GROUP 15

PORTFOLIO OPTIMIZATION

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"WE PLEDGE ON OUR HONOR THAT WE HAVE NOT GIVEN NOR RECEIVED ANY UNAUTHORIZED ASSISTANCE ON THIS ASSIGNMENT WITH OTHER GROUPS."

- NOUMAN ALI, YATIN KOUL, WANG-HAN LI, YUTING QIAN

Portfolio

MAKE MONEY!
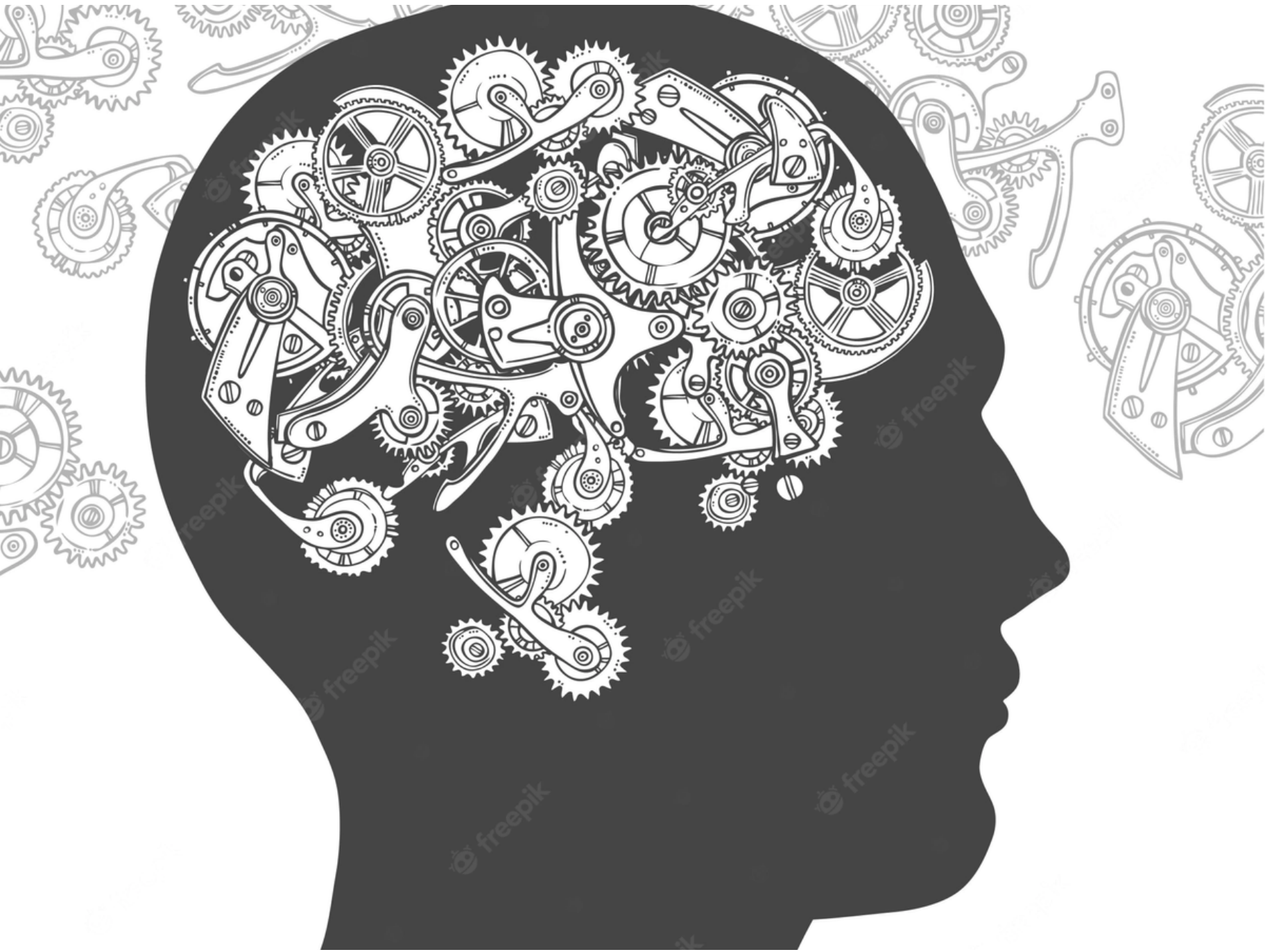

Objectives

Maximize Sharpe Ratio

Portfolio optimization and instrument selection

Outperform straightforward strategies

Portfolio

Instruments we chose:
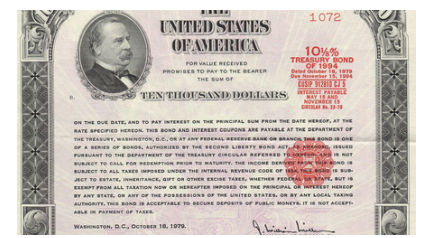
Equity:

Fixed Income:

Commodity:

Currency Pair:

Rationales applied:

Rationale 1: Sharpe ratio
- Balancing risk and reward

Rationale 2: Correlations
- Achieving diversification benefit by aggregating returns

Portfolio

Rationale 1:   High-Sharpe

Looking for high Sharpe ratios across all strategies for each instrument
- Benchmark
- Moving Average - Flat
- Moving Average - Short
- Bollinger Bands

Equity: AAPL, AMZN, GE, INTC and SPY
- AAPL Sharpe using MA crossover goes flat is 0.84.
- AMZN Sharpe using MA crossover goes flat is 0.59.
- INTC Sharpe using Bollinger Band strategy is 0.31.
- SPY Sharpe using MA crossover goes flat is 0.62.
- ???

Fixed Income: Bond

We choose cumulative log returns have Sharpe of .33

Commodity: Gold

For GOLD, we chose MA crossover goes flat.

Currency pairs:

????

	AAPL	AMZN	ATT	GE	INTC	SPY	BOND	AUD	EUR	GOLD	SILVER
Benchmark	0.48	0.3	-0.11	-0.33	0.02	0.15	0.33	0.03	0.07	0.46	0.19
MAC_Flat	0.84	0.59	-0.07	0.14	0.02	0.62	0.24	0.18	0.17	0.57	0.25
MAC_Short	0.53	0.34	0.09	0.48	-0.01	0.54	0.1	0.1	0.08	0.41	0.17
BB	-0.42	0.12	0.22	-0.3	0.32	0.28	-0.16	0.01	-0.27	0.02	-0.17

