Objective

US stock market is generally considered with the following sectors:

- Energy
- Materials
- Industrials
- Consumer Discretionary
- Consumer Staples
- Health Care
- Financials
- Information Technology
- Telecommunication Services
- Utilities
- Real Estate

Assuming you have $100M from investors and want to consult you for investing strategy but only want to play safe and with ETF and bond only. Please research and pick the corresponding ETF stock for each sector and bond ETF to create your portfolio. The total stock ETF is 80% of the total portfolio and total bond ETF is 20% of your portfolio. 10% of your position can be in short position. Based on last 4 years of performance, can you give optimized portfolio solution for your investors.

You also advise your investor based on your own professional opinion and consider the Information Technology will outperform general market by 20% annually in coming years. Can you offer revised portfolio based on this updated information?

Things to consider when choosing ETF's

Expense Ratio:

The whole point of buying ETFs is to keep expenses low to boost your net returns. Expense Ratio is the expense that we incur on the ETF other than the ETF price. They differ on different ETF's. An expense ratio of 0.10 means a fund investment of $ 1000 will cost you $1.0 annually. Preferring lower expense is always better.

Net Asset value:

Net Asset value is the value of Assets held by the investment. A higher value of asset means that the ETF is strong and less likely to close at any point soon. However, a small value of asset means the ETF is weak and can close. Prefer choosing a strong investment with higher Net Asset value.

Bid-Ask spread:

The bid ask spread is the difference in the buying rate and the selling rate of an investment. Bid here is the buying rate and ask the selling rate. A bigger spread means you are offered a high price to buy and a low price to sell which may eat away your potential returns. Choosing one with a low bid-ask spread is always the best option.

Volume:

Volume is the number of stocks traded daily. This decides the liquidity in the stock, which means how liquid the stock is. If the volume is high the stock will be more liquid, and you can buy or sell easily and if the volume is low then liquidity is low, and you cannot buy or sell easily. Prefer choosing a stock with high volume.

Companies included in the ETF:

The performance of the ETF depends on the performance of the companies included in it. Research and choose the ETFs which have better companies (size and performance wise). Choosing ETFs with better companies is always better.

Dividend:

Dividend is the distribution of the earnings of the company stakeholders. As ETF's invest in a number of stocks so they also payout the dividend that they get from the company. You can reinvest the dividend to get more ETF's or cash it out. We are investing to earn money and dividends though being less is something that you earn, so prefer ETF's that pay dividend.

ETF STOCKS

Energy- Vanguard Energy ETF (VDE) -

Vanguard Energy ETF (VDE) is one of the biggest Etfs in the energy sector with total assets of 2.7 Billion. It has a lower expense ratio of 0.10% and the current stock price (USD 54.53) is comparatively less as compared to other stocks in the sector.

Link- https://money.usnews.com/funds/etfs/equity-energy/vanguard-energy-etf/vde

Yahoo Finance - https://finance.yahoo.com/quote/VDE?p=VDE&.tsrc=fin-srch

Companies included-

Exxon Mobil Corp (XOM), Chevron Corp. (CVX), Conoco Phillips (COP), Kinder Morgan Inc - Ordinary Shares - Class P (KMI).
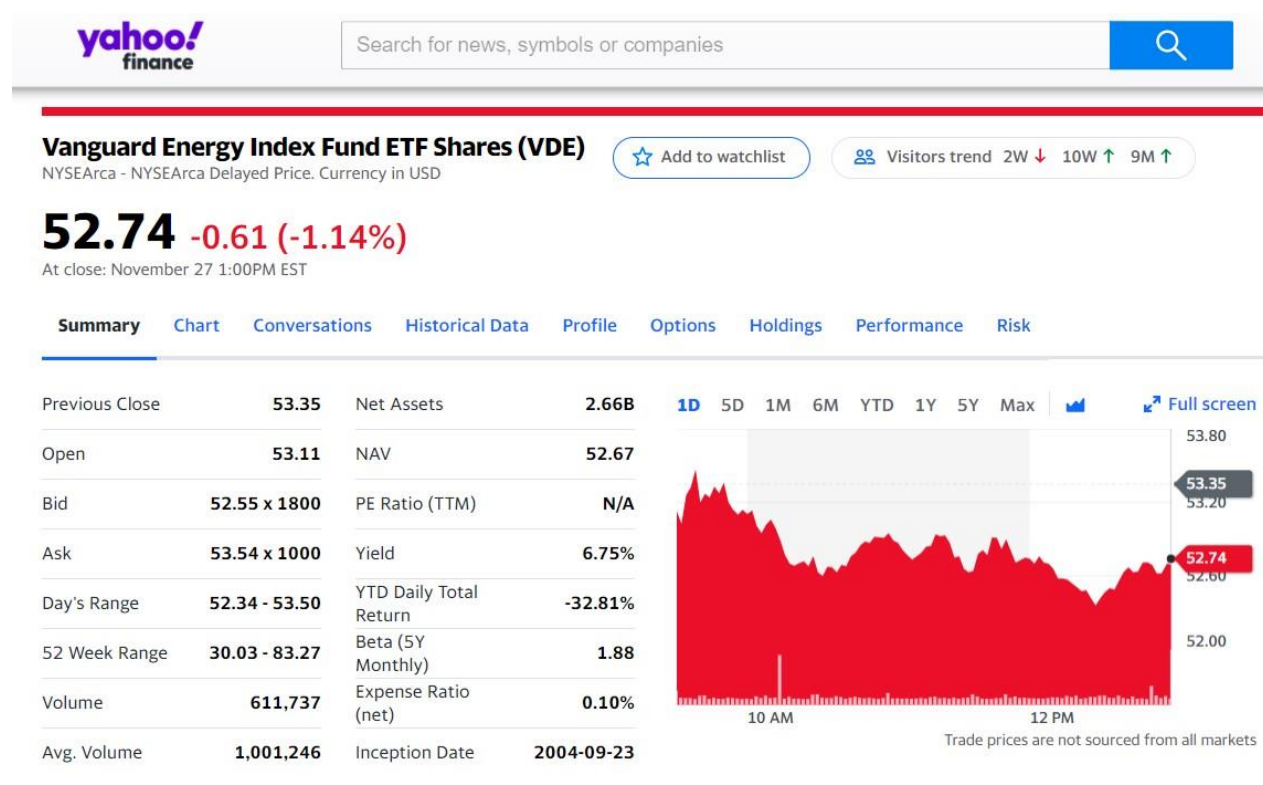
## Materials- VanEck Vectors Gold Miners ETF (GDX) -

VanEck Vectors Gold Miners ETF (GDX) is one of the most efficient stock in the materials industry being prices at USD 33.42. Although the expense ratio is high (0.58%) but the yield being 0.51% almost covers it. Keeping most of the gold miner stocks, its total assets are valued at 16.29 Billion one of the highest in the industry. Performance wise the 3 year daily total return is 17.40 % as compared to the industry rate of -2.9%.

