

The University of Tulsa

Investment Analysis Portfolio Project Report

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I. Summary

Our group selected Tesla (TSLA), Exxon Mobil (XOM), Boeing (BA), Apple (AAPL), and Chipotle (CMG) for our five-stock portfolio. Stock selections were made based on their perceived likelihood for higher than market average returns while mitigating exposure to risk and to achieve multi-sector diversification. Though our portfolio contains only five stocks, it represents the automobile industry, the petrochemical refining industry, aerospace, the technology sector, and restaurant business while also holding linkages with to other sectors and commodities such as the growing renewable energy sector and the price of oil thereby ensuring that our portfolio is thoroughly diversified despite the low number of stocks contained within.

In creating our analysis and requisite asset allocations for a variety of portfolio distributions we used publicly available price data from Yahoo finance detailing the last decade of performance for each stock as well as the St. Louis Federal Reserve's Three-Month Treasury Bill Data to determine our average risk-free rate for our ensuing calculations. The risk-free rate data and stock performance data was monthly from December 1, 2010 to January 1, 2021.

Turning to our analysis that we used the aforementioned stock price data from Yahoo Finance and the St. Louis Federal Reserve data to create, we first found each stock's monthly and annualized expected returns and standard deviation from the price data to determine each stock's Sharpe ratio over the ten year period. We then calculated each stock's worst and best monthly return as well as the skewness and kurtosis of each stock's monthly return distribution. We also determined all of the stock's probabilities of a negative return and the five and ten percent variance. Finally, we rounded out our statistics section of our analysis by determining the correlation matrix, or the extent to which the performance of each stock correlated with one

another, before graphing the average expected return of each relative to the volatility (standard deviation) it experienced.

Lastly, turning to the final section of our analysis, optimization, we utilized the data we initially sourced along with the calculations we made in the statistics section of the portfolio project to determine a variety of suggested portfolio distribution for the five stocks. To do so, we used the Solver function within excel to create a short and non-short Minimum Variance portfolio, a short and non-short Tangency portfolio, an Equally Weighted non-short portfolio, a Same risk as the Lowest Stock Standard Deviation portfolio, and a Two Stocks No More Than 20% portfolio. Based on the resulting portfolio variances, standard deviations, expected returns, and Sharpe ratios we then created our Policy portfolio or our portfolio that we believe best maximizes returns while mitigating risk and ensuring a well-diversified portfolio. After determining the various portfolio options, we then created an efficient frontier that plotted out the expected return of our portfolios as the standard deviation, or the volatility of the portfolio increased.

At the conclusion of our analysis, we found that the portfolio that best maximized the Sharpe ratio, or offered the greatest “bang for the investor’s buck” relative to the riskiness of the portfolio without shorting, an activity which can be potentially unappealing to prospective investors, was the Tangency non-short portfolio. This portfolio had a monthly average return of 2.96%, an annualized average return of 35.57%, a monthly and annualized standard deviation of 7.45% and 25.81% respectively, and a Sharpe ratio of 0.40. This portfolio had an asset allocation of 21.762% in Tesla (TSLA), 0.000% in Exxon Mobil (XOM), 13.082% in Boeing (BA),

49.662% in Apple (AAPL), and 15.494% in Chipotle (CMG) (Table 4 Portfolio Choices and Table 6 Performance and Risk Statistics).

Despite the strong and compelling performance of the non-short Tangency portfolio, we decided to ultimately select a slightly differently allocated portfolio as our Policy portfolio. For our Policy portfolio we decided on allocations of 26.237% for Tesla (TSLA), 7.5% for Exxon Mobil (XOM), 14.340% for Boeing (BA), 43.105% for Apple (AAPL), and 8.818% Chipotle (CMG) (Table 4 Portfolio Choices). Based on these allocations our Policy portfolio had a slightly higher monthly average return of 3.04%, an annualized average return of 36.52%, a monthly and annualized standard deviation of 7.63% and 26.44% respectively, and an identical Sharpe ratio of 0.40 (Table 6 Performance and Risk Statistics).

The main reason we decided not to adopt the Tangency portfolio as our desired portfolio is the Tangency portfolio's lack of asset allocation to Exxon Mobil and its overallocation in Apple, a very strong company but one that does not warrant nearly half of the portfolio being allocated to the stock. In the interest of diversification and firm-specific risk management, we desired to have exposure to the refinery business through Exxon Mobil, as was our intention initially when selecting the stock, and less exposure to Apple. Furthermore, we believe the paltry performance of Exxon Mobil over the ten-year period, (Exxon Mobil had an expected monthly return of 0.04% over the ten year period) (Table 1 Risk and Return Statistics (Jan. 2011-Jan. 2021) was primarily influenced by the Covid-19 pandemic and the massive depreciation in stock price Exxon Mobil along with other upstream and downstream companies experienced. Consequently, the Tangency portfolio, though mathematically correct, is deemphasizing the attractiveness of Exxon Mobil due to an outlier bad performance year. By utilizing our Policy

portfolio, the investor receives a nearly identical 0.4 Sharpe ratio and relatively equivalent annualized returns and standard deviations (36.52% and 26.44% for the Policy profit and 35.57% and 25.81% for the Tangency portfolio), while having a greater level of diversification by having exposure to the refinery business and not being overly exposed to the technology sector. Moreover, as the Covid-19 pandemic continues to be brought under control, Exxon Mobil, along with the rest of the oil industry, will continue to rebound, offering potentially above-market alpha returns that are not available to investors who invest in the Tangency portfolio.

