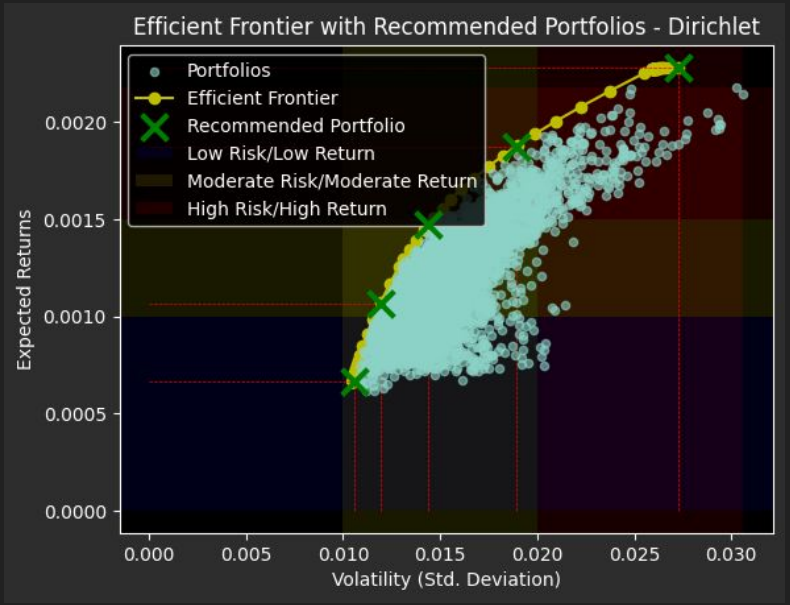
Your Portfolio

THE CAMILLUS GROUP™

www.thecamillusgroup.com

The Camillus Group - Optimized Portfolios



Fundamental Valuation Analysis

+

Proven Market Trend Forecasting

+

Advanced Quadratic Programming

=

Optimized Growth Portfolios

Our Approach

The Camillus Group (TCG) meets with clients to discuss their requirements, objectives, and preferences.

Your situation:

- Substantial assets. Investment portfolio will be large and have room for diversification.
- The client is young. TCG recommends seeking higher returns. Consider initial portfolio without bonds.
- We recommend some asset allocation to real estate. Purchasing a home provides enough at this stage.
- Client wants options for portfolios based on risk.

TCG applies the following criteria to most client portfolios:

1. Assess risk tolerance relative to age and goals.
2. Anchor portfolios with diversified index fund.
3. Seek sector leaders in moderate to high growth industries.
4. Avoid high concentration in one industry sector.
5. Evaluate stocks based on PEG ratio and other fundamentals.
6. Most clients can track a max of 10 stocks.
7. Consider a stock that has been “unfairly punished” recently.
8. Find one or two uncorrelated stocks to dampen market swings.
9. Consider bonds based on life stages and objectives.

Initial Investment Options Evaluated

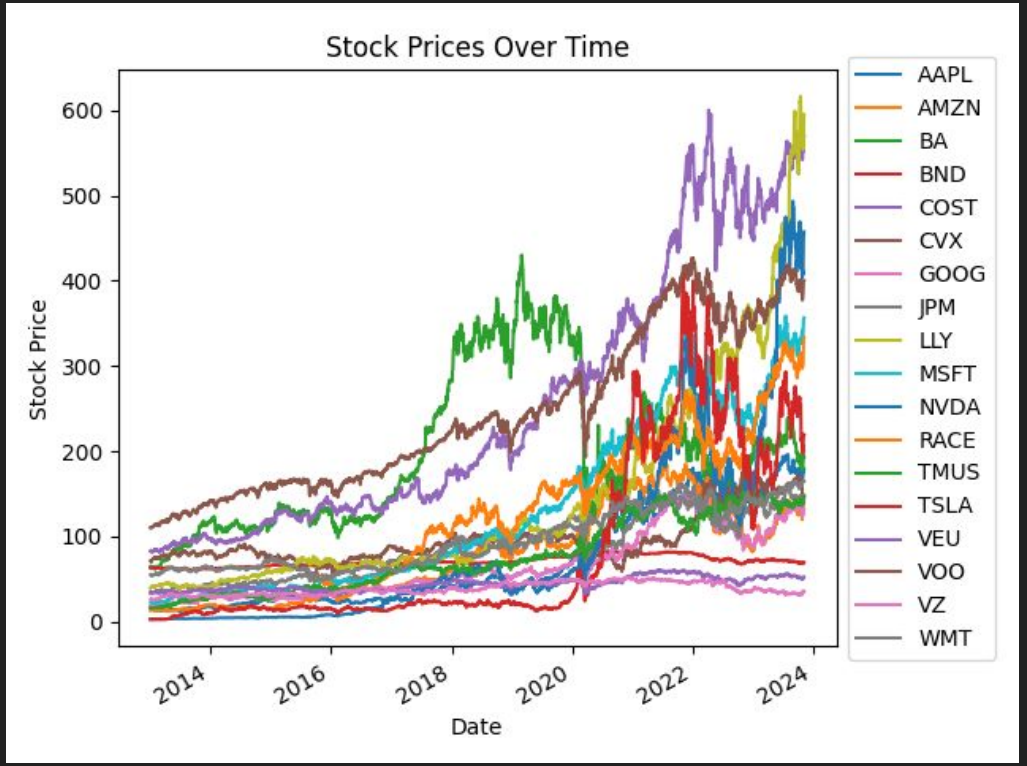
Company	('TICKER')	S&P Sector
Apple	'AAPL'	Information Tech
Amazon	'AMZN'	Consumer Discretionary*
Boeing	'BA'	Industrials
Costco	'COST'	Consumer Discretionary
Chevron	'CVX'	Energy
Alphabet	'GOOG'	Communications Services
JP Morgan	'JPM'	Financials
Eli Lilly	'LLY'	Health Care

Company	('TICKER')	S&P Sector
Microsoft	'MSFT'	Information Technology
Nvidia	'NVDA'	Information Technology
Ferrari '	RACE'	Consumer Discretionary
T-Mobile US	'TMUS'	Communications Services
Tesla	'TSLA'	Consumer Discretionary
Verizon	'VZ'	Communications Services
Walmart	'WMT'	Consumer Staples

ETF	('TICKER')	Asset Type
Vanguard S&P 500	'VOO'	Diversified Large Cap Index
Vanguard FTSE All World Ex US	'VEU'	International Index
Vanguard Total Bond Market	'BND'	Investment Grade Bond Index