Link- https://etfdb.com/etfdb-category/materials/#etfs__overview&sort_name=assets_under_management&sort_order=desc&page=1

Yahoo Finance - https://finance.yahoo.com/quote/GDX?p=GDX&.tsrc=fin-srch

Companies Included- Newmont Corp (NEM), Barrick Gold Corp (ABX), Franco-Nevada Corporation (FNV), Newcrest Mining Ltd (NCM).
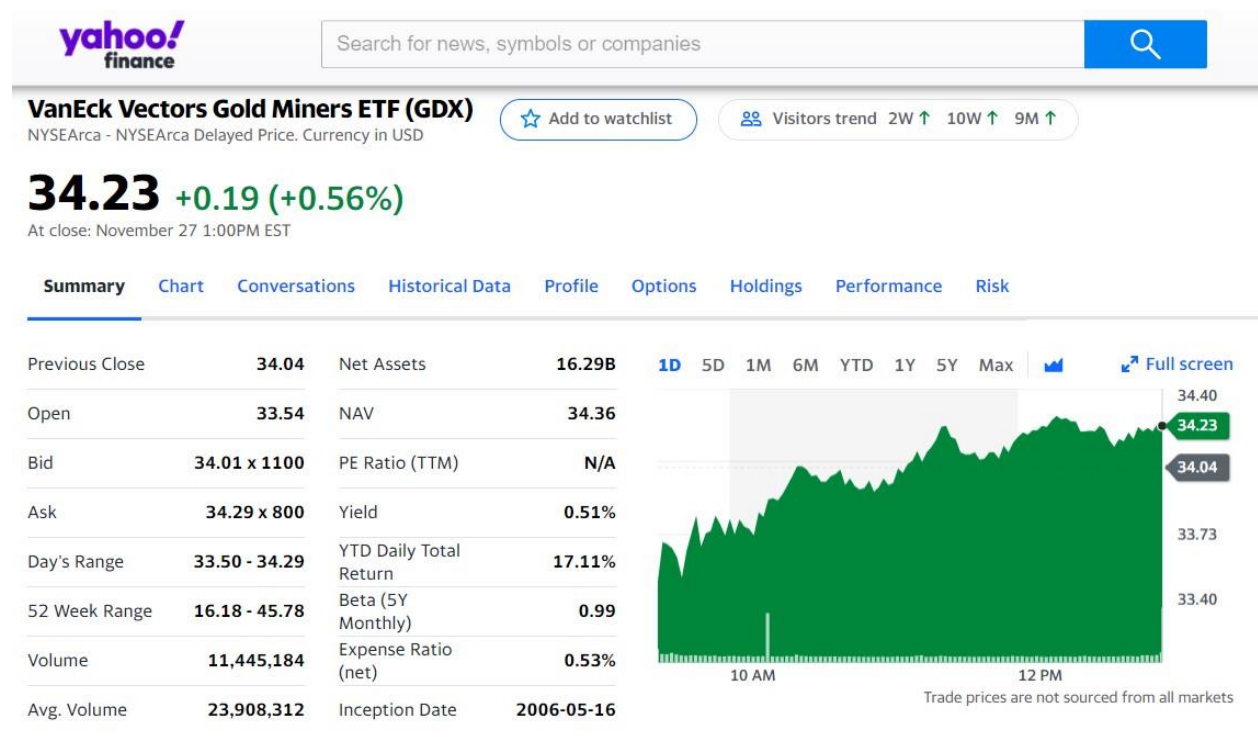
Industrials- Fidelity® MSCI Industrials ETF (FIDU)-

Industrials- Fidelity® MSCI Industrials ETF (FIDU) has one of the least expense ratios of 0.8%. Though having fewer net assets (413.5 Million) as compared to other ETF stocks, FIDU has one of the best performances in the industry.
Link- https://money.usnews.com/funds/etfs/industrials/fidelity-msci-industrials-etf/fidu
Yahoo Finance- https://finance.yahoo.com/quote/FIDU?p=FIDU&.tsrc=fin-srch
Companies Included- Honeywell International Inc (HON), Union Pacific Corp (UNP), United Parcel Service, Inc.- Ordinary Shares- Class B (UPS).
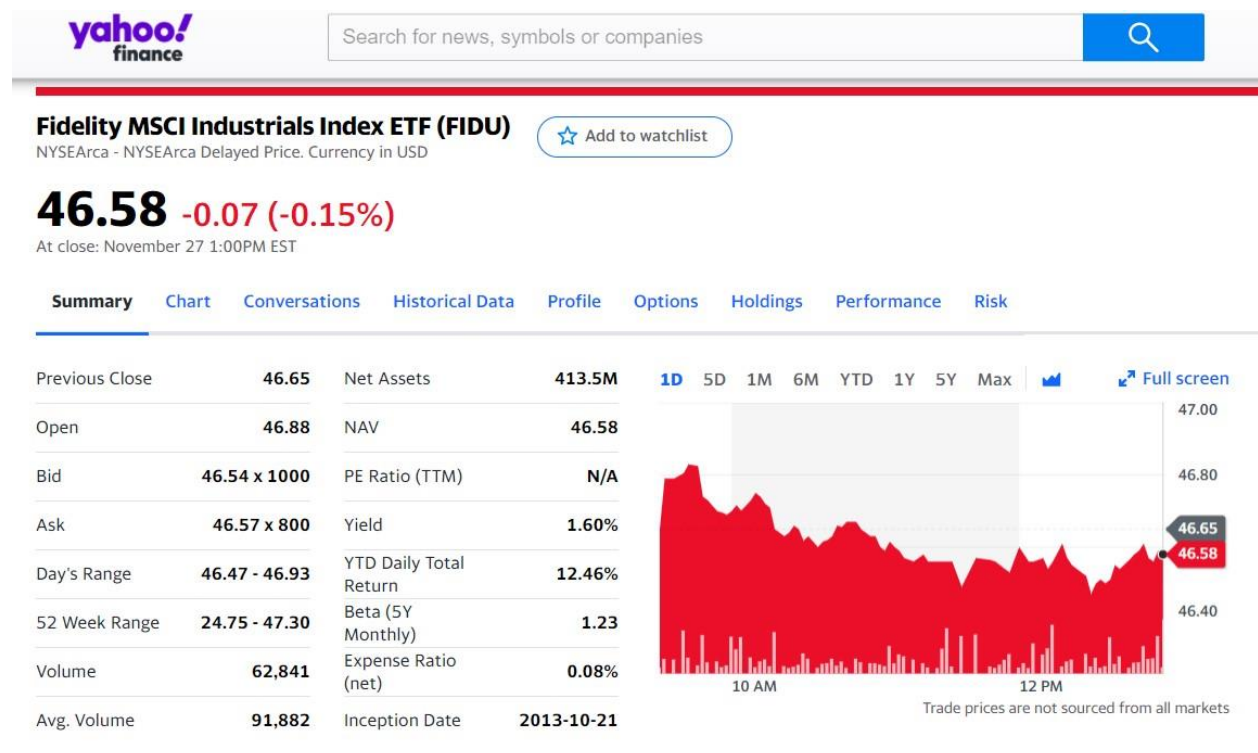
Consumer Discretionary- Consumer Discretionary Select Sector SPDR Fund (XLY)-

