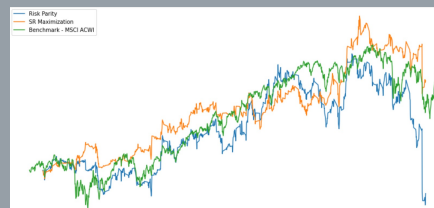
- First, import data from Yahoo! Finance using yfinance Python package
- Next, divide data into subsections based on rebalancing period

$$t = 1$$
$$t = 2 \dots$$

USA_EWJ	-0.025339
USA_EWT	0.076743
USA_MCHI	0.005408
USA_EWY	0.022122
USA_EWZ	0.084546

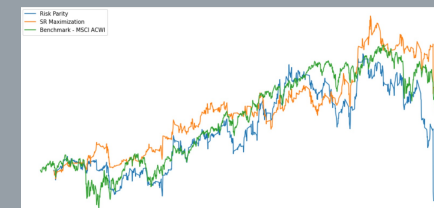
Calculate correlation matrix, select x assets from each geography with lowest mean correlation...

Calculate returns for this period and repeat...



USA_EWJ	-0.025339
USA_EWT	0.076743
USA_MCHI	0.005408
USA_EWY	0.022122
USA_EWZ	0.084546

Calculate returns for this period and repeat...



USA_EWJ	-0.02533
USA_EWT	0.07674
USA_MCHI	0.00540
USA_EWY	0.02212
USA_EWZ	0.08454

OPTION'S STRATEGY

- We will take advantage of the possibility of using leverage and borrow money according to the risk profile of the client.
- With the available cash we will buy Foreign exchange options (either calls or puts plain vanilla) in 8 different FX markets: Canadian Dollar (CAD), Mexican Peso (MXN), Brazil Real (BRL), Chinese Yuan (CNY), Japanese Yen (JPY), Euro (EUR), Russian Ruble (RUB), and South African Rand (ZAR).
- We will use leverage according to the risk profile:

Currency	Leverage
Conservative	0%
Balanced	10%
Aggressive	20%

OPTION'S STRATEGY

- At inception date and in every option's roll-over date, we will run a Max Sharpe Ratio optimization algorithm to obtain the weights of the portfolio. Then we order the weights in absolute value and choose a certain fixed number of them. Then, if the number is positive, the strategy will be a call, if negative, the strategy will be a put.

Example choosing 3 currencies

Currency	USDCAD	USDMXN	USDBRL	USDEUR	USDJPY	USDZAR	USDCNY	USDRUB
Weights	0.5007397	-0.3498119	0.308906	-0.1595334	0.0502015	0.1814953	0.5280568	-0.0600541
	↓	↓					↓	
Strategy	Call	Put	-	-	-	-	Call	-

Test Period

Start date: April 2011

End date: April 2016

Premium per period: 1k

1-month Options

Calibration Period	1 Ccy	2 Ccy	3 Ccy	4 Ccy	AVERAGE
1M	18,683	14,640	15,497	10,007	14,707
2M	22,841	16,582	14,166	17,372	17,740
3M	26,784	11,964	8,936	7,876	13,890
4M	13,171	17,058	6,601	6,513	10,836
5M	630	3,814	7,329	6,231	4,501
6M	(6,997)	7,990	10,565	12,149	5,927
AVERAGE 1M	12,519	12,008	10,516	10,025	11,267

3-month Options

Calibration Period	1 CCY	2 CCY	3 CCY	4CCY	AVERAGE
1M	292	6,589	8,931	5,849	5,415
2M	5,104	6,700	7,690	6,639	6,533
3M	(1,848)	3,359	5,707	3,930	2,787
4M	(3,982)	350	2,525	5,169	1,016
5M	(3,757)	1,507	3,374	6,261	1,846
6M	(1,133)	6,187	5,140	5,519	3,928
AVERAGE 3M	(887)	4,115	5,561	5,561	3,588