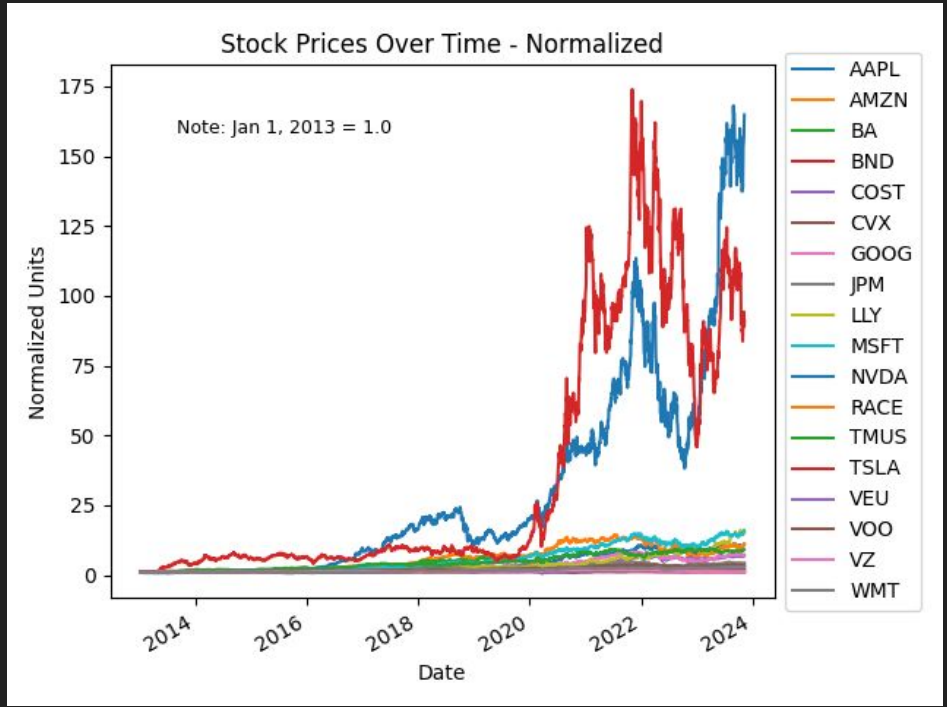
Price evolution of all stocks considered

- This chart shows the price evolution from 2013 to present (10 years) for all stocks considered.
- We can see the upward trend …
- … But this provides limited insight because the stocks prices have different starting points.
- Indexing all of these stocks to the beginning of the period provides better insight.



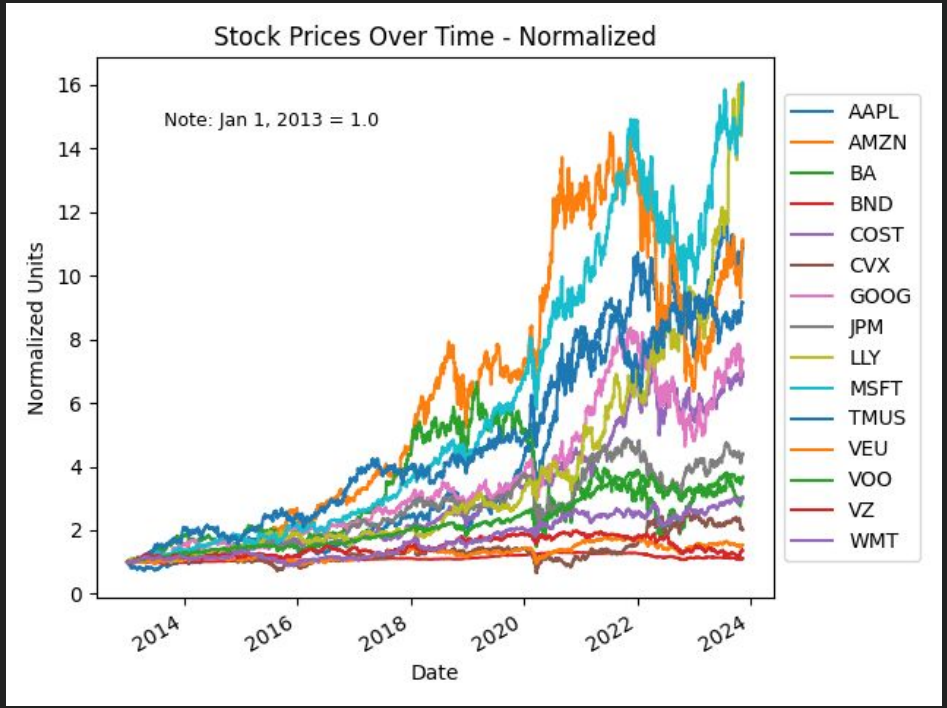
All Stocks - Indexed

- This chart shows the same stocks.
- They are indexed so that they all = 1.0 at beginning of the period.
- We can see the dramatic relative outperformance of TSLA and NVDA.



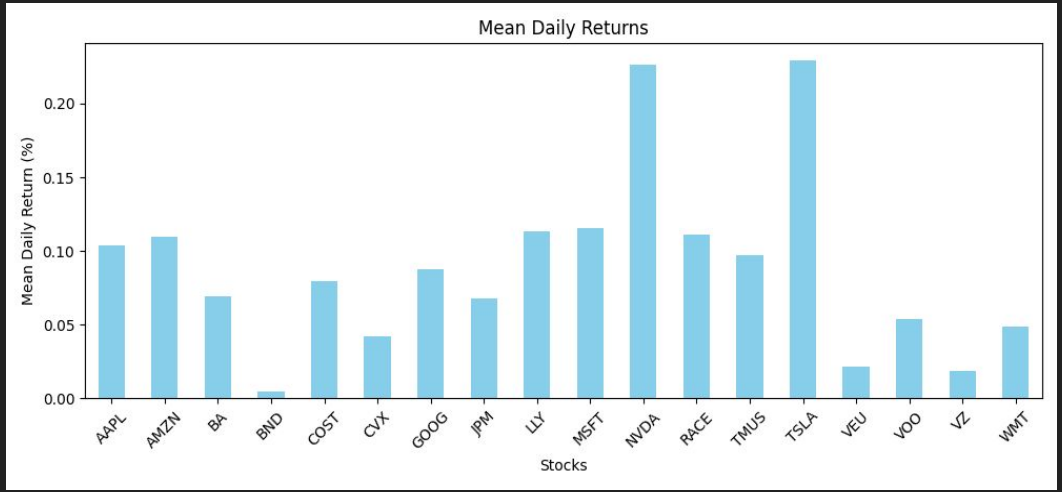
All the other stocks (without TSLA and NVDA)

- This chart shows all of the other stocks without TSLA and NVDA.
- They are indexed so that they all = 1.0 at beginning of the period.
- We can see that they show a range of performance.
- Stocks like AAPL, AMZN, MSFT, and LLY are strong performers.
- This does not provide insight into volatility or correlation between stocks.