Rationale 2 : Low Correlation

Correlation between selected instruments
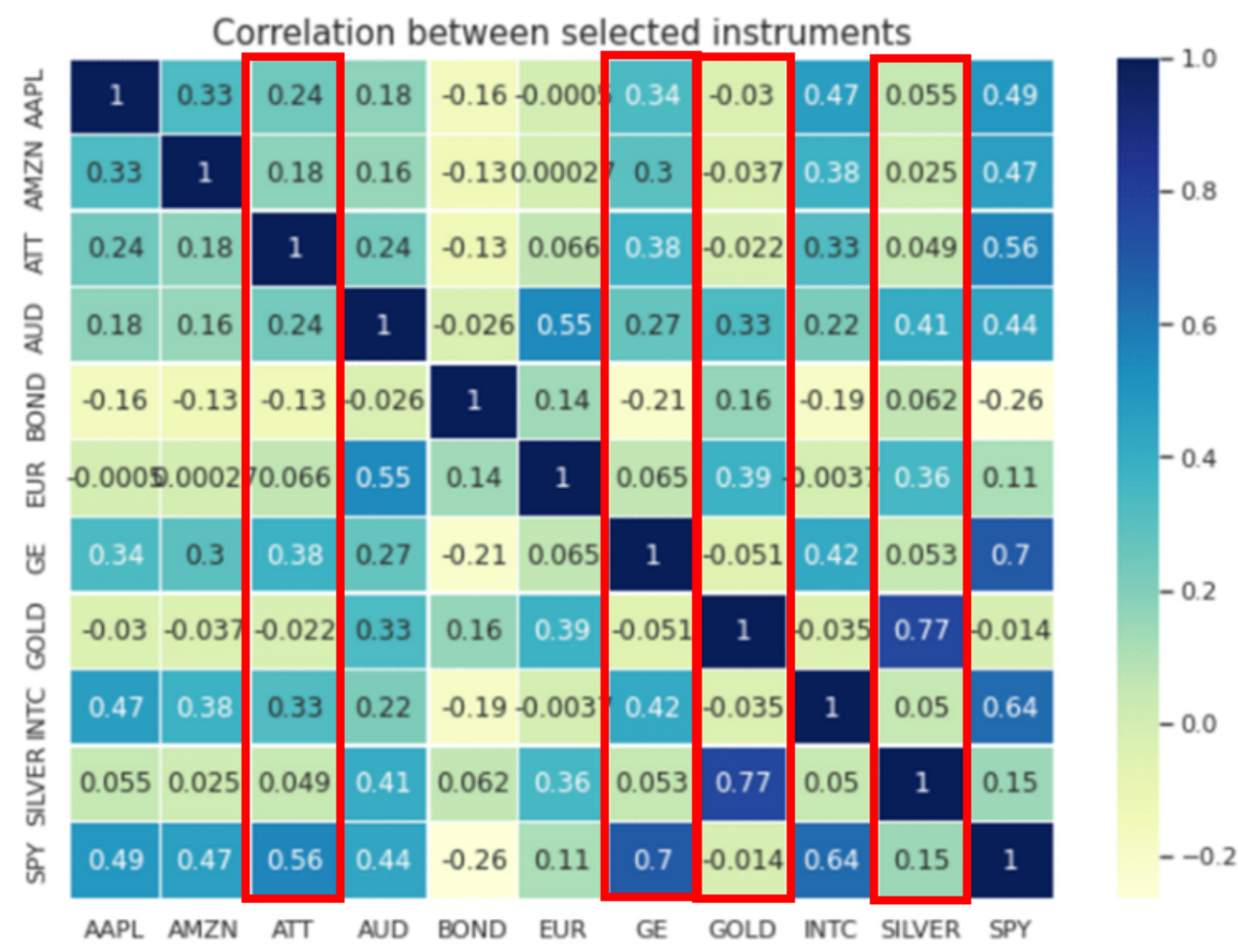
Equity:
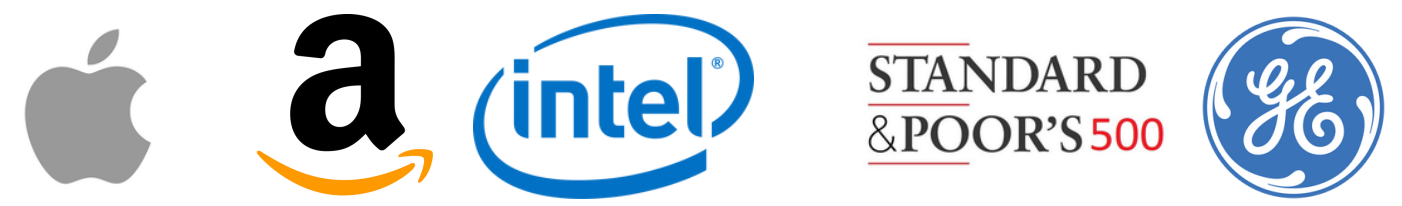
Fixed Income: Bond

Bond has negative correlation with most of the instruments

Commodity Instruments: Gold

GOLD correlation to other instruments is less than SILVER correlation to other instruments.

