Analysis of the findings:

1) Our first question was to find how the stock market performed over a 10 year period. We chose a static time frame for the market from 2012-1-01 to 2022-01-01 so the data would be standardized. After quite a lot of searching for reliable data sources we found a great source of data using a combination of Yfinance and Pandas Datareader which allowed us to ultimately source the data from Yahoo which has a good reputation for providing solid historical stock data.

Chart, line chart

Description automatically generated

We were able to grab our first piece of information from extracting the ETFs representing the base stock performance of the market in the US through 3 most popular ETFs representing the SP&500, QQQ which is the NASDAQ and VTI which is the TOTAL Stock Market index. The prices but the information wasn’t standardized so we came up with the method of finding the Rate of Return for the stocks so they would then be able to be compared to one another.

This resulted in this chart:

Chart, line chart

Description automatically generated

This made us realize that standardization of data helps uncover items which were initially not seen. In this case both the SPY – S&P500 and VTI Total Stock Index both covered almost identical, yet not fully so areas of the market. So we decided to use SPY going forward as our benchmark as the QQQ was the Nasdaq and very Tech heavy.

2) Add in the individual industries and visually see how all of them did.

We then added in the remainder of the ETFs representing the indexes of the market. In total we have: 'SPY - S&P500 ETF', 'QQQ - NASDAQ-100 Index', 'VTI - Vanguard Total Stock Market Index Fund', 'XLK - Technology Select Sector SPDR Fund', 'XLY - Consumer Cyclical/Consumer Discretionary', 'XLP - Consumer Defensive/Consumer Staples', 'XLV - Healthcare', 'XLI - Industrials', 'XLF - Financials', 'VNQ - Real Estate', 'XLE - Energy', 'XLU - Utilities'

This helped us generate this chart which graphically showed us the performance of all of the indexes against one another over 10 years. Chart, histogram

Description automatically generated But we still needed to find the mathematical proof of which industry did best. So it led us to our next question relating to performance that we could visually and definitively prove was higher than the rest.

3) Which industries did the best historically.

After creating a Rate of Return Calculation for all of our Stock Indexes we created a Data Frame which gave us an easy to read grid of returns for all ETF tickers that represent the respective industries

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **10 Year Yearly Rate of Return** | **5 Year Yearly Rate of Return** | **3 Year Yearly Rate of Return** | **1 Year Yearly Rate of Return** |
| SPY | 27.251764 | 22.496309 | 31.496114 | 28.788736 |
| QQQ | 59.920913 | 47.159013 | 55.183996 | 28.625007 |
| VTI | 27.024997 | 21.873049 | 31.169354 | 25.835205 |
| XLK | 57.365362 | 51.906531 | 65.081789 | 35.942137 |
| XLY | 41.954259 | 30.230958 | 36.489073 | 28.239873 |
| XLP | 13.755392 | 9.824019 | 17.878729 | 15.572541 |
| XLV | 30.093911 | 20.873221 | 22.930393 | 24.736612 |
| XLI | 20.678455 | 14.01157 | 22.855927 | 22.451097 |
| XLF | 26.034896 | 13.591397 | 22.103918 | 34.28473 |
| VNQ | 9.834159 | 8.113414 | 19.307561 | 41.182919 |
| XLE | -2.1886 | -5.262878 | -1.381693 | 46.206537 |
| XLU | 10.254669 | 9.474985 | 12.551283 | 17.113879 |

This allowed to graphically represent the data in Bar Charts:

Chart, bar chart

Description automatically generated Chart, bar chart

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The QQQ did the best out of all the indexes over 10 years. The XLK did best for the 5 year period. The XLK did best over the 3 year period. And then lastly XLE did the best over the 1 year period. The big takeaway is that High Technology firms as a part of this index would have made you the most money over the 10 years, meanwhile even though XLE had 1 good year at the end you would have lost money over a 10 year time frame.

4) In this question we wanted to see the top 10 Industries by Market Cap, here the results:

Previously, we looked at the volume traded over the past 10 years on all ETF indexes, to see which had the most trade volume.

Chart, pie chart

Description automatically generated

Since market cap was not part of the data pulled from Yahoo, we chose to use a secondary set of data for market cap. The following pie chart shows the breakdown by industry at the end of 2021. As you can see, the tech industries in the S&P are clearly outperforming every sector by a large margin. Something we originally assumed was that this may be something that also translates into the dividend yield of the actual stocks in the market, but we soon realized that was not the case. As you can see in the bar chart below, the mean dividend yield by sector is visualized. By doing this simple analysis, we can see that it is the Telecommunication Services sector that actually paid the biggest dividend out of the 500 companies in S&P 500.

Chart, pie chart

Description automatically generated

Chart, bar chart

Description automatically generated

5) question five was a bonus idea trying to find if these indexes have a correlation to one another, if we were to pursue this question, we will have to research the methodology to do so.

Bonus Project Takeaways:

- A huge component of this project was finding Data to answer our questions. If we would have picked poor Data we would have been spent a lot of time fixing it instead of working on trying to look for meaningful takeaways from it. We took the time to search through the internet through various sources and materials and we discarded a lot of sources just because of how incomplete or fragmented their data was.

- There was a lot of trial and error with making parts of the code to work, and not only work but work correctly. Just because your code works, doesn’t mean it provides correct output. One area where we had a learning moment was when we found a Rate of Return formula initially based on Daily Change but it provided a slightly off calculation output which compounded over a 10 year period and added up to significant deviation from reality. That code has to be scrapped and a new method for calculating the Rate of Return had to be checked and cross referenced to other websites and even manually calculated using a calculator just to make sure the results were accurate.

- Communication is Key. Without it a project greatly suffers and when instructions are not followed setbacks occur. One learning moment example of this was GitHub errors.

- Making the presentation look attractive was not something fully taught and a lot of self research was need.

- Same goes with finding Data sources. A lot of self research and trial and error had to occur.