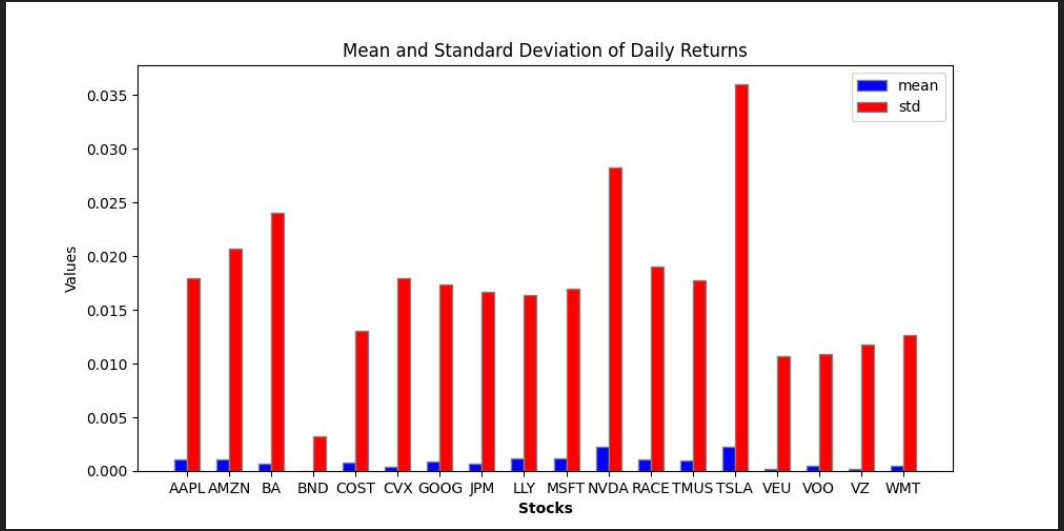
Expected Daily Returns

- Based on historical data, the expected daily return is the mean of the daily % return.
- In this chart, we can see the standouts:
  - TSLA and NVDA
- Other stocks with strong expected returns include:
  - AAPL, AMZN, LLY, MSFT, RACE, and TMUS
- This does not show is volatility.



Expected Returns Relative to Volatility

- The standard deviation of daily price change is a powerful measure of volatility.
- **Volatility = Risk**
- In this chart, we can see that the two stocks with highest expected returns also have the highest volatility
    - TSLA and NVDA
- The least risky in terms of volatility are the highly diversified ETFs - VOO and VEU.
- Bonds are also very low risk but low return.

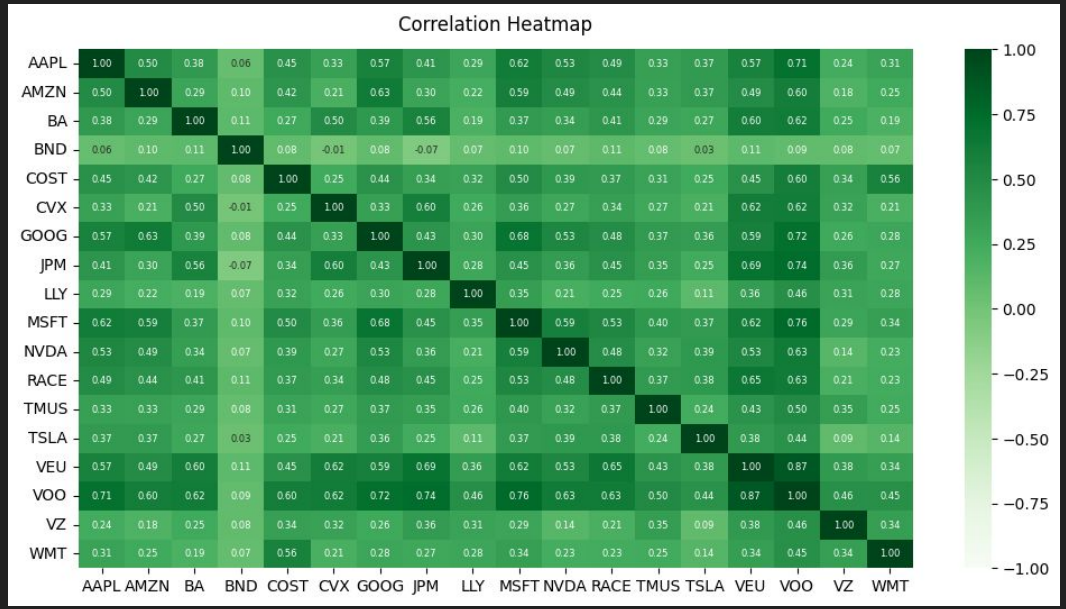


Risk-Reward Ratios

- The Risk-Reward Ratio provides a measure of the “quality” of the risk involved with a stock.
- The equation for this is:
  risk-reward = standard deviation / mean return
- The way to think of this ratio:
  - “How much return do you get per unit of risk?”
- A higher ratio value is better - you are getting more return for every unit of risk.
- We see that NVDA, MSFT, and TSLA have strong risk-reward ratios
  - But you may not have expected to see LLY , COST, and RACE performing like Big Tech!

Correlations Between Stocks

- We want to consider the correlation between stocks to choose some that are less correlated.
- Lower correlation between stocks in a portfolio reduces the overall volatility of the portfolio.
- We can see high correlation between VOO and the individual company stocks - this is to be expected.
- Tech stocks highly correlated to each other - we want to avoid too much concentration here.
- BA, VZ, LLY, VZ, and WMT have low correlations to the other stocks
    - Wise to include 1 or 2 of these
- Bonds are highly uncorrelated.



We design the portfolio based on valuation fundamentals, trend analysis, returns, and risk .

Maximize return with acceptable levels of **risk.**

Provide the client with portfolio options so she can choose based on her **risk tolerance**.

Fundamentals

Apply fundamentals based valuation methods and trend analysis to select a manageable portfolio of investments with attractive risk-to-reward metrics.

Fundamental Valuation Metrics

Ticker	Industry Sector	Rev Growth 5 yr	EPS Growth past 5 yr	EPS Forecast (3-5 yr)	PE Multiple	PEG Ratio	Mkt Cap	Leadership Position	Trend
AAPL	Info Tech	8%	22%	6%	28	4.6	2.57T	Smartphone ecosystem	Massive services opportunity to installed base
AMZN	Cons Disc	24%	n/a	n/a	73	0.8	1.44T	eCommerce and Cloud	Easily double 11% share of total retail mkt + AWS
BA	Industrials	-7%	n/a	n/a	-32	n/a	114B	Commercial airliners	Solve problems and deliver on order book
COST	Cons Disc	11%	15%	8%	40	4.9	250B	Wholesale club	Club wholesale has room to grow
CVX	Energy	12%	37%	n/a	11	n/a	267B	Proven reserves	Petro still needed for many years
GOOG	Comm Serv	21%	23%	19%	23	1.3	1.59T	Digital advertising	All advertising will be digital algorithmic
JPM	Financials	8%	12%	n/a	9	2.9	419B	Strongest balance sheet	Systemically important bank
LLY	Health Care	7%	10%	28%	91	3.8	561B	Blockbuster drugs	Blockbuster weightloss drug Mounjaro
MSFT	Info Tech	14%	20%	16%	33	2.2	2.68T	Cloud and AI	AI applications
NVDA	Info Tech	23%	9%	79%	45	1.4	1.16T	Heart of AI	AI infrastructure
RACE	Cons Disc	8%	13%	26%	47	2.0	61B	Luxury	Luxury brand extension
TMUS	Comm Serv	14%	-2%	67%	21	0.3	170B	5G coverage	5G dominance
TSLA	Cons Disc	47%	n/a	4%	68	19.1	706B	EV, FSD	S-curve EV adoption
VZ	Comm Serv	2%	9%	1%	8	13.5	150B	Largest mobile	Slow growth
WMT	Cons Staples	7%	4%	8%	26	4.1	447B	Largest Retailer	Could grow ecommerce

Stock data as of: 11/10/2023

PEG Ratio standouts: AMZN, GOOG, NVDA, TMUS
Growth standouts (Rev): AMZN, GOOG, NVDA, TSLA
EPS forecast standouts: GOOG, LLY, NVDA, RACE, TMUS

Clear Choices

IN

NVDA
Simply: AI. It all depends on Nvidia GPU's and their proprietary software for generative AI model training.
Fundamentals: Massive growth with a PEG of only 1.4.