Consumer Discretionary- Consumer Discretionary Select Sector SPDR Fund (XLY) is one of the largest in the industry with Net Assets of 15.41 Billion. The expense ratio is low (0.13%) and the bid-ask spread for the ETF is very less so that you can buy and sell the stocks with not much difference in the amounts which doesn't take away a portion of your revenue.
Link- https://etfdb.com/etf/XLY/#etf-ticker-profile
Yahoo Finance - https://finance.yahoo.com/quote/XLE?p=XLE&.tsrc=fin-srch
Companies Included- Amazon.com Inc. (AMZN), Home Depot, Inc. (HD), McDonald's Corp (MCD), Nike, Inc.- Ordinary Shares- Class B (NKE), Starbucks Corp. (SBUX).
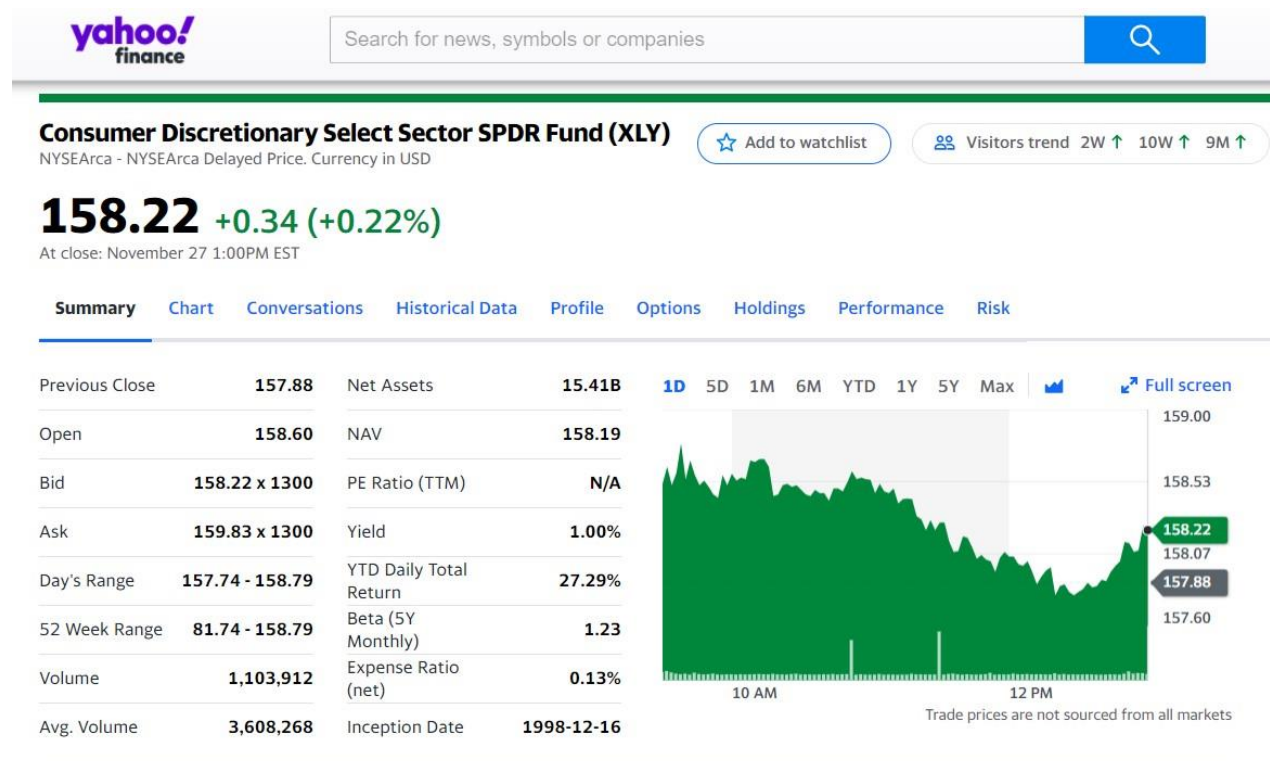
Consumer Staples- Consumer Staples Select Sector SPDR Fund (XLP)-

Consumer Staples Select Sector SPDR Fund tracks the S&P Consumer Staples Select Sector Index which comprises of the Consumer Staples stocks in the S&P 500. It is one of the largest ETF in the category with Net Assets of about USD 13.26 Billion. It also has a low expense ratio of 0.13% so you pay only $1.3 annually for a $1000 investment. It also has a yield of 2.63%.

Link- https://www.optimizedportfolio.com/best-consumer-staples-etfs/
Yahoo Finance- https://finance.yahoo.com/quote/XLP?p=XLP&.tsrc=fin-srch
Companies included- Proctor & Gamble Co. (PG), Walmart Inc. (WMT), Coca-Cola Co (KO), Pepsico Inc. (PEP), Costco Wholesale Corp (COST).
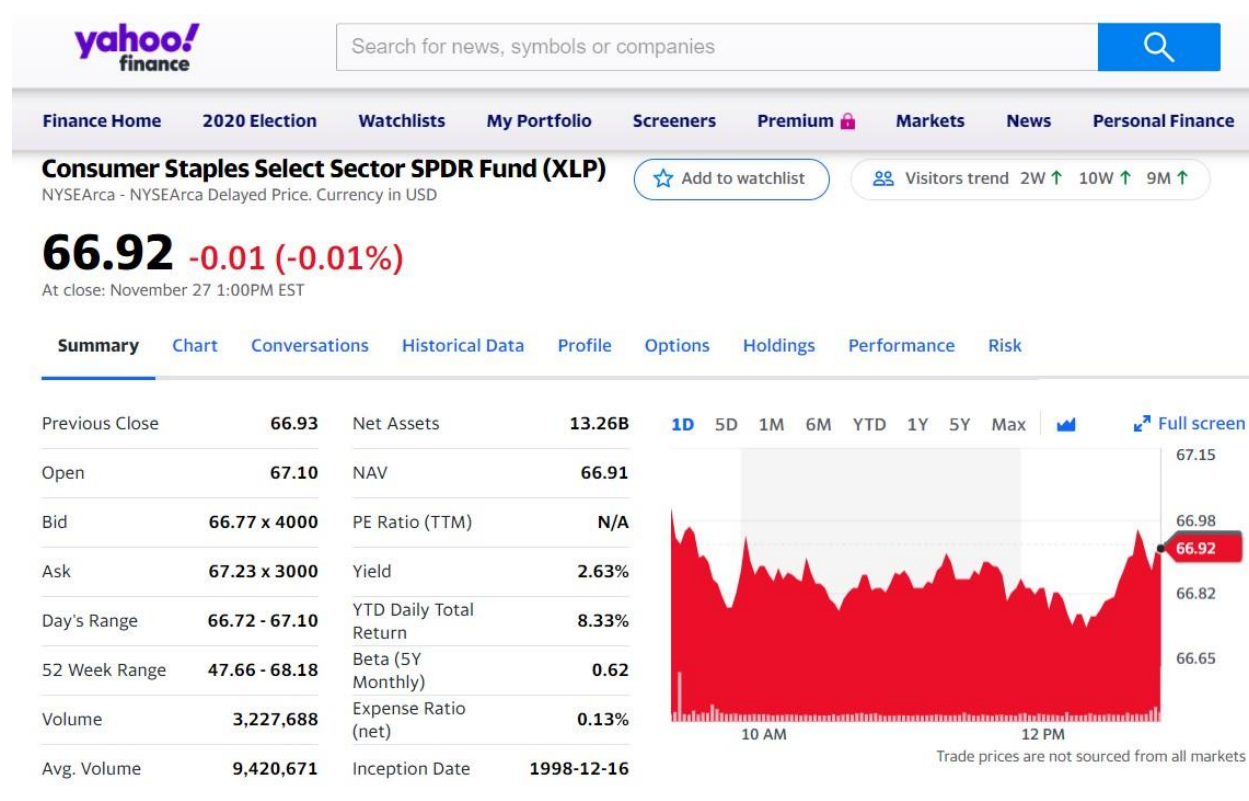
Health care- Health Care Select Sector SPDR Fund (XLV)-

Health Care Select Sector SPDR Fund has the highest volume as compared to other ETFs in the category which ensures liquidity in the stock. It has an expense ratio of 0.13% and a net asset value of 22.44 Billion which is pretty huge. The bid-ask spread of the investment is very low which is a good factor to choose an ETF.