BACKTESTING – OPTIONS STRATEGY

ANALYZING TENOR OF THE OPTION AND THE CALIBRATION PERIOD. RESULTS SHOW CUMULATIVE P&L

$$c = S_0 N(d_1) - K e^{-rT} N(d_2)$$

$$\Delta_p = -e^{-q\tau} \Phi(-d_1)$$

$$p = K e^{-rT} N(-d_2) - S_0 N(-d_1)$$

$$\begin{aligned} \Gamma_c &= \frac{\partial \Delta_c}{\partial S} \\ &= e^{-q\tau} \phi(d_1) \frac{1}{S\sigma\sqrt{\tau}} \end{aligned}$$

where $d_1 = \frac{\ln(S_0 / K) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}}$

$$d_2 = \frac{\ln(S_0 / K) + (r - \sigma^2 / 2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

$$\Lambda_c = S e^{-q\tau} \phi(d_1) \sqrt{\tau}$$

$$\begin{aligned} \Theta_c &= \frac{\partial V_c}{\partial \tau} \\ &= \left(-\frac{S e^{-q\tau} \phi(d_1) \sigma}{2\sqrt{\tau}} - r K e^{-r\tau} \Phi(d_2) + q S e^{-q\tau} \Phi(d_1) \right) / 365 \end{aligned}$$

METHODOLOGY FX OPTIONS

IN THE FX OPTIONS MARKET IT'S BROADLY ACCEPTED THE BLACK-SCHOLES FRAMEWORK

Market Quotes

$$\sigma_{RR} = \sigma_{25\Delta c} - \sigma_{25\Delta p}$$



Implied Volatility

$$\begin{aligned}\sigma_{25\Delta c} &= \sigma_{ATM} + \sigma_{BF} + \frac{1}{2}\sigma_{RR} \\ \sigma_{25\Delta p} &= \sigma_{ATM} + \sigma_{BF} - \frac{1}{2}\sigma_{RR}\end{aligned}$$



Parabolic Interpolation

$$\sigma_{BF} = \frac{\sigma_{25\Delta c} + \sigma_{25\Delta p}}{2} - \sigma_{ATM}$$