LLY
Simply: Mounjaro in a world with an obesity crisis.
Fundamentals: PEG of 3.8 is still reasonable.

JPM
Simply: Systemically indispensable. Strongest balance sheet of major banks.
Fundamentals: PEG 2.9, reasonable valuation, steady growth.

BA
Simply: Order book of commercial airliners.
Fundamentals: These look bad due to management mistakes. We believe these problems will be solved.

OUT

CVX
Simply: EV transition poses to much risk for gasoline retailer.
Fundamentals: Good, but could deteriorate fast.

The Mobile Choice: TMUS vs. VZ

IN

TMUS

TMUS does not have the largest market share, but for other reasons is the leader in mobile service in the US. TMUS based its 5G network expansion on 2.5GHz spectrum, while AT&T and VZ gambled on millimetric wave spectrum (+20GHz). 2.5GHz propagates further and wider and enabled rapid buildout of 5G coverage. While growing rapidly, TMUS still has outstanding valuation metrics with a forward PE multiple of 21 and an incredible PEG ratio of 0.3. We also prefer TMUS because it is a pure play in wireless communications.

OUT

VZ

VZ has the largest wireless market share. It is also a dividend aristocrat, yielding 7.5%. However, VZ is richly valued with a PEG ratio of 13.5. VZ has a large debt burden on its balance sheet and rapidly depreciating fixed network assets. For the reasons listed above, TMUS is the better choice in this space.

Harder Choices: AAPL, AMZN, GOOG, MSFT

IN

AMZN

Even with a market cap of $1.44T, AMZN has the most reasonable valuation of any Big Tech company, with a PEG ratio of only 0.8. The dominant player in e-commerce and cloud services, strong growth forecast, EPS could easily be dialed up if management decides to shift to balancing growth with earnings.

GOOG

GOOG has recently gone out of favor. Confused outlook on AI and antitrust lawsuit. But GOOG has a 90% market share in search, has the leading digital advertising platform, and with YouTube has the most watched video content (surpasses even Netflix and all broadcast TV). GOOG is actually a leader in AI development. PEG of only 1.3.

OUT

AAPL

AAPL is an amazing company. But with the world's 2nd largest market cap at $2.6T, it is simply too richly valued. Despite four straight quarters of revenue decline, AAPL trades at forward PE multiple of 28 with a PEG ratio of 4.6.

MSFT

MSFT has the world's largest market cap of $2.7T. Even at this size, MSFT still posts double digit sales growth. It has a high forward PE ratio of 33 but a reasonable PEG of 2.2. While we like MSFT, we prefer AMZN and GOOG.

Harder Choices: AMZN, COST, WMT

IN

AMZN

AMZN provides market dominance and fast growth in retail …. But also cloud services, with strong stories in logistics and advertising. As mentioned, the valuation is just too attractive to ignore with a PEG ratio of only 0.8.

OUT

COST

COST invented the wholesale club business. It still has room to grow, especially globally. But it is already richly valued with a forward PE of 40 and a PEG ratio of 5.

WMT

WMT is the world's largest retailer and a fundamentally strong company. It's valuation metrics are on the high side though not as high as COST. But the biggest growth will be in e-commerce, where AMZN is dominant.

The Hardest Choice: RACE vs. TSLA

IN

TSLA

TSLA is the clear leader in EV's. It is the only profitable EV maker, with gross margins that surpass traditional ICE auto makers. It is richly valued already, but we believe this is for a good reason. Multiple factors favor EV over ICE. TSLA's charging network is quickly become the standard while the company has yet to monetize it. TSLA also is well position to be the first to deliver Full Self Driving (FSD) and this might be a case of "winner takes all."