Link- https://www.fool.com/investing/2019/10/26/5-top-healthcare-etfs.aspx
Yahoo Finance - https://finance.yahoo.com/quote/XLV/
Companies included- Pfizer (PFE), Johnson and Johnson (J&J), Unitedhealth group (UNH), Merck & Co Inc (MRK), Abbott Laboratories (ABT).
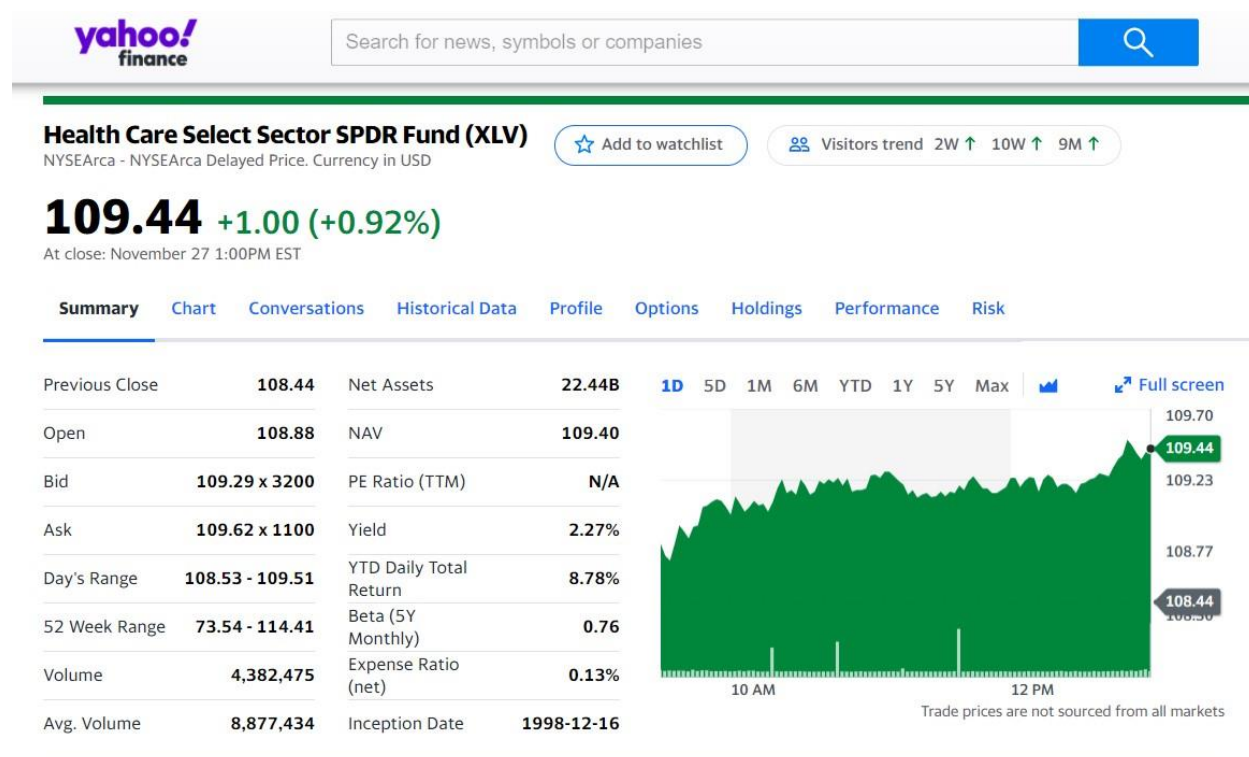
Financials- SPDR® S&P Bank ETF (KBE) -

SPDR® S&P Bank ETF (KBE) has an average volume of 3 Million which ensures liquidity of the stock. It has an expense ratio of 0.35 % but the yield of 3.18 % covers it. The net asset value is 1.56 Billion. The bid-ask spread is a bit high for this ETF. It tracks the index of banks in the S&P 500.

Link- https://money.usnews.com/funds/etfs/financial/spdr-s-p-bank-etf/kbe
Yahoo Finance - https://finance.yahoo.com/quote/KBE?p=KBE&.tsrc=fin-srch
Companies included- CIT Group Inc (CIT), SVB Financial Group (SIVB), Regions Financial Corp. (RF), Equitable Holdings Inc (EQH).
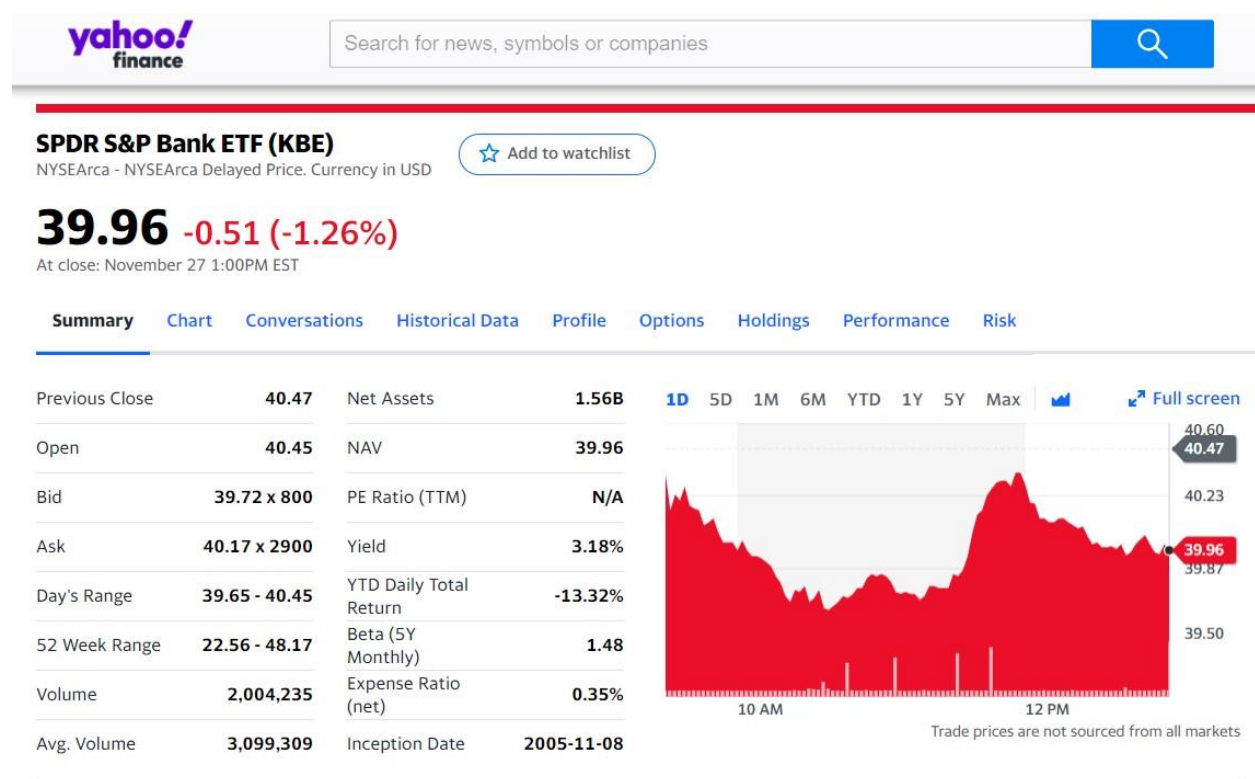
IT- Technology Select Sector SPDR Fund (XLK)-

Technology Select Sector SPDR Fund (XLK) is traded at a low price as compared to other ETFs in the category, also the bid-ask spread is very low. It has a good performance over the years. The net Asset value is 32.68 Billion and the expense ratio is 0.13 %. It has a huge average volume of 11 Million. It trades some well-known tech companies which have shown a good growth in the past years.