II. Risk and Return Analysis

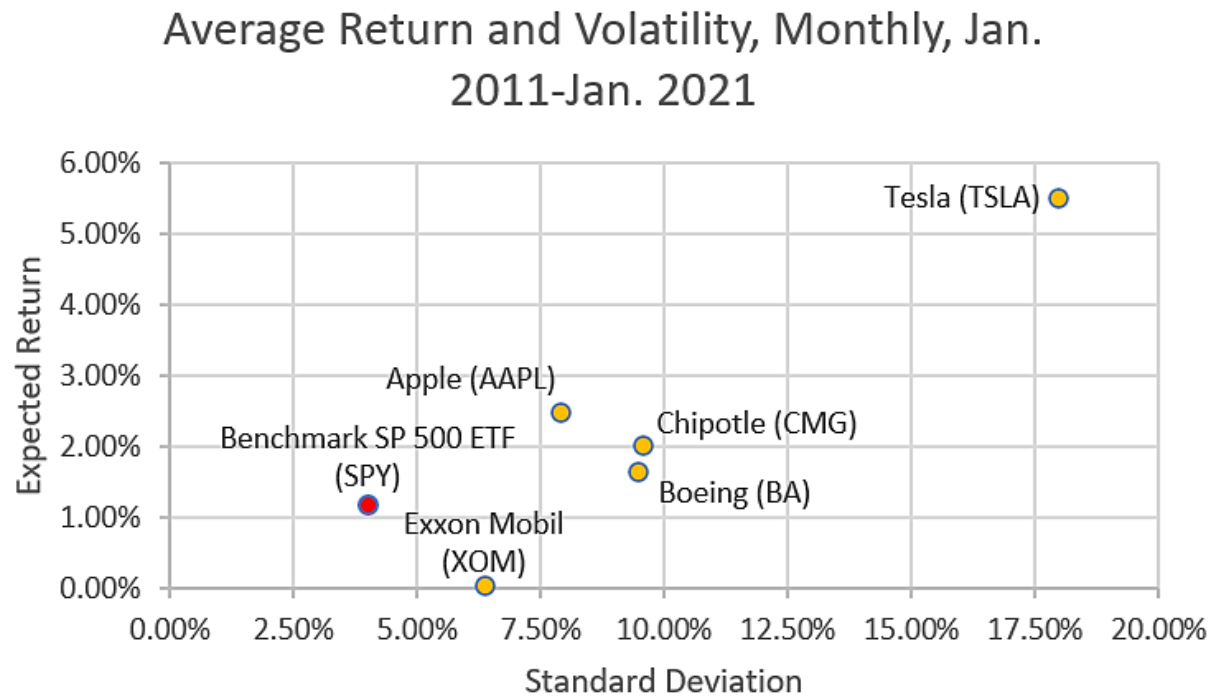
In our five-stock portfolio the stocks from lowest to highest risk were Exxon Mobil (XOM), Apple (AAPL), Boeing (BA), Chipotle (CMG), and Tesla (TSLA). The stocks had a monthly standard deviation of 6.35%, 7.90%, 9.47%, 9.57% and a massive 17.97% in the case of Tesla (Table 1. Risk and Return Statistics (Jan. 2011-Jan. 2021). Relative to the Benchmark SP 500 ETF (SPY) monthly standard deviation of 4.00% (Table 1. Risk and Return Statistics), our selected stocks universally had higher standard deviations than the market average indicating that our portfolio as a whole was positioned for aggressive growth.

Turning to the returns of the five stocks within our portfolio, Tesla (TSLA) had the greatest monthly expected return at 5.52%, followed by Apple (AAPL) at 2.49%, Chipotle (CMG) at 2.02%, Boeing (BA) at 1.65% and finally Exxon Mobil at a paltry 0.04% (Table 1. Risk and Return Statistics). Exxon Mobil's expected return data was disproportionately affected by the outlier bad performance year it and the rest of the refinery industry experienced in 2020. Relative to the benchmark monthly expected return of 1.16% our stocks, with the exception of Exxon Mobil (XOM), had higher expected returns coinciding with their higher than market

average standard deviations and requisite riskiness. The stocks that offered the most attractive tradeoff, offering higher expected returns relative to lower standard deviations, are indicated by a high Sharpe ratio. The stocks in our portfolio in order of increasing Sharpe ratio were Exxon Mobil (XOM) at 0.0061, Boeing (BA) at 0.1738, Chipotle (CMG) at 0.2109, Tesla (TSLA) at 0.3069, and finally Apple (AAPL) had the highest Sharpe Ratio at 0.3151 (Table 1. Risk and Return Statistics). Consequently, relative to their riskiness (standard deviations), Apple (AAPL) followed by Tesla (TSLA) offered the most attractive risk-to-reward tradeoff of our five stocks and were the only two stocks within our portfolio that offered a higher Sharpe ratio than the market average Sharpe ratio of 0.2896 (Table 1. Risk and Return Statistics).

Table 1. Risk and Return Statistics (Jan. 2011-Jan. 2021)

1. Risk and Return Statistics							
	Tesla (TSLA)	Exxon Mobil (XOM)	Boeing (BA)	Apple (AAPL)	Chipotle (CMG)	Benchmark SP 500 ETF (SPY)	
Monthly Expected Return	5.52%	0.04%	1.65%	2.49%	2.02%	1.16%	
Monthly Standard Deviation	17.97%	6.35%	9.47%	7.90%	9.57%	4.00%	
Annualized Expected Return	66.19%	0.46%	19.74%	29.87%	24.21%	13.92%	
Annualized standard deviation	62.27%	22.01%	32.79%	27.36%	33.14%	13.87%	
Sharpe Ratio	0.3069	0.0061	0.1738	0.3151	0.2109	0.2896	

Figure 1. Average Monthly Return and Volatility (Jan. 2011-Jan. 2021)

Due to Apple (AAPL) and Tesla (TSLA) having higher Sharpe ratios than the market average this means that these stocks lied furthest to the Northwest upper-left corner of the Average Monthly Return and Volatility Graph where stocks have high expected returns and lower standard deviations or risk (Figure 1 Average Monthly Return and Volatility (Jan. 2011-Jan. 2021)).

III. Portfolio Choices

With our investment strategy we set out to achieve robust diversification through multiple different industry sectors whilst also achieving a rate of return higher than market average returns. This was to be done whilst only selecting five different stocks from the S&P 500. Our group selected Tesla (TSLA), Exxon Mobil (XOM), Boeing (BA), Apple (AAPL), and Chipotle (CMG) for our five-stock portfolio. While our portfolio contains only five stocks, it represents

multiple sectors such as the automotive industry and petrochemical refining, aerospace, technology, and the restaurant business, as well as holding links with other sectors and commodities such as the growing renewable energy sector and the price of oil. These stocks were weighted within our portfolio as follows: 43% Allocated, to our largest holding, Apple (AAPL), 26% to Tesla (TSLA), 14% to Boeing (BA), 9% to Chipotle (CMG) and 8% to Exxon Mobil (XOM) (Table 4 Portfolio Choices). In terms of risk tolerance of the client we decided to take a high level of risk. The reason for this decision was made was with such a limited number of holdings, it is already very difficult to achieve significant levels of return and exceed average market returns without also taking on higher levels of risk, particularly from firm-specific risk which cannot be diversified away in such a small portfolio.