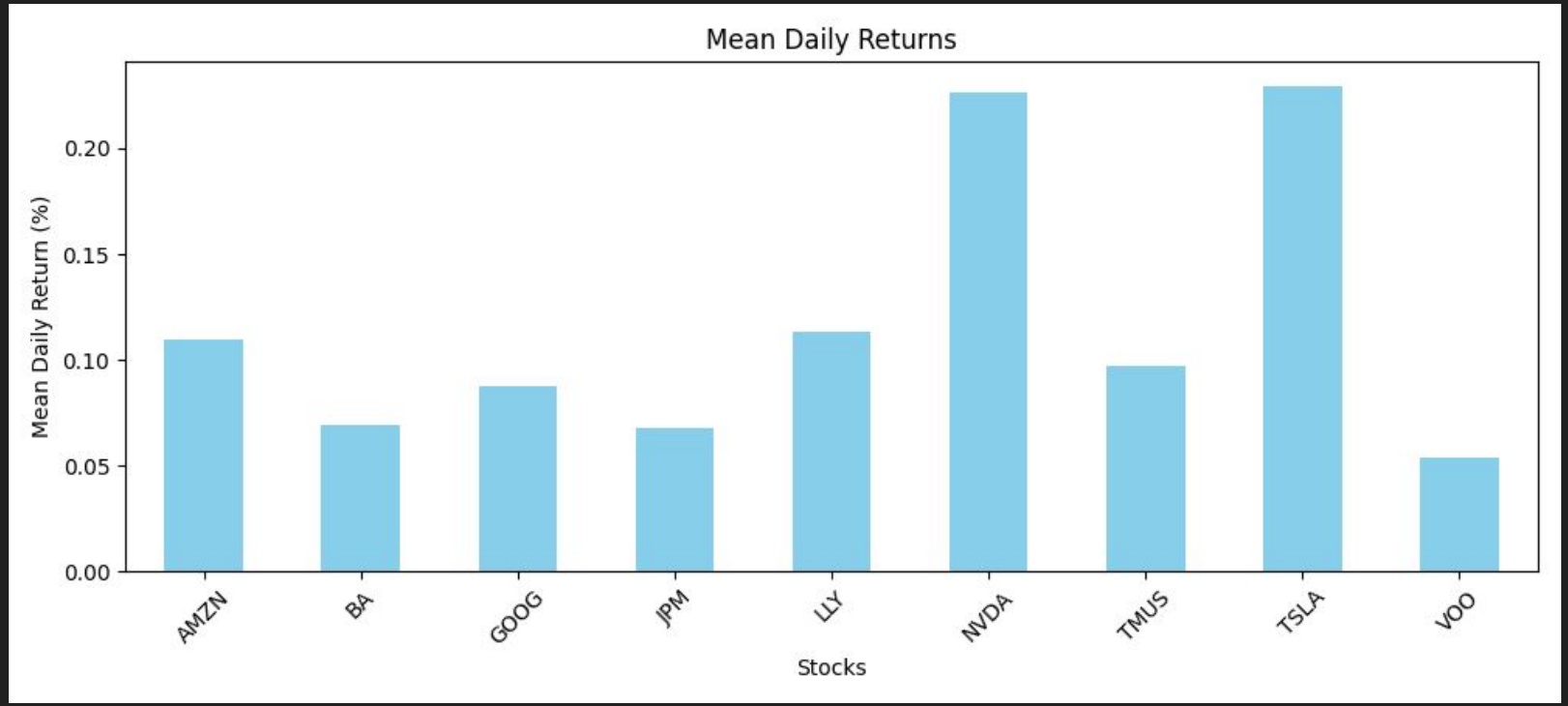
OUT

RACE

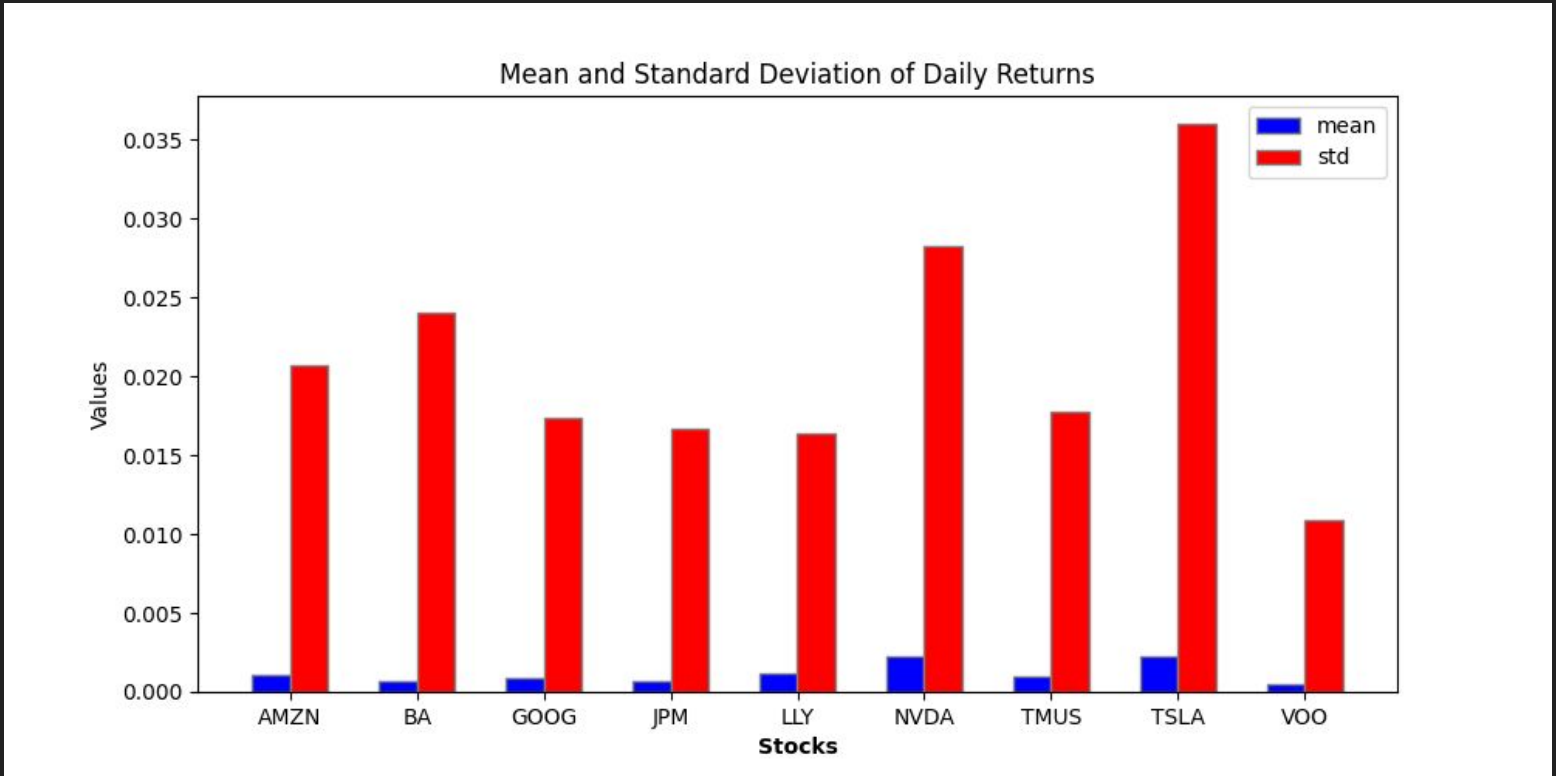
For a luxury brand, Ferrari is hard to beat. Since going public, it's stock has performed well. In many respects, RACE is in its own category. RACE still has a reasonable valuation with a PEG of 2. But, in a choice of automakers for a portfolio, we prefer TSLA. But just barely.