Expense Ratio- 0.13% Net Asset- 32.68 Billion (low bid-ask) (also low price and better returns)
Link- https://etfdb.com/etfdb-category/technology-equities/
Yahoo Finance - https://finance.yahoo.com/quote/XLK/
Companies Included- Microsoft Corporation (MSFT), Apple Inc (AAPL), Visa Inc- Ordinary Shares – Class A (V), NVIDIA Corp (NVDA), Mastercard Incorporated- Ordinary Shares- lass A (MA).
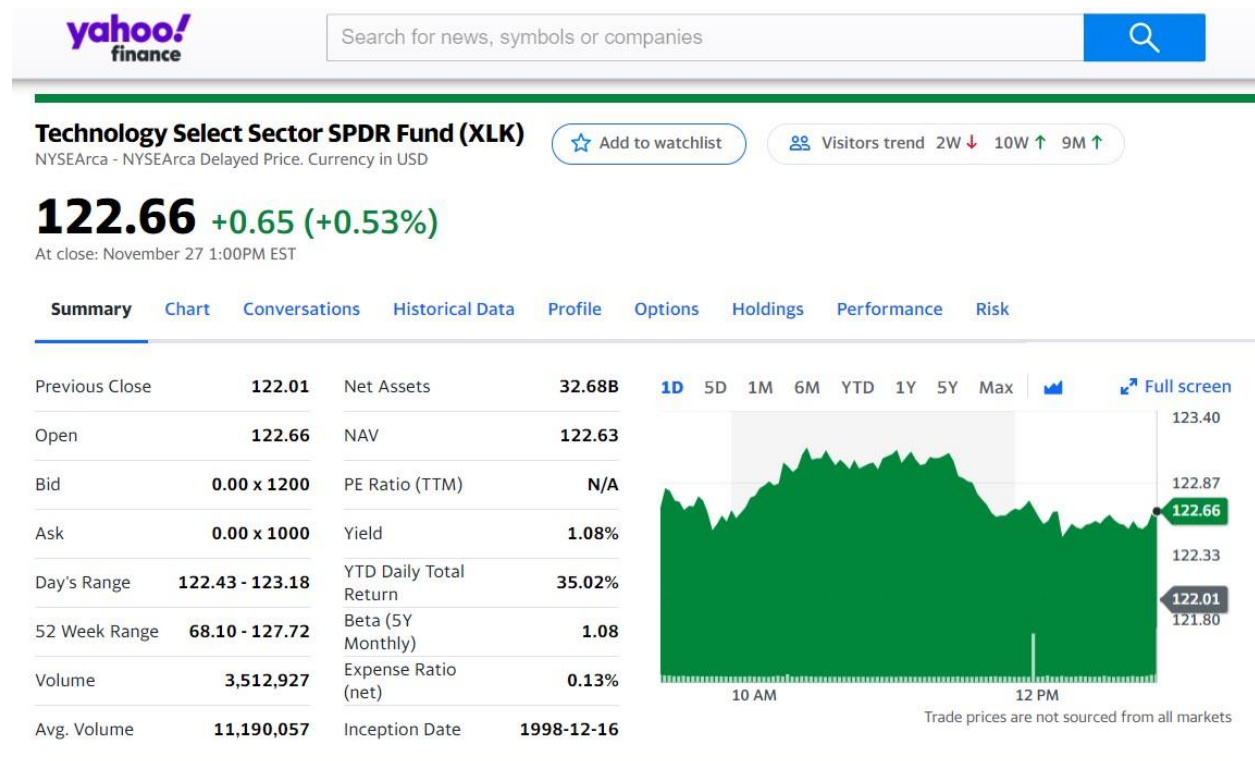
**Telecommunications- Fidelity® MSCI Communication Services ETF (FCOM)-**

Fidelity® MSCI Communication Services ETF (FCOM) has given a return of 10.79 % as compared to the industry return of 6.91 %. It has Net Assets of 544.67 Million with majority stakes in industry leaders like Facebook, Alphabet and Verizon. The expense ratio is as low as 0.08 % giving a less expense on the money invested. Though there is less average volume of 85,269 but due to the composition of market leaders in the ETF, we can be sure that the ETF won't close in the near future.

Link-
https://etfdb.com/etfs/sector/telecom/#etfs__returns&sort_name=join_table:industry&sort_order=desc&page=1
Yahoo Finance - https://finance.yahoo.com/quote/ARKW?p=ARKW
Companies Included- Facebook Inc - Ordinary Shares - Class A (FB), Verizon Communications Inc. (VZ), Alphabet Inc- Ordinary Shares- Class C (GOOG).
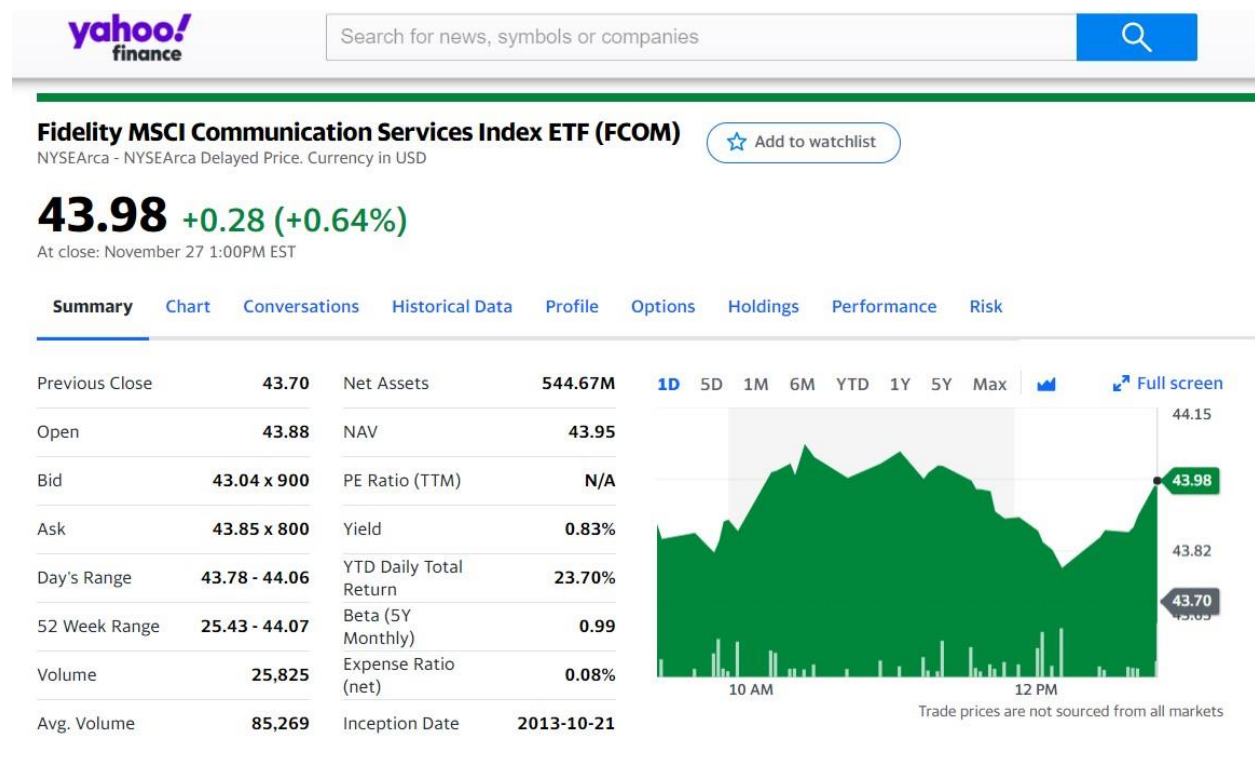
Utilities- Fidelity MSCI Utilities Index ETF (FUTY)-