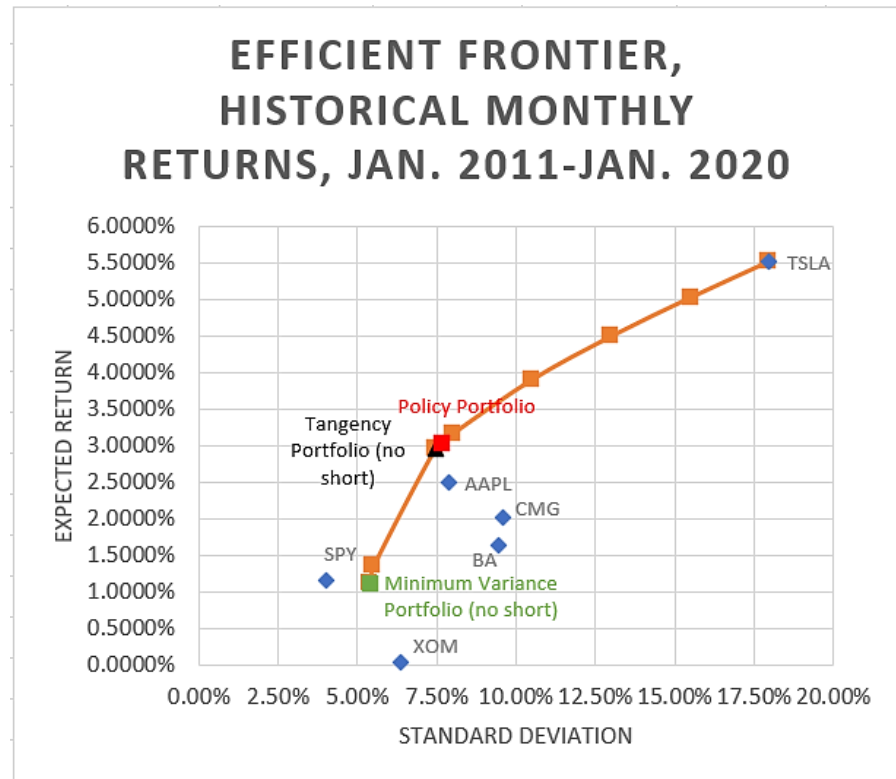
With regards to our primary goal, we set out to achieve the highest possible growth and the highest Sharpe ratio whilst retaining the lowest standard deviation possible. In terms of standard deviation, we knew that it would be very unlikely to keep it below the market average due to the limited number of holdings we have and their higher-than-average risk. Hence, we focused on attaining the best Sharpe ratio possible which would indicate that even if our standard deviation was above the market average, relative to the higher than market average returns we were pursuing, our portfolio had the best risk-to-reward ratio. Despite having such a limited number of holdings, we wanted to benefit as much as possible from diversification, hence the reason for us selecting multiple industries allowing us to receive returns from multiple sectors within the market. The purpose of our investment strategy is to fund the purchase of a beachfront property within the near future explaining our aggressive approach relating to risk as we are prioritizing higher returns during a short-term time horizon, (approximately a three-year period)

in order to fund this purchase. In terms of potential constraints our client requires quick liquidity at the end of his time horizon to divest from the portfolio to pay for the new property.

Furthermore, our client also has an aforementioned short predetermined time horizon lasting about three years. Finally, our client will be expecting a substantial tax event on both his returns when divesting from the positions in the account as well as a second tax event when the purchase of the beachfront property occurs further explaining why a high level of return is desired to secure the capital to afford these costs.

Table 4. Portfolio Choices

Portfolio Choices - Results									
	<i>Policy</i>	<i>Policy with unrounded weights</i>	<i>Equally-weighted (no short)</i>	<i>Min. Variance (no short)</i>	<i>Min. Variance (short)</i>	<i>Tangency (no short)</i>	<i>Tangency (short)</i>	<i>Same Risk as Lowest Stock SD (no short)</i>	<i>Two stocks no more than 20%</i>
<i>Weights</i>									
Tesla (TSLA)	26%	26.237%	20.000%	0.000%	-0.598%	21.762%	30.751%	9.419%	20.000%
Exxon Mobil (XOM)	8%	7.500%	20.000%	50.567%	50.500%	0.000%	-92.783%	4.741%	0.000%
Boeing (BA)	14%	14.340%	20.000%	7.479%	7.641%	13.082%	47.346%	20.332%	27.553%
Apple (AAPL)	43%	43.105%	20.000%	27.647%	27.954%	49.662%	81.920%	45.167%	20.000%
Chipotle (CMG)	9%	8.818%	20.000%	14.307%	14.504%	15.494%	32.766%	20.341%	32.447%
<i>Statistics</i>									
Portfolio Variance	0.005824	0.005824	0.004513	0.002902	0.002901	0.005552	0.014045	0.004038	0.005281
Portfolio Std. Deviation	0.076313	0.076313	0.067179	0.053872	0.053863	0.074512	0.118514	0.063545	0.072667
Expected Return	0.029370	0.029370	0.023414	0.011194	0.011007	0.029644	0.051398	0.023906	0.027091
Sharpe Ratio	0.378421	0.378421	0.341216	0.198670	0.195222	0.391256	0.459542	0.368482	0.366048

Figure 2. Efficient Frontier for the Portfolio of Five Stocks

When comparing our Policy portfolio with the Target portfolio (Tangency portfolio), the expected return and standard deviation of both are extremely similar. The Policy portfolio has a higher monthly average return of 3.04% compared to a 2.96% return of the Target portfolio (Table 6. Performance and Risk Statistics). In addition, our Policy portfolio has a higher monthly standard deviation of 7.63% compared to the Target Portfolio's 7.45% (Table 6. Performance and Risk Statistics). Both portfolios have the same Sharpe ratio of 0.40 meaning that The Policy portfolio receives a relatively equivalent "bang for its buck" compared to that of the Target portfolio (Table 6. Performance and Risk Statistics). With the Policy portfolio being more diversified due to holdings in Exxon Mobil (XOM) compared to the Target Portfolio having a lack of weighting in Exxon Mobil (XOM) the Policy Portfolio to be exposed to the

potential rebound upside of Exxon Mobil (XOM) without increasing the overall risk due to the equal Sharpe Ratios.