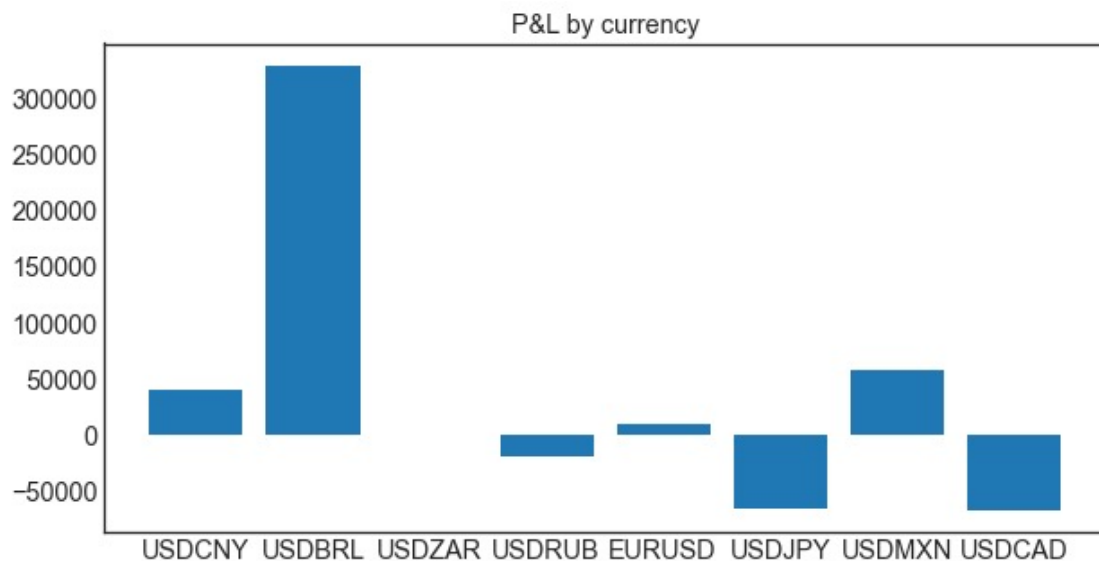
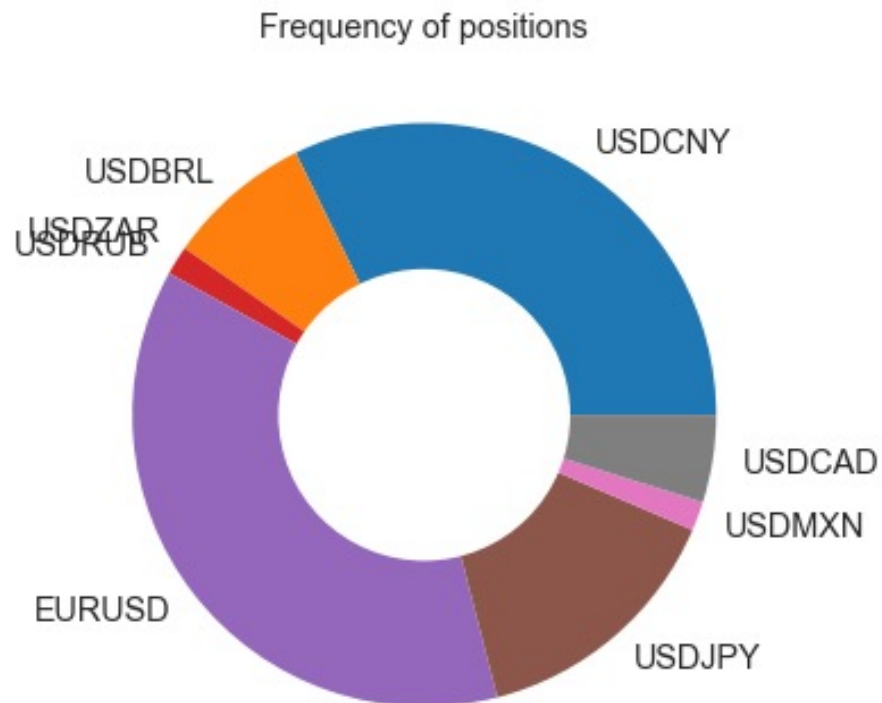
$$\sigma(\Delta_f) = \sigma_{ATM} - 2\sigma_{RR}(\Delta_f - 0.5) + 16\sigma_{BF}(\Delta_f - 0.5)^2$$