Fidelity MSCI Utilities Index ETF (FUTY) tracks the MSCI US IMI utilities index which comprises of 70 US utilities stocks. The expense ratio is 0.8 % and it has net asset value of 1.09 Billion. The bid-ask spread is lower than other ETFS in the same category. The yield is 3.20 % and 3-years return is 6.84 %. The average volume is 2,48,492 which is fair to ensure liquidity in the ETF stock.
Link- https://www.thebalance.com/best-utilities-etfs-4175444
Yahoo Finance - https://finance.yahoo.com/quote/FUTY?p=FUTY
Companies included- NextEra Energy Inc (NEE), Dominion Energy Inc (D), Duke Energy Corp. (DUK), Southern Company (SO).
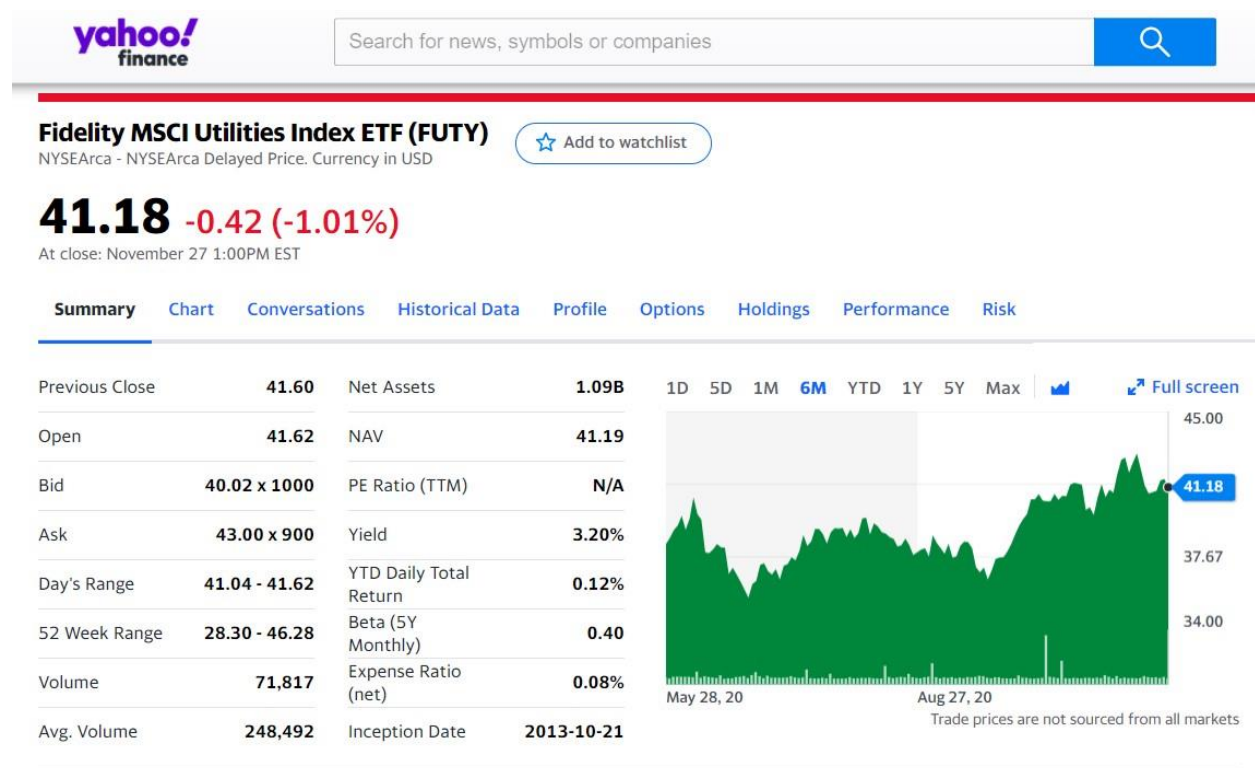
Real Estate- iShares U.S. Real Estate ETF (IYR)

iShares U.S. Real Estate ETF (IYR) follows the Dow Jones U.S. Real Estate Index, with fewer than 100 holdings diversified in the large and mid-cap size companies. The expense ratio is 0.42 % but thee yield being 3.22% covers it. The performance of the stock for the past 3 years in negative but it is better than the other ETFs in the category. The net asset value is 4.03 Billion which is huge. The average volume being 6 Million ensures liquidity. The bid-ask spread is small which is better for us.

Link-   https://etfdb.com/etfdb-category/real-estate/#etfs__overview&sort_name=assets_under_management&sort_order=desc&page=1

Yahoo Finance - https://finance.yahoo.com/quote/IYR?p=IYR

Companies included- American Tower Corp. (AMT), Prologis Inc (PLD), Crown Castle International Corp (CCI), Equinox Inc (EQIX).
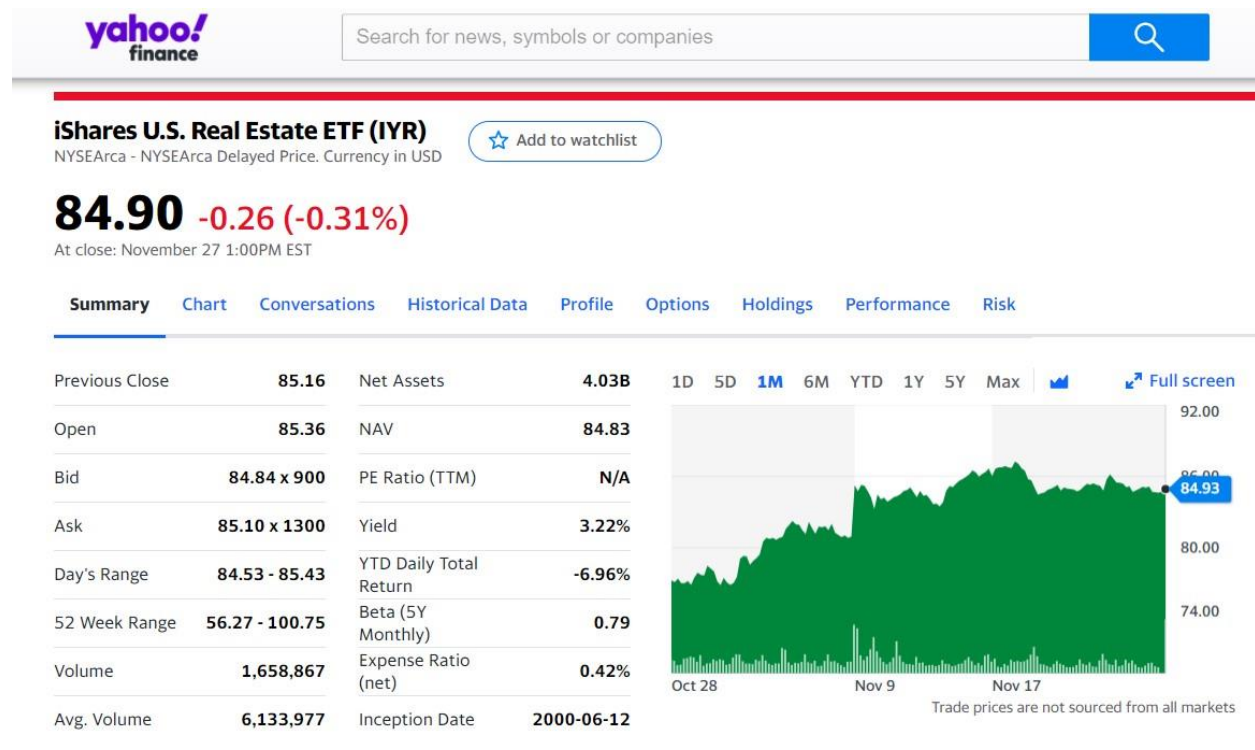
BOND ETF

Bond ETF- iShares Core U.S. Aggregate Bond ETF (AGG)

iShares Core U.S. Aggregate Bond ETF (AGG) tracks an index of US investment-grade bons which include US Treasuries, agencies, CBMS, ABS and investment-grade corporates. The expense ratio on bonds are low and for AGG it is 0.04 %. The net asset value is 81.57 Billion and the average volume in 5 Million. The yield is 2.30 % and the 3-year return is 4.94 % as compared to industry return of 3.78 %.