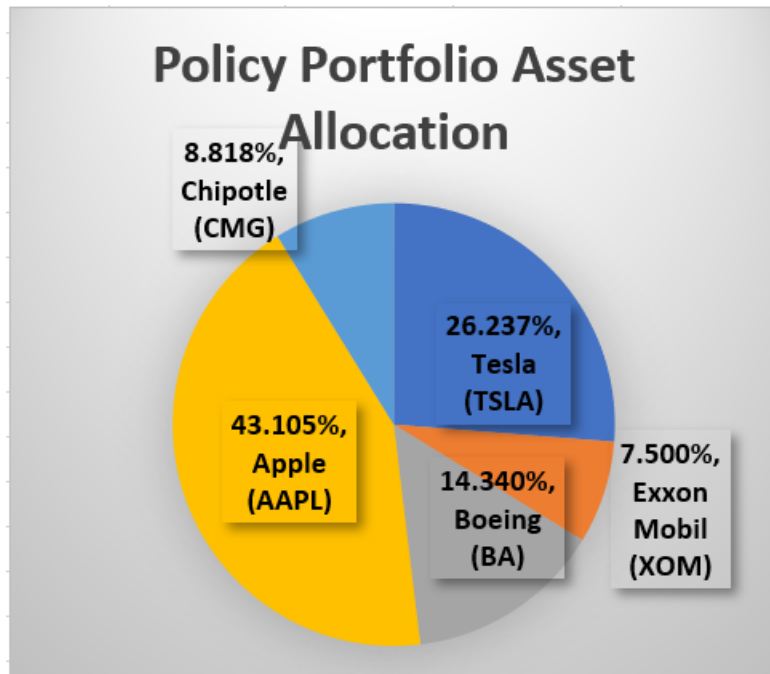
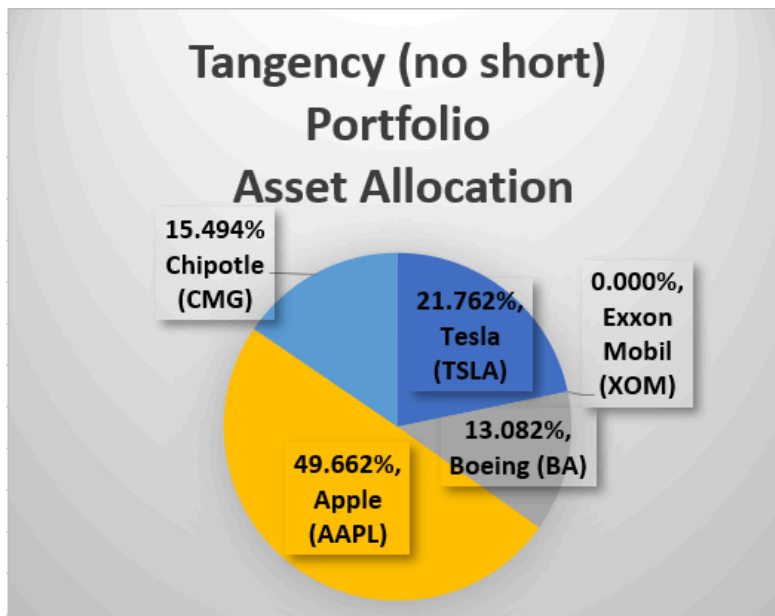
For the Tangency portfolio (with shorting) the stock that has been shorted is Exxon Mobil and the reason for this is because in 2020 Exxon Mobil (XOM) drastically underperformed due to the Covid-19 pandemic therefore biasing the ten year Exxon Mobil (XOM) data. There is definitely an advantage to investing in portfolios that are not 100% invested in individual stocks as it allows for much less risk and a lower portfolio standard deviation compared to our portfolio however investing solely in individual stocks also offers a much less expected monthly return. The same is true for equally weighted portfolios which offer lower standard deviations and less risk at the price of lower expected returns. If we are to look at the Benchmark SP 500 ETF (SPY) compared to our Policy portfolio it has a much lower standard deviation of 4.00% compared to our 7.63% however, the Benchmark SP 500 ETF (SPY) only has an expected monthly rate of return of 1.16% compared to our 3.04% (Table 6. Performance and Risk Statistics). To conclude, to achieve our clients' investments goals of high returns in a short period of time we selected our Policy portfolio out of the portfolios represented (Table 4. Portfolio Choices) as it is the portfolio most likely to achieve the highest returns without taking exceedingly higher levels of risk while offering satisfactory diversification.

Table 6. Performance and Risk Statistics

Performance & Risks					
	Policy Portfolio	Target Portfolio (Tangency)	Benchmark SP 500 ETF (SPY)	+/- Performance (Target vs Benchmark)	+/- Performance (Target vs Policy)
Monthly Average Return	3.04%	2.96%	1.16%	1.80%	-0.08%
Annualized Average Return	36.52%	35.57%	13.92%	21.65%	-0.94%
Monthly Standard Deviation	7.63%	7.45%	4.00%	3.45%	-0.18%
Annualized St. deviation	26.44%	25.81%	13.87%	11.94%	-0.62%
Sharpe Ratio	0.40	0.40	0.29	0.11	0.00

IV. Recommended Allocation

As mentioned in the Summary section, we selected our Policy portfolio with the goal of maximizing the portfolio's expected return while mitigating its standard deviation thereby offering us the best possible Sharpe ratio. We did not elect to utilize the Tangency Portfolio due to its overweighting of Apple (AAPL) and complete lack of allocation to Exxon Mobil (XOM) in part due to the portfolio being biased towards Exxon Mobil's bad performance outlier year in 2020 (Figure 3 Policy Portfolio Asset Allocation and Figure 4 Tangency Portfolio Asset Allocation).