VOLATILITY SURFACE CALIBRATION

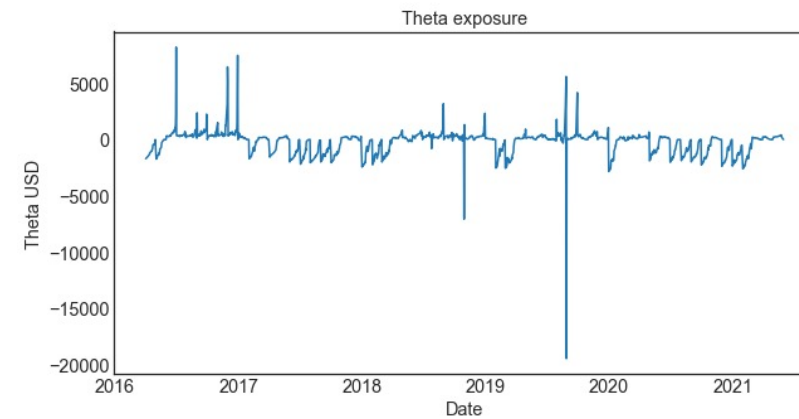
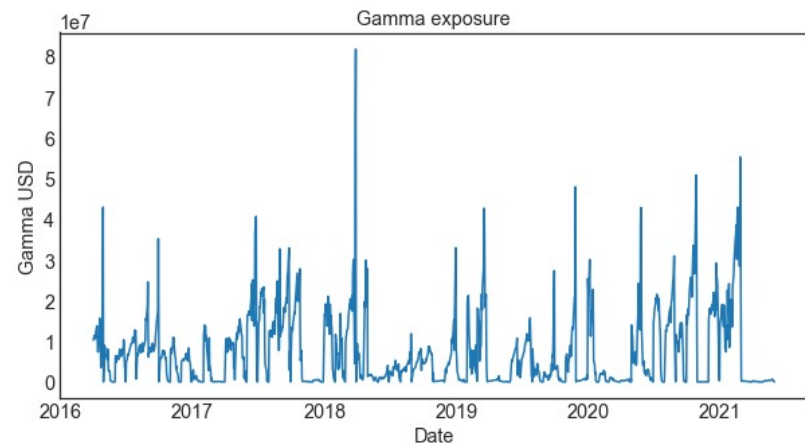
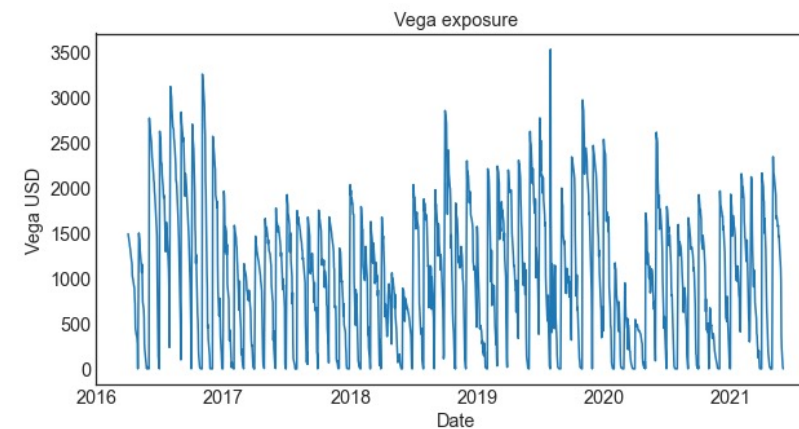
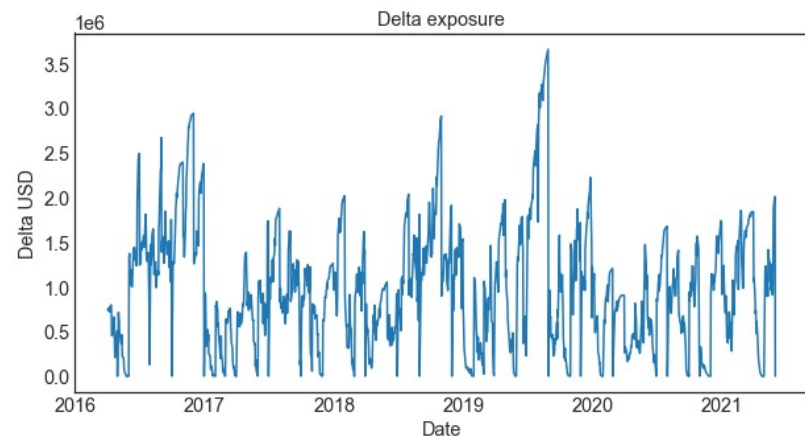
WE CALIBRATE THE SURFACE USING 3 TYPES OF MARKET QUOTES AND A PARABOLIC INTERPOLATION

OPTION'S PERFORMANCE

- The currency pair that had more times options position was the EURUSD, then the USDCNY
- The currency pairs that had the better outcome was the USDBRL, then the USDMXN.

