CSX Corporation
(NASDAQ: CSX)

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EXECUTIVE SUMMARY

CSX is more volatile than the market, following the market's movement. Overall, its average return is positive, based on 36 monthly returns from January 2016 to January 2019. In addition, CSX stock performance tends to deviate from its calculated returns. However, a diversification opportunity may be done for investment safety purpose. Depending on risk aversion of investors, constructing a portfolio of CSX and any other stock may reduce risk. This is very possible by finding a stock that is unlikely to be correlated with CSX.

Buying CSX is a promising investment according to research and analysis performed in this paper. CSX Corporation is one of major players in the railroad industry in the United States, meaning the company has strong sustainability. Due to this fact, it strengthens the findings that investing in CSX is safe. Using statistical approach such as linear regression, CSX is determined to yield positive returns assuming the market's performance is doing well. Although it is more volatile than the market, which is represented by Standard & Poor 500 stock index, CSX has shown to yield large abnormal returns.

Cisco Systems, which operate in a very distinct industry, is found to be an excellent diversifier. Its stock, which is represented by CSCO, has shown overall positive average return using the same period of data. Due to their industries distinction, CSX and CSCO have an insignificant and weak correlation. Therefore, a construction of a portfolio consisting of these two stocks may help investors feel more secure. Although investing only in CSX may yield highest returns among the strategies mentioned in this paper, its risk is also the highest among every possible efficient portfolio. This paper is written to give options to potential investors depending on their risk aversion level.

INTRODUCTION

CSX Corporation is a transportation company that provides rail-based freight transportation services, such as rail service, intermodal containers and trailers transportation, rail-to-truck transfers, and bulk commodity operations. CSX provides approximately 20,500-mile rail network and serves 70 port terminals, such as ocean, river, and lake, along Atlantic and Gulf Coasts[1]. 61% of revenue in 2018 was generated from merchandise business which include shipments of chemicals, automotive, agricultural and food products, etc. 18% was yielded from transporting domestic coal, coke, and iron ore. 16% was a result of the intermodal business.

There were approximately 22,500 employees as of December 2018. It has about $36 billion worth of asset, which keeps growing since 2015. Their assets include railroads, bridges, locomotive, freight cars, etc. The company's revenue reached over $12 billion in 2018, therefore it is considered as a large company. In the railroad industry, CSX Corporation takes about 14.8% of the market share, which follows Burlington Northern Santa Fe and Union Pacific Corporation, which have 29.4% and 28.8% of market share respectively. Among their competitors, CSX Corporation has the highest operating income growth in the past two years[2].

Since railroad transportation mainly uses diesel fuel for operating, oil price volatility may increase operating expense, hence a decline in profit may occur. Railroad industry also requires developments, upgrades, and maintenance in infrastructure. Future regulations for terrorism and war may indirectly affect CSX Corporation, causing increase in costs and liabilities as premiums charged by insurance company. Extreme weather conditions, such as floods, hurricanes, and earthquakes, may disrupt the company's operation. Railroad operations are also exposed to claims and lawsuits risk, disputed over labor and unemployment matters, property damage, etc.

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[1] EDGAR
[2] IBISWorld

The assets of CSX Corporation have shown increasing trend since 2014. However, their liabilities have also shown an inclining trend due to their long-term debt which significantly climbed by $3 billion in 2018.

Current ratio, which determines the capability of a company to liquidate asset to cash in case of financial difficulty, of CSX Corporation is 1.34, which indicates that it is healthy as it has significantly increased from 2017. More specifically, their quick ratio, which only considers cash and cash equivalents and account receivables, is 1.20, increasing from the past year's 0.81[3]. This shows that they are sufficiently liquid to pay any hardship that may be faces, and that they also use their asset efficiently. Moreover, the company generates $544,444 of revenue per employee and $147,022 of profit per employee.

To further assess their asset efficiency, CSX Corporation's return on asset is 8.93%, which is better than the industry's average of 8.41%. Their total asset turnover is 0.33, meaning that they earn $0.33 of revenue for each dollar of asset. As their assets and liabilities increased together, their debt-to-asset ratio has been stable at around 40%. However, with the decrease in total equity in 2018, debt-to-equity ratio is 117.46%.

Although their gross income dipped for about 9.45% in 2016, but it has been increasing in the past two years with 22.76% in 2018. Ignoring the effect of Tax Cut and Job Acts in 2017, their net income reached $3.3 billion in 2018, which indicates that CSX Corporation is generating high profit.

[3] Wall Street Journal

BETA CALCULATION

A stock's beta is a measure of the volatility of a stock related to the market. Beta tells how sensitive a company's stock is reacting to market movement. The beta of the market, such as the Standard and Poor 500 (S&P 500) index which is used in this analysis, is 1. S&P 500 is used as a market proxy because it represents the market performance since it tracks 500 large-cap companies in the United States. Using 36 monthly rates of return of CSX and S&P 500 ending January 31, 2019, (Appendix F) a beta of CSX is found to be 1.152. This finding can be interpreted as that CSX averagely changes $1.15 per $1.00 change of the market toward the same direction. Therefore, it is theoretically correct to perceive that CSX is more volatile than the market.