Figure 3. Policy Portfolio Asset Allocation**Figure 4. Tangency Portfolio Asset Allocation**

Our Policy portfolio had an annualized average return of 36.52% compared to the Tangency Portfolio's 35.57% and an annualized standard deviation of 26.44% compared to the Tangency Portfolio's 25.81% corresponding in a 0.40 Sharpe ratio for our Policy portfolio,

equivalent to the Sharpe ratio offered by the Tangency portfolio. (Table 6. Performance and Risk Statistics). In essence, our Policy portfolio offers the same Sharpe ratio as the Tangency portfolio, with slightly higher expected returns and standard deviations while offering a greater level of diversification and less overweight allocations in the portfolio. When compared against the Benchmark SP 500 ETF (SPY) data, we found that the market returned an annualized average return of 13.92% while entailing an annualized standard deviation of 13.87% leading to a lower Sharpe ratio of 0.29 (Table 5. Performance and Risk Statistics). Hence, the Tangency portfolio and our Policy portfolio offer a greater expected portfolio return relative to standard deviation.

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Table 2. Distributional Statistics (Jan. 2011-Jan. 2021)

2. Distributional Statistics						
	Tesla (TSLA)	Exxon Mobil (XOM)	Boeing (BA)	Apple (AAPL)	Chipotle (CMG)	Benchmark SP 500 ETF (SPY)
Worst monthly return	22.43 %	-25.13%	-45.47%	-18.40%	-23.06%	-13.00%
Best monthly return	81.07 %	22.39%	45.93%	21.44%	34.25%	13.36%
Skewness	1.46	-0.31	-0.05	-0.13	0.31	-0.28
Kurtosis	3.508	2.723	8.068	-0.205	1.147	1.725
Probability of negative return	38%	50%	43%	38%	42%	39%
5% Var	24.05 %	-10.41%	-13.92%	-10.50%	-13.72%	-5.43%
10% Var	17.52 %	-8.11%	-10.48%	-7.63%	-10.24%	-3.97%

Table 3. Correlation Matrix (Jan. 2011-Jan. 2021)

3. Correlation Matrix						
	Tesla (TSLA)	Exxon Mobil (XOM)	Boeing (BA)	Apple (AAPL)	Chipotle (CMG)	Benchmark SP 500 ETF (SPY)
Tesla (TSLA)	1.0000	0.1591	0.2119	0.3121	0.2657	0.3762
Exxon Mobil (XOM)	0.1591	1.0000	0.5085	0.2827	0.2752	0.7013
Boeing (BA)	0.2119	0.5085	1.0000	0.2311	0.1604	0.5730
Apple (AAPL)	0.3121	0.2827	0.2311	1.0000	0.3054	0.5674
Chipotle (CMG)	0.2657	0.2752	0.1604	0.3054	1.0000	0.4272
Benchmark SP 500 ETF (SPY)	0.3762	0.7013	0.5730	0.5674	0.4272	1.0000

Table 5. Efficient Frontier

Efficient Frontier						
Target SD	5.50%	8.00%	10.50%	13.00%	15.50%	17.97%
Weights						
Tesla (TSLA)	5.780%	26.901%	46.889%	66.326%	83.733%	99.970%
Exxon Mobil (XOM)	47.203%	0.000%	0.000%	0.000%	0.000%	0.000%
Boeing (BA)	9.501%	9.161%	0.000%	0.000%	0.000%	0.000%
Apple (AAPL)	23.328%	50.925%	51.953%	33.674%	16.267%	0.030%
Chipotle (CMG)	14.188%	13.014%	1.158%	0.000%	5.409%	0.000%
Statistics						
Portfolio Variance	0.003025	0.006400	0.011025	0.016900	0.024025	0.032292
Portfolio Std. Deviation	0.055000	0.080000	0.105000	0.130000	0.155000	0.179700
Expected Return	0.013603	0.031648	0.039030	0.044968	0.050237	0.055151
Sharpe Ratio	0.238396	0.389456	0.367033	0.342126	0.320938	0.304172

Data Set 1. Prices (Jan. 2011-Jan. 2021)

Prices, 2011-2021, 120 months

	Tesla (TSLA)	Exxon Mobil (XOM)	Boeing (BA)	Apple (AAPL)	Chipotle (CMG)	Benchmark SP 500 ETF (SPY)
Date						
12/1/2010	5.33	49.49	52.12	9.92	212.66	102.51
1/1/2011	4.82	54.61	55.49	10.44	218.92	105.46
2/1/2011	4.78	57.90	57.52	10.87	245.00	109.12
3/1/2011	5.55	57.25	59.39	10.72	272.37	108.66
4/1/2011	5.52	59.87	64.09	10.77	266.79	112.29
5/1/2011	6.03	56.80	62.69	10.70	289.07	111.03
6/1/2011	5.83	55.69	59.71	10.33	308.19	108.62
7/1/2011	5.63	54.60	56.91	12.01	324.58	106.98
8/1/2011	4.95	50.65	54.00	11.84	313.37	101.09
9/1/2011	4.88	50.03	49.20	11.73	302.95	93.59
10/1/2011	5.87	53.79	53.49	12.45	336.12	104.35
11/1/2011	6.55	55.41	55.85	11.76	321.56	103.92
12/1/2011	5.71	58.73	60.02	12.46	337.74	104.35
1/1/2012	5.81	58.03	60.70	14.04	367.29	109.88
2/1/2012	6.68	59.94	61.33	16.69	390.22	114.65
3/1/2012	7.45	60.43	61.21	18.44	418.00	117.82
4/1/2012	6.63	60.16	63.21	17.96	414.15	117.54
5/1/2012	5.90	54.78	57.29	17.77	413.07	110.48
6/1/2012	6.26	60.03	61.51	17.97	379.95	114.37
7/1/2012	5.48	60.93	61.19	18.79	292.33	116.33
8/1/2012	5.70	61.24	59.11	20.46	288.64	119.24
9/1/2012	5.86	64.57	57.97	20.61	317.54	121.62
10/1/2012	5.63	64.38	58.67	18.39	254.53	120.04
11/1/2012	6.76	62.24	61.87	18.08	263.78	120.72
12/1/2012	6.77	61.50	63.15	16.52	297.46	120.94
1/1/2013	7.50	63.93	61.90	14.14	307.01	128.03
2/1/2013	6.97	63.63	64.44	13.70	316.79	129.67
3/1/2013	7.58	64.43	72.40	13.82	325.87	133.99
4/1/2013	10.80	63.63	77.09	13.82	363.19	137.18
5/1/2013	19.55	64.69	83.51	14.04	361.00	140.41
6/1/2013	21.47	65.05	86.84	12.46	364.35	137.81
7/1/2013	26.86	67.50	89.09	14.22	412.27	145.70
8/1/2013	33.80	62.76	88.09	15.31	408.17	141.33
9/1/2013	38.67	62.38	100.06	15.08	428.80	145.10
10/1/2013	31.99	64.97	111.13	16.53	526.97	152.55