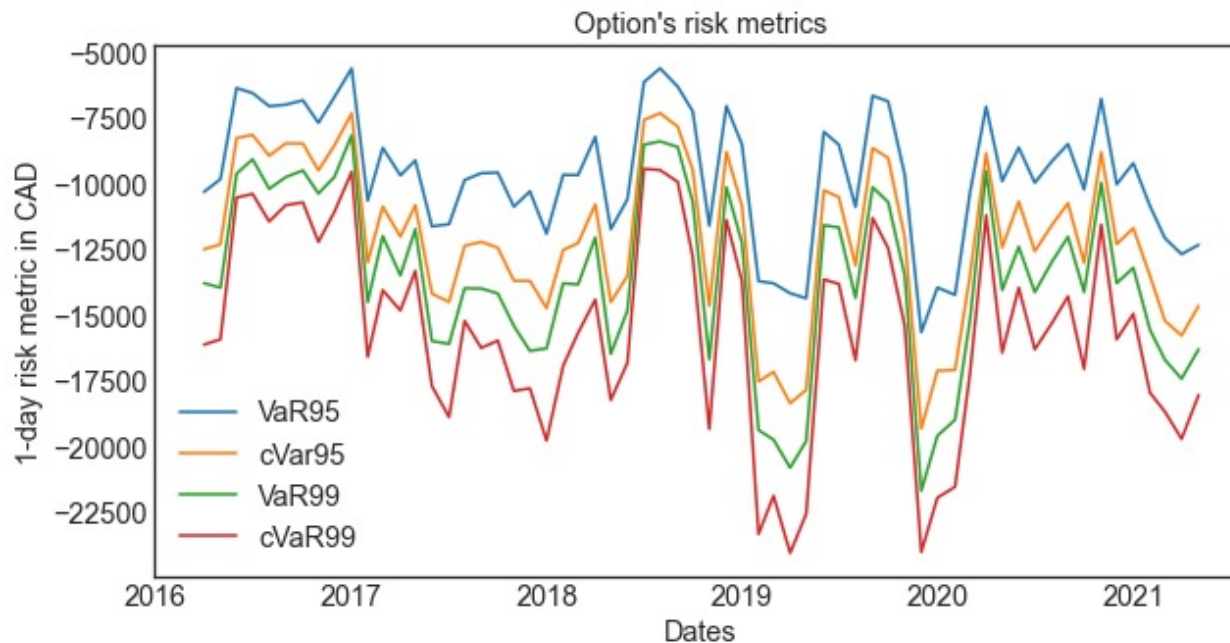


OPTION'S MARKET RISK

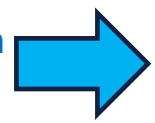


OPTION'S RISK METRICS

- The graph shows two types the VaR and cVaR, 95% and 99%, of options with a premium of 20,000 CAD.



User
Information
& appetite
access



Portfolio
Back-test



Robo Advisor Platform

Welcome to Global Macro Portfolio Robo Advisor

Please enter your name:

Dan

Please load all the data:

/Users/apple/D

/Users/apple/Desktop/I

/Users/apple/Desktop/I

Select return

Select risk free rate

Select benchmark

Load data

Please enter your initial capital:

100000

Please choose your cutoff:

20

Please choose your preferred optimization method:

Sharpe ratio maximization

Rebalancing period

M

Start date (mm/dd/yy)

04/01/2016

Please select your risk appetite

aggressive

Hit me to back-test your portfolio!

Hit me to optimize your portfolio!

Show back-test metrics

Plot back-testing PnL v.s. Benchmark

Plot back-testing Pie chart

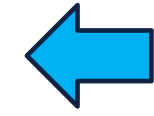
Your back tested portfolio using Sharpe ratio maximization with M rebalancing frequency and having 20 US and CA ETFs has Sharpe Ratio of 2.1344, Max drawdown of -14.27%

Show your optimized portfolio metrics

Plot your portfolio PnL v.s. Benchmark

Plot your portfolio Pie chart

Hi, Dan. Your optimal portfolio using Sharpe ratio maximization with M rebalancing frequency and having 20 US and CA ETFs and 20% leverage of options has Sharpe Ratio of 1.2524, Max drawdown of -76.07000000000001%.



Portfolio
Performances

AN AUTOMATED ROBO-ADVISOR USER INTERFACE

SERVED AS BACK-TEST AND PORTFOLIO PERFORMANCE SIMULATION TOOL

10 assets/Geographical universe	Sharpe ratio	Max drawdown	15 assets/Geographical universe	Sharpe ratio	Max drawdown	20 assets/Geographical universe	Sharpe ratio	Max drawdown
Sharpe Ratio maximization	0.8983	-23.34%	Sharpe Ratio maximization	1.701	-14.02%	Sharpe Ratio maximization	2.0458	-14.28%
Risk parity	-0.1884	-51.15%	Risk parity	0.0625	-44.8%	Risk parity	0.2768	-37.89%