The Portfolio

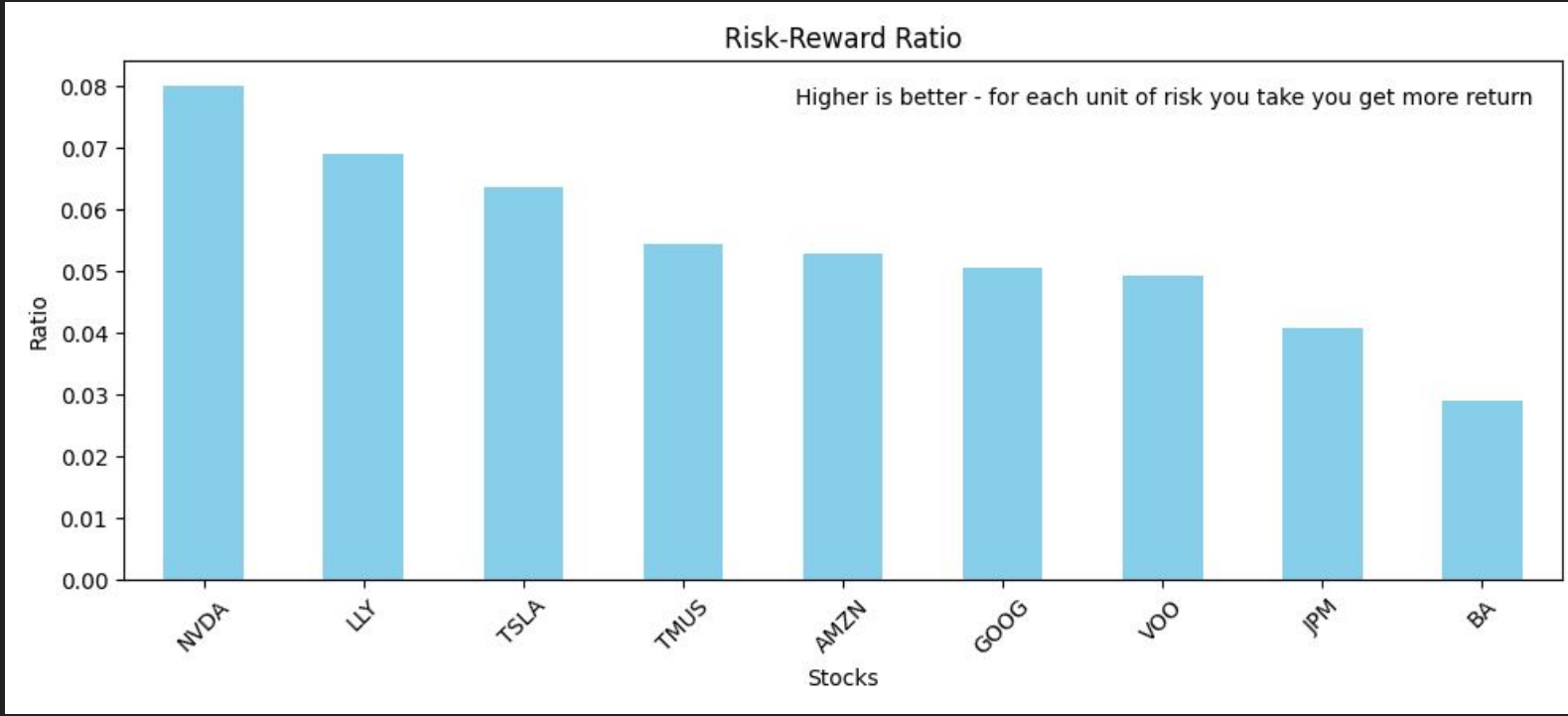
The Portfolio - Expected Daily Returns



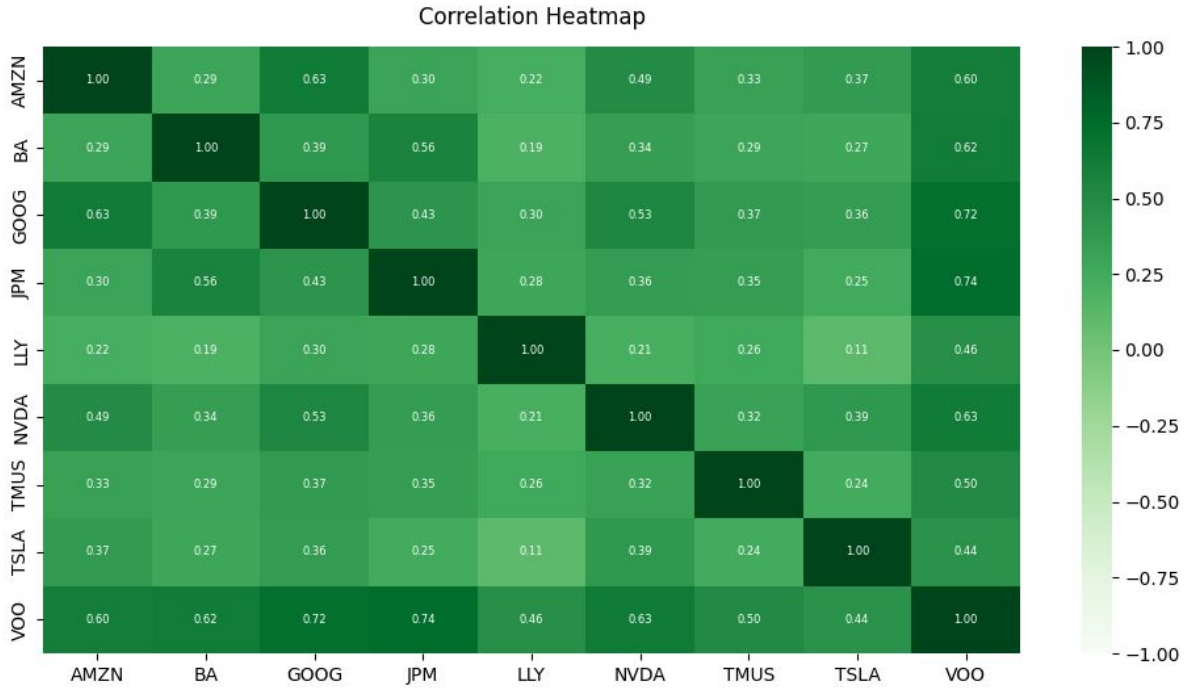
The Portfolio - Expected Returns Relative to Volatility



The Portfolio - Risk-Reward Ratios



The Portfolio - Correlations Between Stocks

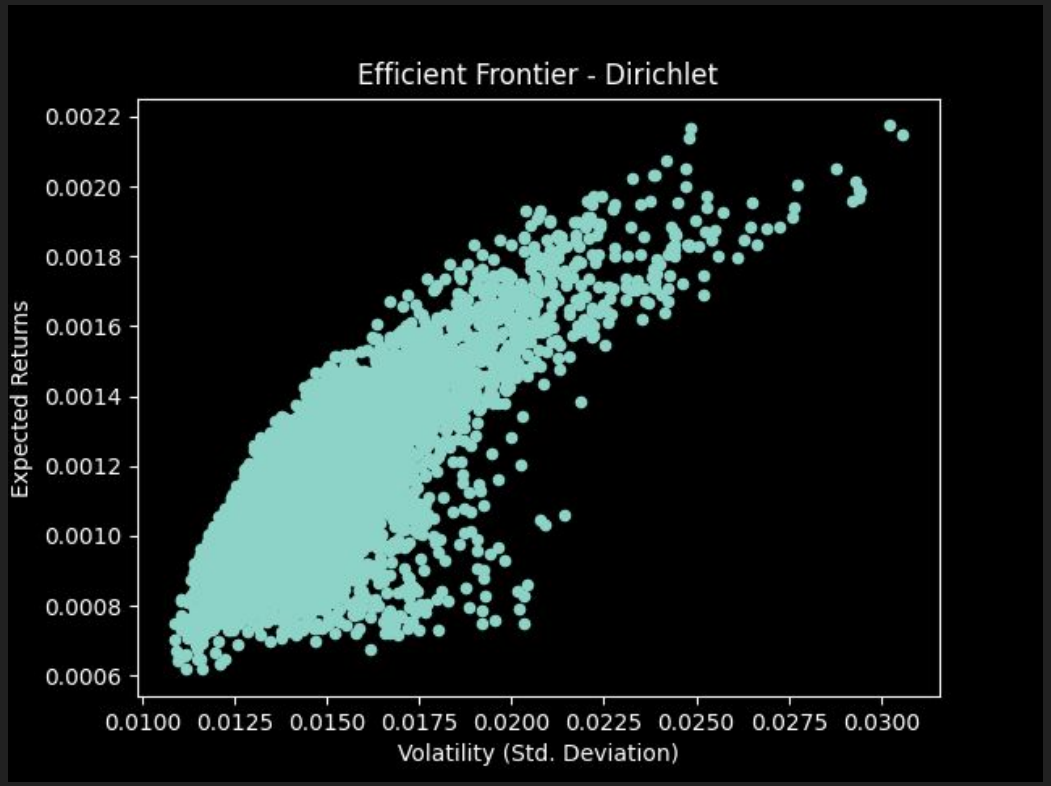


```python
import numpy as np
import pandas as pd
import cvxopt as opt

def optimal_portfolio_revised(returns_df):
    n = returns_df.shape[1]
    returns = np.transpose(returns_df.to_numpy())

    # Calculate mean returns and covariance matrix based on daily returns
    mean_returns = returns_df.mean()
    cov_matrix = returns_df.cov()

    # Define the range of expected returns for the efficient frontier
    N = 100
    mus = [10**(5.0 * t/N - 1.0) for t in range(N)]

    # Convert to cvxopt matrices for the optimization
    S = opt.matrix(cov_matrix.values)
    pbar = opt.matrix(mean_returns.values)

    # Create constraint matrices
    G = -opt.matrix(np.eye(n))  # negative n x n identity matrix
    h = opt.matrix(0.0, (n, 1))
    A = opt.matrix(1.0, (1, n))
    b = opt.matrix(1.0)

    # Calculate efficient frontier weights using quadratic programming
    portfolios = [opt.solvers.qp(mu*S, -pbar, G, h, A, b)['x'] for mu in mus]

    # Calculate risks and returns for the frontier
    returns = [opt.blas.dot(pbar, x) for x in portfolios]
    risks = [np.sqrt(opt.blas.dot(x, S*x)) for x in portfolios]

    # Set up the list for the target returns we want to achieve
    target_returns = np.linspace(min(returns), max(returns), 5)

    # Initialize lists to store recommended portfolio returns and volatilities
    recommended_returns = []
    recommended_volatility = []
    recommended_weights = []

    for target_return in target_returns:
        # Define the constraint for the target return
        A = opt.matrix(np.vstack((np.ones((1, n)), np.array(mean_returns))))
        b = opt.matrix(np.array([1.0, target_return]))

        # Perform the optimization with an additional constraint that the portf
```