11/1/2013	25.46	67.77	114.32	17.59	523.86	157.08
12/1/2013	30.09	73.87	116.65	17.85	532.78	160.28
1/1/2014	36.28	67.27	107.06	15.93	551.96	155.47
2/1/2014	48.96	70.27	110.18	16.74	565.21	162.54
3/1/2014	41.69	71.80	107.86	17.18	568.05	163.17
4/1/2014	41.58	75.28	110.89	18.89	498.50	165.03
5/1/2014	41.55	73.90	116.25	20.26	547.09	168.86
6/1/2014	48.01	74.51	109.97	20.94	592.51	171.53
7/1/2014	44.66	73.22	104.13	21.54	672.50	170.03
8/1/2014	53.94	73.61	109.60	23.09	678.65	176.74
9/1/2014	48.54	70.09	110.76	22.81	666.59	173.49
10/1/2014	48.34	72.07	108.62	24.45	638.00	178.41
11/1/2014	48.90	67.47	116.83	26.93	663.62	183.31
12/1/2014	44.48	69.39	113.68	25.10	684.51	181.84
1/1/2015	40.72	65.62	127.14	26.64	709.84	177.43
2/1/2015	40.67	66.46	131.94	29.21	664.97	187.40
3/1/2015	37.75	64.28	132.08	28.41	650.54	183.64
4/1/2015	45.21	66.07	126.14	28.57	621.34	186.27
5/1/2015	50.16	64.43	123.66	29.74	615.52	188.66
6/1/2015	53.65	63.44	122.86	28.75	604.99	183.94
7/1/2015	53.23	60.40	127.69	27.81	742.23	189.01
8/1/2015	49.81	57.37	115.74	25.85	710.01	177.49
9/1/2015	49.68	57.22	116.72	25.40	720.25	172.06
10/1/2015	41.39	63.68	131.98	27.52	640.23	187.67
11/1/2015	46.05	62.85	129.64	27.24	579.55	188.36
12/1/2015	48.00	60.52	129.67	24.34	479.85	184.01
1/1/2016	38.24	60.44	107.74	22.51	452.97	175.89
2/1/2016	38.39	62.23	105.99	22.36	509.16	175.74
3/1/2016	45.95	65.49	114.90	25.34	470.97	186.60
4/1/2016	48.15	69.25	122.01	21.80	420.97	188.30
5/1/2016	44.65	69.74	114.18	23.22	441.96	191.50
6/1/2016	42.46	74.05	118.51	22.36	402.76	191.18
7/1/2016	46.96	70.27	121.97	24.38	423.99	199.18
8/1/2016	42.40	68.84	118.13	24.82	413.73	199.42
9/1/2016	40.81	69.54	121.21	26.59	423.50	198.43
10/1/2016	39.55	66.38	131.05	26.71	360.76	195.97
11/1/2016	37.88	69.55	138.53	26.00	396.33	203.19
12/1/2016	42.74	72.55	144.34	27.38	377.32	206.09
1/1/2017	50.39	67.43	151.51	28.69	421.44	211.02
2/1/2017	50.00	65.36	167.10	32.39	418.74	219.31
3/1/2017	55.66	66.52	165.39	34.11	445.52	218.63
4/1/2017	62.81	66.23	172.84	34.11	474.47	221.76
5/1/2017	68.20	65.30	175.46	36.27	477.35	224.89
6/1/2017	72.32	66.10	186.34	34.34	416.10	225.23
7/1/2017	64.69	65.54	228.46	35.46	343.77	230.98

8/1/2017	71.18	62.50	225.83	39.10	316.71	231.65
9/1/2017	68.22	67.78	240.96	36.89	307.83	235.15
10/1/2017	66.31	68.91	244.54	40.46	271.90	241.89
11/1/2017	61.77	68.86	262.38	41.13	304.39	249.28
12/1/2017	62.27	69.79	281.05	40.65	289.03	251.02
1/1/2018	70.86	72.84	337.71	40.22	324.76	266.53
2/1/2018	68.61	63.20	345.18	42.79	318.41	256.84
3/1/2018	53.23	62.89	314.01	40.47	323.11	248.80
4/1/2018	58.78	65.54	319.45	39.86	423.33	251.09
5/1/2018	56.95	68.48	337.26	45.07	430.18	257.19
6/1/2018	68.59	70.44	322.92	44.82	431.37	257.51
7/1/2018	59.63	69.40	342.93	46.07	433.66	268.25
8/1/2018	60.33	68.26	329.93	55.12	475.18	276.81
9/1/2018	52.95	73.14	359.71	54.85	454.52	277.21
10/1/2018	67.46	68.54	343.23	53.18	460.33	259.22
11/1/2018	70.10	68.39	335.40	43.39	473.21	264.03
12/1/2018	66.56	59.25	313.37	38.46	431.79	239.38
1/1/2019	61.40	63.68	374.71	40.58	529.61	260.06
2/1/2019	63.98	68.67	427.51	42.22	607.53	268.49
3/1/2019	55.97	70.99	372.49	46.51	710.31	272.15
4/1/2019	47.74	70.53	368.84	49.14	688.04	284.51
5/1/2019	37.03	62.18	333.61	42.87	659.97	266.37
6/1/2019	44.69	68.10	357.53	48.65	732.88	283.53
7/1/2019	48.32	66.08	335.10	52.37	795.53	289.21
8/1/2019	45.12	60.86	357.61	51.31	838.42	284.37
9/1/2019	48.17	63.53	376.03	55.26	840.47	288.57
10/1/2019	62.98	60.79	335.94	61.38	778.16	296.31
11/1/2019	65.99	61.30	361.90	65.94	813.92	307.04
12/1/2019	83.67	63.54	323.83	72.68	837.11	314.41
1/1/2020	130.11	56.57	316.39	76.60	866.76	315.83
2/1/2020	133.60	46.84	273.48	67.65	773.58	290.83
3/1/2020	104.80	35.07	149.14	63.08	654.40	253.02
4/1/2020	156.38	42.92	141.02	72.89	878.55	286.83
5/1/2020	167.00	42.00	145.85	78.87	1003.9	
					1	300.50
					1052.3	
6/1/2020	215.96	42.11	183.30	90.74	6	304.49
					1155.1	
7/1/2020	286.15	39.62	158.00	105.73	6	323.84
					1310.2	
8/1/2020	498.32	37.61	171.82	128.39	8	346.44
					1243.7	
9/1/2020	429.01	32.96	165.26	115.44	1	332.14
					1201.4	
10/1/2020	388.04	31.32	144.39	108.51	8	325.15