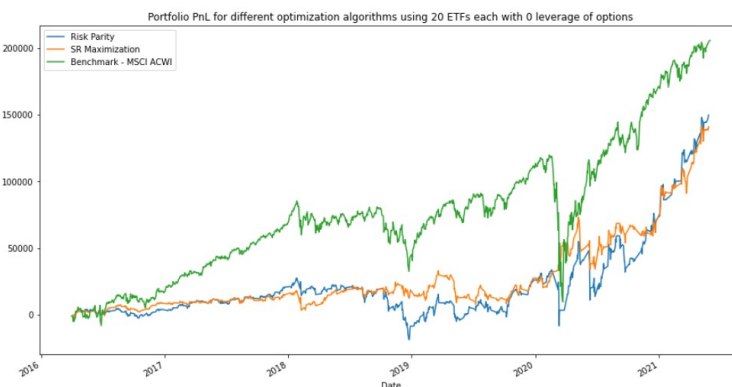
- Overall Sharpe ratio maximization provides more attractive Sharpe Ratio and max drawdowns
- As we increase number of ETFs in each geographical universe, the metrics are strengthened
- Final decision: **Select Sharpe Ratio Maximization algorithm using 20 ETFs from each geographical universe**

BACK-TEST RESULTS

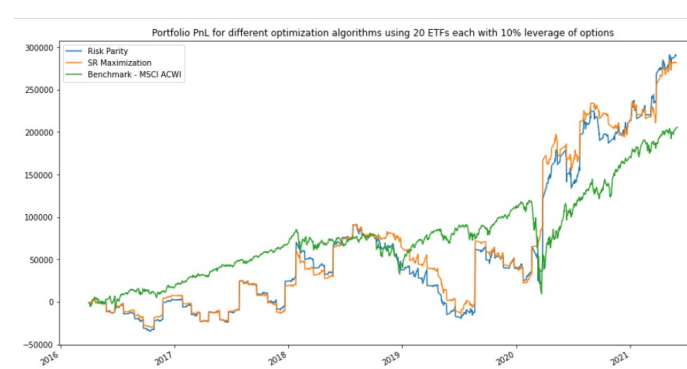
RISK METRICS COMPARISON OF DIFFERENT STRATEGY CANDIDATE



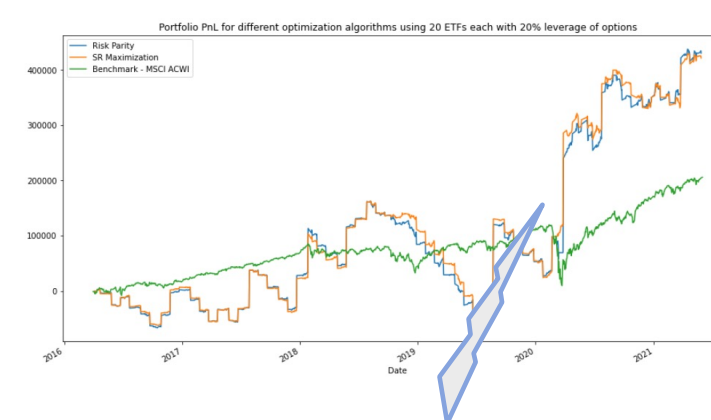
20 assets/Geographical universe(conservative)	Sharpe ratio	Max drawdown
Option Leverage 0%	2.0458	-22.73%



20 assets/Geographical universe (neutral)	Sharpe ratio	Max drawdown
Option Leverage 10%	1.57	-55.42%



20 assets/Geographical universe (aggressive)	Sharpe ratio	Max drawdown
Option Leverage 20%	1.25	-76.01%