Currency Pairs : EUR -USD

EUR correlation to other instruments is less than AUD correlation to other instruments. For EUR, we chose cumulative log returns

Monte Carlo Optimization and Efficient Frontier:

Minimum variance portfolio:
- Return is 6.4%
- **Volatility is 5.5%**
- Sharpe is 1.16

Maximum Sharpe portfolio:
- Return is 10.6%
- Volatility is 8.7%
- **Sharpe is 1.23**

Return vs Risk - Color Coded by Sharpe Ratio

★ Min Vol Portfolio:x=5.49%; y=6.34%; 1.16
★ Max Sharpe Portfolio:x=8.66%; y=10.61%; 1.23

Minimum Variance VS Maximum Sharpe

1. Weight allocation:
   - Min Volatility Portfolio - SPY and BOND constitute more the 60% of portfolio
   - Max Sharpe Portfolio - AAPL, SPY, BOND. and GOLD dominate

2. Equal-weighted portfolio:
   - Sharpe ratio of equal-weighted portfolio is 1.1703

3. Beta of maximum Sharpe portfolio:
   - Beta is 0.1292

Instrument	Min Vol Weights	Max Sharpe Weights
AAPL	7.20%	19.46%
AMZN	5.22%	5.11%
GE	4.67%	8.32%
INTC	1.12%	6.11%
SPY	21.23%	14.01%
BOND	41.65%	18.95%
EUR	9.86%	3.44%
GOLD	9.06%	24.59%
Total	100.00%	100.00%

Mean Variance Optimization - Using Benchmark, MAC, and BB strategies on Selected-Instrument Portfolio

1. All benchmarks
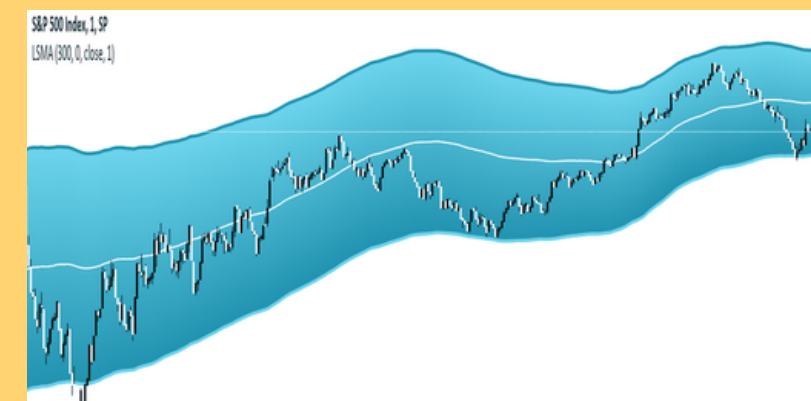   - The maximum sharpe ratio using benchmarks is **0.8028**

2. MA strategy on the chosen instruments
   - The maximum sharpe ratio using moving average crossover is **1.1746**.

3. Bollinger Bands strategy on the chosen instruments
   - The maximum sharpe ratio using bollinger bands is **0.2817**

Portfolio Summary - Comparing the salient features

	AAPL	AMZN	GE	INTC	SPY	BOND	EUR	GOLD		Portfolio
Strategy	MA Flat	MA Flat	MA Short	BB	MA Flat	Log Ret	MA Flat	MA Flat		Optimal
Sharpe Ratio	0.84	0.6	0.48	0.32	0.62	0.27	0.17	0.57		1.23
Beta	0.51	0.63	-0.59	0.25	0.33	-0.05	0.06	-0.02		0.13
Annual Return	23.6%	19.9%	15.0%	8.2%	7.0%	1.0%	1.7%	8.2%		10.6%
Annual Risk	28.1%	33.4%	31.1%	25.6%	11.2%	3.8%	10.1%	14.4%		8.7%
maxDD	-85.3%	-105.0%	-96.0%	-45.8%	-19.5%	-14.2%	-43.1%	-40.4%		-16.5%
Success Ratio	65.4%	66.9%	51.7%	74.5%	69.6%	52.4%	51.3%	68.3%		55.1%

THANK YOU