					1289.4	
11/1/2020	567.60	36.61	210.71	118.67	3	360.52
					1386.7	
12/1/2020	705.67	40.53	214.06	132.49	1	372.29

Data Set 2. Stock Returns (Jan. 2011-Jan. 2021)**Returns**

Tesla (TSLA)	Exxon Mobil (XOM)	Boeing (BA)	Apple (AAPL)	Chipotle (CMG)	Benchmark SP 500 ETF (SPY)	Risk-free rate*	3 Month Treasury Bill Data from St. Louis FED
-0.095	0.103	0.065	0.052	0.029	0.029	0.00013	0.15
-0.009	0.060	0.036	0.041	0.119	0.035	0.00011	0.13
0.162	-0.011	0.033	-0.013	0.112	-0.004	0.00008	0.10
-0.005	0.046	0.079	0.005	-0.020	0.033	0.00005	0.06
0.092	-0.051	-0.022	-0.007	0.084	-0.011	0.00003	0.04
-0.034	-0.020	-0.048	-0.035	0.066	-0.022	0.00003	0.04
-0.033	-0.020	-0.047	0.163	0.053	-0.015	0.00003	0.04
-0.122	-0.072	-0.051	-0.014	-0.035	-0.055	0.00002	0.02
-0.014	-0.012	-0.089	-0.009	-0.033	-0.074	0.00001	0.01
0.204	0.075	0.087	0.062	0.109	0.115	0.00002	0.02
0.115	0.030	0.044	-0.056	-0.043	-0.004	0.00001	0.01
-0.128	0.060	0.075	0.060	0.050	0.004	0.00001	0.01
0.018	-0.012	0.011	0.127	0.087	0.053	0.00003	0.03
0.149	0.033	0.010	0.188	0.062	0.043	0.00008	0.09
0.115	0.008	-0.002	0.105	0.071	0.028	0.00007	0.08
-0.110	-0.004	0.033	-0.026	-0.009	-0.002	0.00007	0.08
-0.110	-0.089	-0.094	-0.011	-0.003	-0.060	0.00008	0.09
0.061	0.096	0.074	0.011	-0.080	0.035	0.00008	0.09
-0.124	0.015	-0.005	0.046	-0.231	0.017	0.00008	0.10
0.040	0.005	-0.034	0.089	-0.013	0.025	0.00008	0.10
0.027	0.054	-0.019	0.007	0.100	0.020	0.00009	0.11
-0.039	-0.003	0.012	-0.108	-0.198	-0.013	0.00008	0.10
0.202	-0.033	0.055	-0.017	0.036	0.006	0.00008	0.09
0.001	-0.012	0.021	-0.087	0.128	0.002	0.00006	0.07
0.107	0.040	-0.020	-0.144	0.032	0.059	0.00006	0.07
-0.071	-0.005	0.041	-0.031	0.032	0.013	0.00008	0.10
0.088	0.013	0.124	0.009	0.029	0.033	0.00008	0.09
0.425	-0.012	0.065	0.000	0.115	0.024	0.00005	0.06