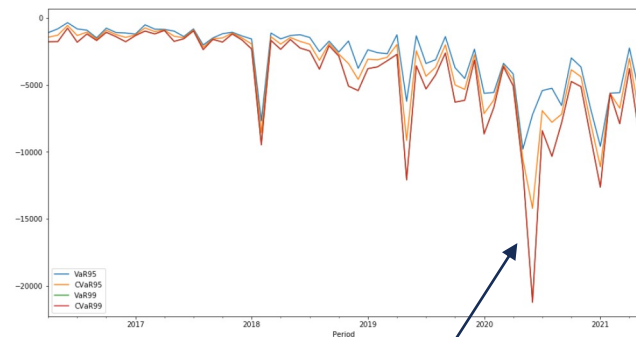


PORTFOLIO RESULTS

DIFFERENT STRATEGY CANDIDATE

**AGGRESSIVE
BUT PROFITABLE !**

0%
leverage



COVID

10%
leverage



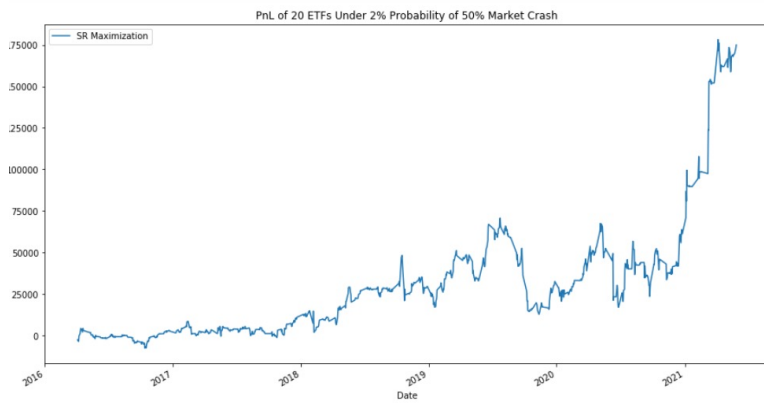
20%
leverage



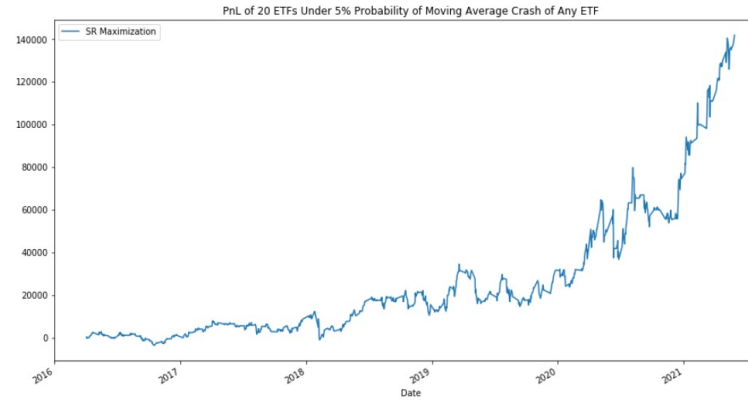
Risk spiking

RISK METRIC RESULTS

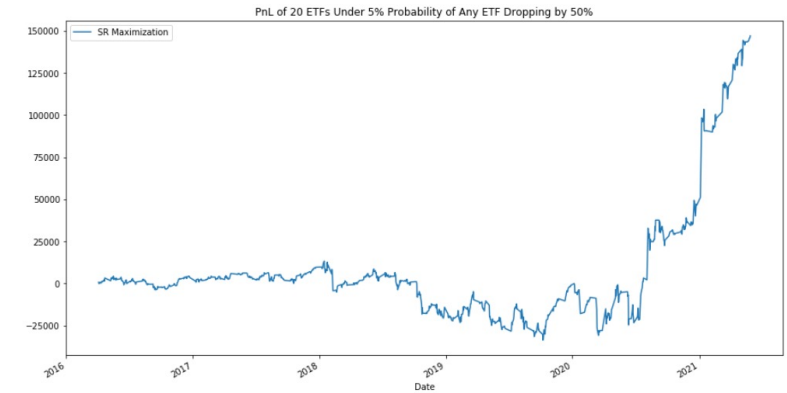
FROM SAFE TO AGGRESSIVE



Individual crush



Market crash



MA crush

We are doing fine even under COVID!!!

SCENARIO ANALYSIS

3 DIFFERENT SCENARIOS USED AS RISK MANAGEMENT

CONCLUSION