Link- https://www.etf.com/channels/bond-etfs

Yahoo Finance - https://finance.yahoo.com/quote/AGG?p=AGG&.tsrc=fin-srch

Holdings- BlackRock Cash Funds Intl SL Agency (BISXX), Federal National Mortgage Association 2%, Federal National Mortgage Association 2.5 %, Fnma Pass- Thru I 3%.
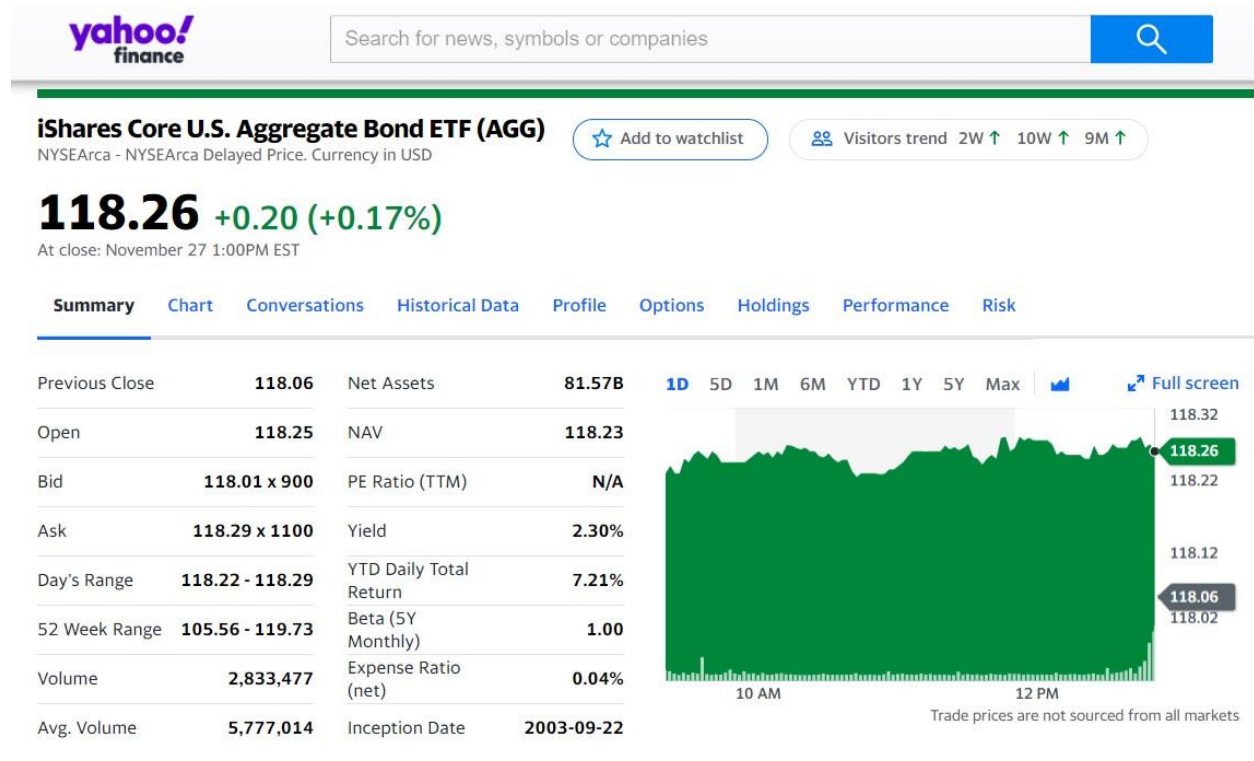
Portfolio Optimization using Python

Portfolio with random weights for ETF stocks (which sum to 80%) and a fixed 20% for ETF bond

Procedure followed-

1. Getting data for the past four years. Here's a screenshot of the data of the whole portfolio for last five trading days.

```
                   VDE         GDX        FIDU         XLY         XLP  \
2020-11-20   48.430000   35.900002   45.520000  153.690002   66.500000
2020-11-23   51.900002   34.360001   46.290001  155.380005   66.519997
2020-11-24   54.529999   33.419998   47.080002  157.690002   66.970001
2020-11-25   53.349998   34.040001   46.650002  157.880005   66.930000
2020-11-27   52.740002   34.230000   46.580002  158.220001   66.919998


                   XLV         KBE         XLK        FCOM        FUTY  \
2020-11-20  108.800003   38.490002  120.110001   42.790001   40.930000
2020-11-23  108.519997   39.169998  120.080002   42.959999   41.000000
2020-11-24  108.839996   41.070000  121.750000   43.700001   41.529999
2020-11-25  108.440002   40.470001  122.010002   43.700001   41.599998
2020-11-27  109.440002   39.959999  122.660004   43.980000   41.180000


                   IYR         AGG
2020-11-20   84.919998  118.290001
2020-11-23   84.849998  118.260002
2020-11-24   85.089996  118.099998
2020-11-25   85.160004  118.059998
2020-11-27   84.900002  118.260002
```

2. Covariance matrix of all the ETFs in the portfolio. Here is the covariance matrix which shows the covariance between the stocks in the portfolio.

```
covariance matrix for the etf"s

              VDE        GDX       FIDU       XLY        XLP        XLV        KBE  \
VDE      0.117798   0.016437   0.064712   0.050310   0.030494   0.039646   0.089590
GDX      0.016437   0.144437   0.008663   0.010735   0.008856   0.007215  -0.000556
FIDU     0.064712   0.008663   0.056073   0.043677   0.028717   0.035718   0.066517
XLY      0.050310   0.010735   0.043677   0.045212   0.025656   0.032248   0.050246
XLP      0.030494   0.008856   0.028717   0.025656   0.029149   0.025318   0.031227
XLV      0.039646   0.007215   0.035718   0.032248   0.025318   0.037366   0.038801
KBE      0.089590  -0.000556   0.066517   0.050246   0.031227   0.038801   0.113553
XLK      0.053000   0.010292   0.047951   0.048379   0.030443   0.040234   0.050569
FCOM     0.045898   0.009802   0.038058   0.037720   0.025520   0.030145   0.044582
FUTY     0.036028   0.015111   0.032419   0.026870   0.029103   0.027681   0.037400
IYR      0.050975   0.012926   0.042744   0.037099   0.029683   0.031820   0.052532
AGG      0.001412   0.007998   0.000497   0.000986   0.000520  -0.000050  -0.001009

              XLK       FCOM       FUTY       IYR        AGG
VDE      0.053000   0.045898   0.036028   0.050975   0.001412
GDX      0.010292   0.009802   0.015111   0.012926   0.007998
FIDU     0.047951   0.038058   0.032419   0.042744   0.000497
XLY      0.048379   0.037720   0.026870   0.037099   0.000986
XLP      0.030443   0.025520   0.029103   0.029683   0.000520
XLV      0.040234   0.030145   0.027681   0.031820  -0.000050
KBE      0.050569   0.044582   0.037400   0.052532  -0.001009
XLK      0.065515   0.043791   0.030875   0.039636   0.000376
FCOM     0.043791   0.047099   0.026886   0.034250   0.000917
FUTY     0.030875   0.026886   0.048083   0.041557   0.001093
IYR      0.039636   0.034250   0.041557   0.055439   0.002175
AGG      0.000376   0.000917   0.001093   0.002175   0.002416
```

2. An Example of random weights selected. Here weights mean the weightage that we will give to each stock in the portfolio. We will get many combinations of such weights and see which gives the most returns with the least volatility. [best Sharpe ratio]

[0.028344186674857715, 0.19154491608765073, 0.024016704204858158, 0.010443655497337929, 0.038234556992968745, 0.057741692575180935, 0.1814652914838528, -0.019816745476114395, 0.14518175041220063, 0.12129090751421061, 0.0215530840329963, 0.2]