Quadraditic Programming

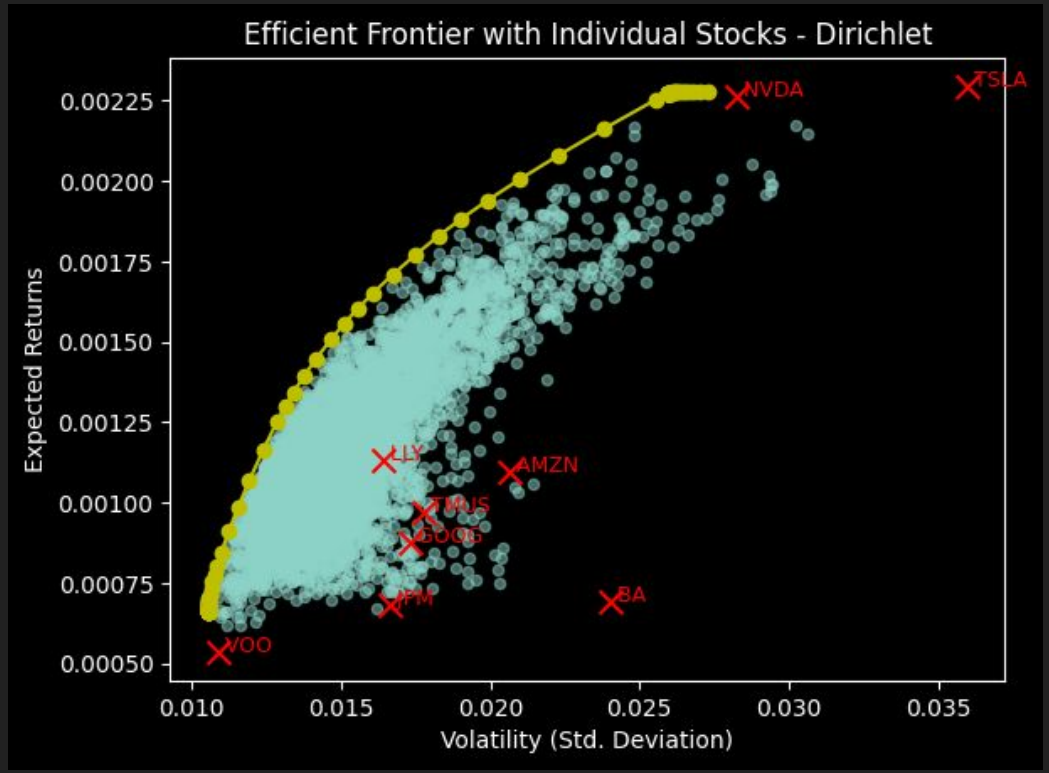
TCG uses Quadratic Programming and Markowitz's Modern Portfolio Theory (MPT) to determine optimal portfolio weighting at each level of risk.

Distribution of Possible Portfolios



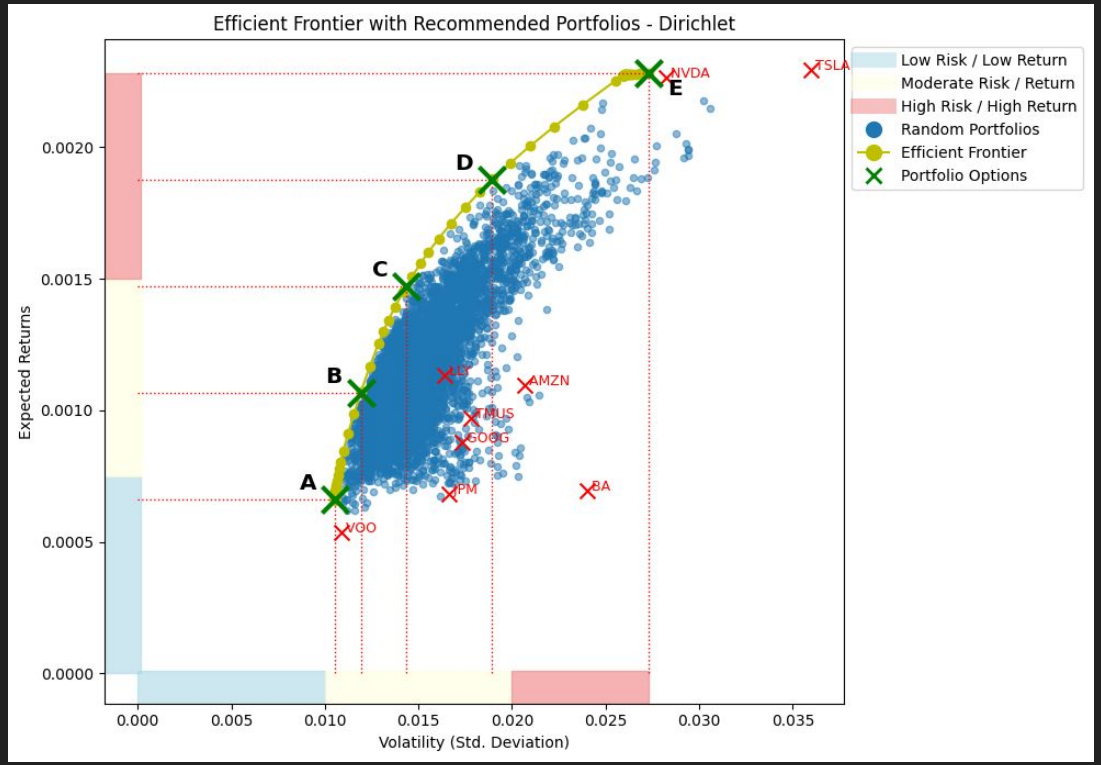
- We plotted the expected returns and volatility (standard deviation) of 5,000 random portfolios containing the 9 stocks in the recommended portfolio.
- Dirichlet distribution used to achieve a good spread of random portfolios.
- A wide variety of different possible outcomes based on the weighting given to each stock in the portfolio.
- **This graphic shows the importance of optimizing the weight given to each stock in the portfolio in order to maximum the return for any given level of risk.**

The Efficient Frontier of Optimized Portfolios



- Applying Markowitz MPT and utilizing advanced quadratic programming, we defined the 'Efficient Frontier' (yellow line) of optimized portfolios.
- The portfolios on the Efficient Frontier maximize the expected return at every level of risk.
- There are no better combinations of portfolio component weights than those in the portfolios on the Efficient Frontier.
- Each individual stock is plotted, showing that the diversified portfolios on the Efficient Frontier achieve better results than any single stock when factoring in risk.