0.811	0.017	0.083	0.016	-0.006	0.024	0.00003	0.04
0.098	0.006	0.040	-0.112	0.009	-0.019	0.00004	0.05
0.251	0.038	0.026	0.141	0.132	0.057	0.00003	0.04
0.259	-0.070	-0.011	0.077	-0.010	-0.030	0.00003	0.04
0.144	-0.006	0.136	-0.015	0.051	0.027	0.00002	0.02
-0.173	0.042	0.111	0.096	0.229	0.051	0.00004	0.05
-0.204	0.043	0.029	0.064	-0.006	0.030	0.00006	0.07
0.182	0.090	0.020	0.015	0.017	0.020	0.00006	0.07
0.206	-0.089	-0.082	-0.108	0.036	-0.030	0.00003	0.04
0.349	0.045	0.029	0.051	0.024	0.046	0.00004	0.05
-0.149	0.022	-0.021	0.026	0.005	0.004	0.00004	0.05
-0.003	0.048	0.028	0.099	-0.122	0.011	0.00003	0.03
-0.001	-0.018	0.048	0.073	0.097	0.023	0.00003	0.03
0.155	0.008	-0.054	0.033	0.083	0.016	0.00003	0.04
-0.070	-0.017	-0.053	0.029	0.135	-0.009	0.00003	0.03
0.208	0.005	0.052	0.072	0.009	0.039	0.00003	0.03
-0.100	-0.048	0.011	-0.012	-0.018	-0.018	0.00002	0.02
-0.004	0.028	-0.019	0.072	-0.043	0.028	0.00002	0.02
0.012	-0.064	0.076	0.101	0.040	0.027	0.00002	0.02
-0.090	0.028	-0.027	-0.068	0.031	-0.008	0.00003	0.03
-0.085	-0.054	0.118	0.061	0.037	-0.024	0.00003	0.03
-0.001	0.013	0.038	0.096	-0.063	0.056	0.00002	0.02
-0.072	-0.033	0.001	-0.028	-0.022	-0.020	0.00003	0.03
0.197	0.028	-0.045	0.006	-0.045	0.014	0.00002	0.02
0.109	-0.025	-0.020	0.041	-0.009	0.013	0.00002	0.02
0.070	-0.015	-0.006	-0.033	-0.017	-0.025	0.00002	0.02
-0.008	-0.048	0.039	-0.033	0.227	0.028	0.00003	0.03
-0.064	-0.050	-0.094	-0.070	-0.043	-0.061	0.00006	0.07
-0.003	-0.003	0.008	-0.017	0.014	-0.031	0.00002	0.02
-0.167	0.113	0.131	0.083	-0.111	0.091	0.00002	0.02
0.113	-0.013	-0.018	-0.010	-0.095	0.004	0.00010	0.12
0.042	-0.037	0.000	-0.106	-0.172	-0.023	0.00019	0.23
-0.203	-0.001	-0.169	-0.075	-0.056	-0.044	0.00022	0.26
0.004	0.030	-0.016	-0.007	0.124	-0.001	0.00026	0.31
0.197	0.052	0.084	0.133	-0.075	0.062	0.00024	0.29
0.048	0.058	0.062	-0.140	-0.106	0.009	0.00019	0.23
-0.073	0.007	-0.064	0.065	0.050	0.017	0.00023	0.27
-0.049	0.062	0.038	-0.037	-0.089	-0.002	0.00023	0.27
0.106	-0.051	0.029	0.090	0.053	0.042	0.00025	0.30
-0.097	-0.020	-0.031	0.018	-0.024	0.001	0.00025	0.30
-0.038	0.010	0.026	0.071	0.024	-0.005	0.00024	0.29
-0.031	-0.045	0.081	0.004	-0.148	-0.012	0.00028	0.33
-0.042	0.048	0.057	-0.027	0.099	0.037	0.00038	0.45
0.128	0.043	0.042	0.053	-0.048	0.014	0.00043	0.51
0.179	-0.071	0.050	0.048	0.117	0.024	0.00043	0.51

-0.008	-0.031	0.103	0.129	-0.006	0.039	0.00043	0.52
0.113	0.018	-0.010	0.053	0.064	-0.003	0.00062	0.74
0.129	-0.004	0.045	0.000	0.065	0.014	0.00067	0.80
0.086	-0.014	0.015	0.063	0.006	0.014	0.00074	0.89
0.060	0.012	0.062	-0.053	-0.128	0.001	0.00082	0.98
-0.105	-0.009	0.226	0.033	-0.174	0.026	0.00089	1.07
0.100	-0.046	-0.012	0.103	-0.079	0.003	0.00084	1.01
-0.042	0.084	0.067	-0.057	-0.028	0.015	0.00086	1.03
-0.028	0.017	0.015	0.097	-0.117	0.029	0.00089	1.07
-0.068	-0.001	0.073	0.017	0.119	0.031	0.00103	1.23
0.008	0.013	0.071	-0.012	-0.050	0.007	0.00110	1.32
0.138	0.044	0.202	-0.011	0.124	0.062	0.00118	1.41
-0.032	-0.132	0.022	0.064	-0.020	-0.036	0.00131	1.57
-0.224	-0.005	-0.090	-0.054	0.015	-0.031	0.00142	1.70
0.104	0.042	0.017	-0.015	0.310	0.009	0.00147	1.76
-0.031	0.045	0.056	0.131	0.016	0.024	0.00155	1.86
0.204	0.029	-0.043	-0.006	0.003	0.001	0.00158	1.90
-0.131	-0.015	0.062	0.028	0.005	0.042	0.00163	1.96
0.012	-0.016	-0.038	0.196	0.096	0.032	0.00169	2.03
-0.122	0.071	0.090	-0.005	-0.043	0.001	0.00178	2.13
0.274	-0.063	-0.046	-0.030	0.013	-0.065	0.00188	2.25
0.039	-0.002	-0.023	-0.184	0.028	0.019	0.00194	2.33
-0.050	-0.134	-0.066	-0.114	-0.088	-0.093	0.00198	2.37
-0.077	0.075	0.196	0.055	0.227	0.086	0.00198	2.37
0.042	0.078	0.141	0.040	0.147	0.032	0.00199	2.39
-0.125	0.034	-0.129	0.102	0.169	0.014	0.00200	2.40
-0.147	-0.006	-0.010	0.056	-0.031	0.045	0.00198	2.38
-0.224	-0.118	-0.096	-0.128	-0.041	-0.064	0.00196	2.35
0.207	0.095	0.072	0.135	0.110	0.064	0.00181	2.17
0.081	-0.030	-0.063	0.076	0.085	0.020	0.00175	2.10
-0.066	-0.079	0.067	-0.020	0.054	-0.017	0.00163	1.95
0.068	0.044	0.052	0.077	0.002	0.015	0.00158	1.89
0.307	-0.043	-0.107	0.111	-0.074	0.027	0.00138	1.65
0.048	0.008	0.077	0.074	0.046	0.036	0.00128	1.54
0.268	0.037	-0.105	0.102	0.028	0.024	0.00128	1.54
0.555	-0.110	-0.023	0.054	0.035	0.005	0.00127	1.52
0.027	-0.172	-0.136	-0.117	-0.108	-0.079	0.00127	1.52
-0.216	-0.251	-0.455	-0.068	-0.154	-0.130	0.00024	0.29
0.492	0.224	-0.054	0.155	0.343	0.134	0.00012	0.14
0.068	-0.022	0.034	0.082	0.143	0.048	0.00011	0.13
0.293	0.003	0.257	0.150	0.048	0.013	0.00013	0.16
0.325	-0.059	-0.138	0.165	0.098	0.064	0.00011	0.13
0.741	-0.051	0.087	0.214	0.134	0.070	0.00008	0.10
-0.139	-0.124	-0.038	-0.101	-0.051	-0.041	0.00009	0.11
-0.095	-0.050	-0.126	-0.060	-0.034	-0.021	0.00008	0.10

0.463	0.169	0.459	0.094	0.073	0.109	0.00008	0.09
0.243	0.107	0.016	0.116	0.075	0.033	0.00008	0.09
						<-- Average Risk Free Rate	