3. We get the volatility and the annual returns by taking random weights and plotting them. Here's a plot of volatility and annual returns with volatility on x axis and the returns on y axis for 5000 random observations as weights.
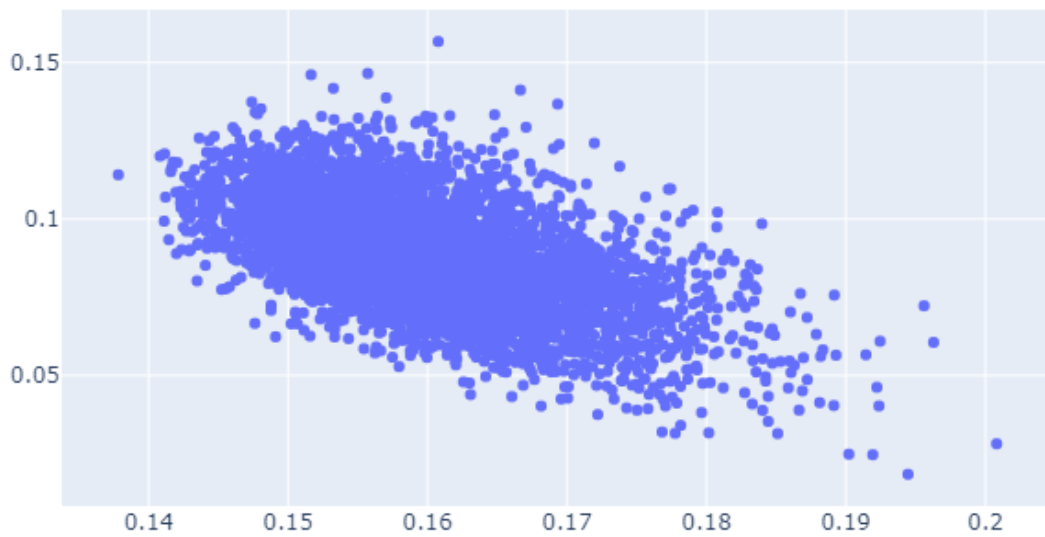
4. We iterate to get many random weights to get a combination and choose the one which gives the best Sharpe Ratio. Here's the screenshot of the best Sharpe ratio and the points of volatility and returns. (Our efficient frontier)
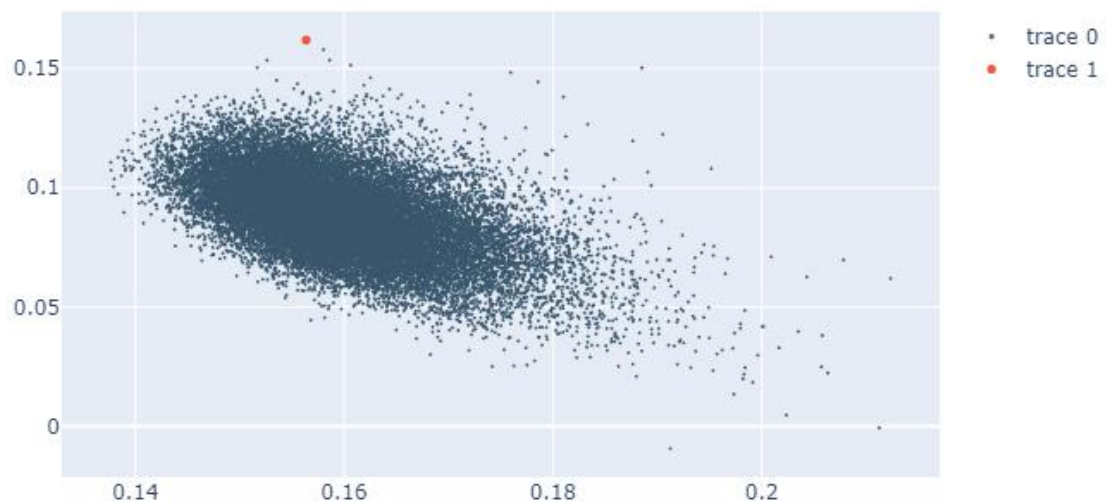
Trace-1 is the optimal point where we get the highest Sharpe ratio of 0.715611 where the return is 0.161895 and the volatility is 0.156363.

```
Best Sharpe Ratio-
          rtn      sharpe      vol \
16909  0.161895  0.715611  0.156363
24587  0.157870  0.682632  0.158021
16566  0.153393  0.677495  0.152611
7372   0.150360  0.661679  0.151674
12683  0.153471  0.652412  0.158598
16604  0.151341  0.630893  0.160631
24785  0.144999  0.618752  0.153534
14940  0.138071  0.608778  0.144668
7827   0.138499  0.607024  0.145791
1487   0.143599  0.601801  0.155532
8229   0.140925  0.599461  0.151678
12498  0.136229  0.598824  0.143997
5949   0.136316  0.593970  0.145321
2815   0.137786  0.593806  0.147837
18653  0.138147  0.593162  0.148605
13295  0.146075  0.591152  0.162522
48     0.141525  0.589800  0.155179
4885   0.136693  0.588715  0.147257
20380  0.133137  0.585463  0.142002
21294  0.138343  0.581488  0.151926

                                                   wgt
16909  [-0.025323702149298927, 0.09909118575444681, 0...
24587  [-0.023355740162487565, 0.06940523244918119, 0...
16566  [-0.01240380316345994, 0.01826260605731255, 0....
7372   [-0.019296176962941374, 0.19143949073981253, -...
12683  [-0.019688278854262907, 0.12288151911401997, 0...
16604  [-0.01937670980526343, -0.019190575272385865, ...
24785  [-0.017490187456930695, 0.047656146171472215, ...
14940  [-0.029863454144957145, 0.11309417314994011, -...
7827   [-0.011889324688174191, 0.15550876311583076, -...
1487   [-0.019535136582386377, 0.01971583841745443, 0...
8229   [-0.0038756607290390613, 0.05195902614635696, ...
12498  [-0.0108120129000060168, 0.15613121579027373, -...
5949   [-0.01842280051755861, 0.1417353446749068, 0.1...
2815   [-0.011332798433085543, 0.13967701543846467, 0...
18653  [0.00214220724254040432, 0.077054273266471, -0.0...
13295  [-0.017078129466592384, 0.05959180410374079, 0...
48     [-0.022160191553050403, 0.03254117409290863, 0...
4885   [-0.019549953046188857, 0.1740156429116512, 0....
20380  [-0.01915906174799013, 0.14118595288684588, -0...
21294  [-0.018923473684513855, 0.12770399687502626, 0...
```

5. This is the screenshot of the data frame which is sorted according to the best Sharpe ratio. So, the optimized portfolio weights are-

[-.0253237021, 0.0990911858, 0.0224070610, 0.294464385, 0.0000160243426, 0.0465962444, -0.0296651080, 0.193310904, 0.190379172, 0.0402256729, -0.0315018397, 0.200000000]

Optimized Portfolio Solution

We would propose to invest the 100 Million in the following way in the ETF stocks and the ETF bond that we have chosen-

Industry/sectors (ticker)	Percentage (%)	Amount (USD)
Energy (VDE)	-2.53 %	$ (2,530,000.00)
Materials (GDX)	9.90 %	$ 9,900,000.00
Industrials (FIDU)	2.24 %	$ 2,240,000.00
Consumer Discretionary (XLY)	29.45 %	$ 29,400,000.00
Consumer Staples (XLP)	0.0016 %	$ 1,600.00
Health Care (XLV)	4.66 %	$ 4,660,000.00
Financials (KBE)	-2.97 %	$ (2,970,000.00)
Information Technology (XLK)	19.33 %	$ 19,330,000.00
Telecommunication Services (FCOM)	19.04 %	$ 19,040,000.00
Utilities (FUTY)	4.02 %	$ 4,020,000.00
Real Estate (IYR)	-3.15 %	$ (3,150,000.00)
ETF Bond (AGG)	20.00 %	$ 20,000,000.00
	Total	$ 100 Million (approx.)

With this portfolio the expected annual returns are 16.19 % and the volatility or risk is 15.63 %. Our portfolio has 8.65 % in short position.

Revised Portfolio

We now know that the Information Technology sector will outperform the market by 20 %. Here's the revised portfolio that we offer considering this information.

Industry/sectors (ticker)	Percentage (%)	Amount (USD)
Energy (VDE)	-2.91 %	$ (291,700,000.00)
Materials (GDX)	9.51 %	$ 951,300,000.00
Industrials (FIDU)	1.85 %	$ 185,300,000.00
Consumer Discretionary (XLY)	29.06 %	$ 2,906,300,000.00
Consumer Staples (XLP)	-0.38 %	$ (38,540,000.00)
Health Care (XLV)	4.27 %	$ 427,300,000.00
Financials (KBE)	-3.35 %	$ (335,700,000.00)
Information Technology (XLK)	23.19 %	$ 2,319,600,000.00
Telecommunication Services (FCOM)	18.65 %	$ 1,865,300,000.00
Utilities (FUTY)	3.63 %	$ 363,300,000.00
Real Estate (IYR)	-3.53 %	$ (353,700,000.00)
ETF Bond (AGG)	20.00 %	$2,000,000,000.00
	Total	100 Million (approx.)

For this we invest more amount in the Information Technology ETF and reduce the investment for the other sectors. So that the revised portfolio gives better returns than the old one.