Putting It All Together - Choosing a Portfolio



- **Now, you can choose your optimized portfolio based on your preference for risk.**
- We have created portfolio options A - E for your consideration.
- Portfolio A has the lowest risk and the lowest return. Portfolio E has the highest risk and highest return.
- Whichever portfolio you chose, you can be assured that the weighting applied to each individual stock in the portfolio is optimized so that you receive the maximum return for the degree of risk you prefer.

Optimized Portfolio Weights

PORTFOLIO	Expected Daily Returns	Volatility (Std Dev)	AMZN	BA	GOOG	JPM	LLY	NVDA	TMUS	TSLA	VOO	TOTAL
A	0.0662%	1.0549%	0.00095	0.00025	0.00057	0.00097	0.15378	0.00013	0.07644	0.00031	0.76662	1.00000
B	0.1067%	1.1918%	0.05348	0.00044	0.01218	0.07102	0.34663	0.06420	0.17115	0.05371	0.22719	1.00000
C	0.1471%	1.4361%	0.02772	0.00035	0.00123	0.01661	0.44820	0.21137	0.17613	0.11813	0.00025	1.00000
D	0.1876%	1.8930%	0.00001	0.00000	0.00000	0.00000	0.34909	0.43343	0.00005	0.21742	0.00000	1.00000
E	0.2280%	2.7292%	0.00000	0.00000	0.00000	0.00000	0.00000	0.45503	0.00000	0.54497	0.00000	1.00000

Based on stock data Jan 2, 2023 to Nov 10, 2023

Optimized Portfolios - Annualized Returns and Volatility

Annualized expected returns and volatility are easier to understand.

- All of these portfolios are geared toward growth, with moderate to high risk.
- It's important to note that past performance does not guarantee future results.

These numbers assume 250 trading days in a year.

Formula for annualized returns:

Annualized Return = (1 + Daily Return)^*N* − 1

Formula for annualized standard deviation:

Annualized Volatility = Daily Volatility × SQRT(*N*)

PORTFOLIO	Annual Expected Returns	Annualized Volatility (Std Dev)
A	18.00%	16.68%
B	30.55%	18.84%
C	44.42%	22.71%
D	59.76%	29.93%
E	76.72%	43.15%

Based on stock data Jan 2, 2023 to Nov 10, 2023

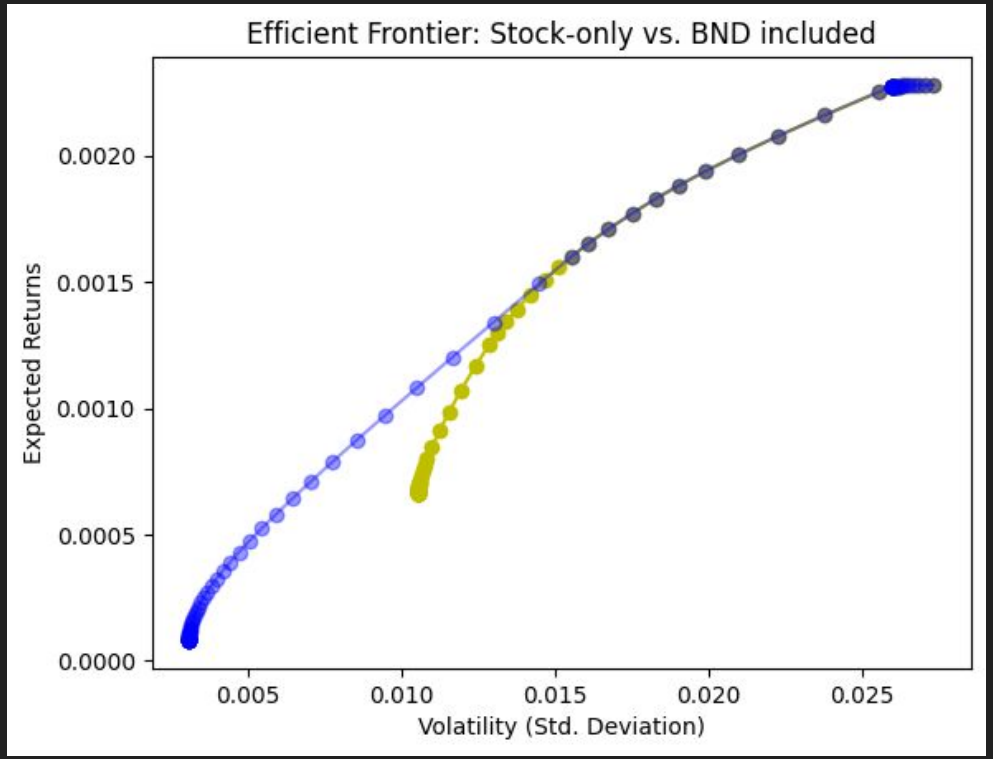
Optimized Portfolio - Investing $100,000

PORTFOLIO	AMZN	BA	GOOG	JPM	LLY	NVDA	TMUS	TSLA	VOO	TOTAL
A	$ 95	$ 25	$ 57	$ 97	$ 15,378	$ 13	$ 7,644	$ 31	$ 76,662	$ 100,000
B	$ 5,348	$ 44	$ 1,218	$ 7,102	$ 34,663	$ 6,420	$ 17,115	$ 5,371	$ 22,719	$ 100,000
C	$ 2,772	$ 35	$ 123	$ 1,661	$ 44,820	$ 21,137	$ 17,613	$ 11,813	$ 25	$ 100,000
D	$ 1	$ 0	$ 0	$ 0	$ 34,909	$ 43,343	$ 5	$ 21,742	$ 0	$ 100,000
E	$ 0	$ 0	$ 0	$ 0	$ 0	$ 45,503	$ 0	$ 54,497	$ 0	$ 100,000

Based on stock data Jan 2, 2023 to Nov 10, 2023

Important Note: When building this portfolio, we recommend income averaging over a period of time. Build each position with multiple stock purchases over several months.

Add Bonds for Lower Risk Portfolios



- The risk profile of our recommended portfolios are moderate to high (shifted right).
- We recommend that a young investor with a long time horizon accept more risk in order to achieve higher long term returns.
- If you would like to see lower risk options, we can add asset allocation to bonds
- This chart shows the Efficient Frontier (purple) that would result if we added the diversified bond ETF 'BND'.
- Adding bonds provides portfolio options with lower risk. In a narrow band, adding bonds actually increasing the rate of return per unit of risk.
- Let us know if you want to add bonds.

Learn more about integrating AI to dramatically improve your business operations.

Contact us: https://www.thecamillusgroup.com/contact

At the intersection of deep data, AI, and opportunity. ©

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