In the security market line (SML) graph of CSX (Appendix H), market returns are plotted on the x-axis as an independent variable, and CSX returns are plotted on the y-axis as a dependent variable. SML is a linear representation of 36 monthly returns of CSX and S&P 500, which have positive average returns. Due to its linearity, SML explains a proportion of CSX's price change that is explainable by the movement of the S&P 500, which is quantified by R-squared. This proportion is found to be 22.706% for CSX in relation to the S&P 500. Such a low R-squared value generally indicates that the beta should not be the only indicator or reference for the performance of the stock.

Potential investors should also consider alpha that is derived from CSX's SML, which is found to be 2.263%. In the SML graph, this alpha can be seen as the intercept of the line with the y-axis. Essentially, alpha measures the difference between actual performance and expected performance, which is the excess or active return of CSX relative to that of S&P 500.

Combining alpha and beta of CSX, potential investors should see the regression equation for CSX relative to S&P 500, which happens to be: $R_{csx} = \alpha + \beta \times R_{market} + \varepsilon$, such that R_{csx} is return

on CSX stock, α is CSX's alpha which is 0.02263, β is CSX's beta which is 1.15213, R_{market} is return on S&P 500 which represents the market, and ε is the distance from SML to each point which is actual observed return. This is not the CAPM equation.

Using CAPM equation, required return of CSX is calculated by using observed risk-free rate and market return. As shown in Appendix _, the last 36-month rates of return of the 3-Month Treasury Bills are used to calculate the risk-free rate (r_{RF}) because the US government, which back this asset, has never failed to pay back investors. In other words, it has no default risk whatsoever, and its beta is zero as it is assumed to have no correlation with the stock market. The market return (r_M) is calculated as the mean of 36-month rates of return of S&P 500, which has been averagely positive. Using the calculated beta of 1.152, required return of CSX is computed to be 4.449%. Hence, abnormal return for a portfolio consisting only CSX is 9.107% by subtracting required return from actual return of 13.556%. This stock is worth buying as it is undervalued according to the last 36 months rates of return of 3-Month Treasury Bill, S&P 500 index, and CSX stock.

The calculated beta in this report, 1.15, is close to Value Line's beta of 1.20 and CNBC's beta of 1.27. It differs from the Value Line's beta since Value Line uses its own market index which also includes foreign stocks. While CNBC also uses the S&P 500 as its market index, CNBC calculates beta using 60 months rates of return. However, using other betas from reliable sources still give a positive abnormal return which allows buying the stock is always a recommended decision for now.

DIVERSIFICATION

Combining CSX with a stock with low correlation to it increases the return and decreases the risk. This process is called diversification. Cisco Systems (CSCO), which operates in networking hardware and telecommunication equipment industry, is a proper choice as diversifier because they are unlikely to be correlated. Due to their unique industry distinction, both industries main drivers of failure and success are independent. Furthermore, the benefit of having two uncorrelated stocks in a portfolio is that if a crisis were to happen in the railroad industry, this will have no direct impact on the technology industry. Financially, Cisco Systems is healthy because their revenue and expense have been stable[4], generating positive net earnings.

To first assess the correlation between CSX and CSCO, a relationship measurement between these stocks is computed, namely correlation coefficient (ρ). ρ of CSX and CSCO is 0.17704, which is relatively low since ρ takes value from -1 to +1, which 0 being perfectly non-correlated and 1 being perfectly correlated, regardless of its direction. A weak positive correlation between two stocks indicates that forming a portfolio consisting of them may be a smart strategy as if one changes, the other is unlikely to follow the movement. ρ does not consider weight of each asset in a portfolio, hence it is the same for any mix of portfolio. ρ is used to find standard deviation of any proportion of each pair of assets, in this case CSX and CSCO. Depending on the weight of each stock in a portfolio, standard deviation of portfolio changes accordingly.

Various strategies can be developed to diversify a portfolio consisting of CSX and CSCO, with an objective to reduce standard deviation. In this report, 50/50 portfolio which consists of 50% of CSX and 50% of CSCO and MVP, which has lowest variance, hence standard deviation, are used in addition to CSX-only and CSCO-only portfolio. The table below shows the data.

[4] Market Watch: https://www.marketwatch.com/investing/stock/CSCO

	100% CSX	100% CSCO	50/50 Portfolio	MVP
Mean Return	3.389%	2.313%	2.851%	2.614%
Std. Dev.	7.816%	5.352%	5.112%	4.756%
Beta	1.152	0.971	1.062	1.022
CV	2.306	2.314	1.793	1.819

Investing in CSX-only portfolio yields higher return than other strategies, but also generates highest standard deviation among them. A CSCO-only portfolio yields lower return, and it has lower standard deviation than CSX-only portfolio. To even further decrease standard deviation, MVP may be an ideal strategy, which works better than 50/50 portfolio, to achieve lowest standard deviation.

Although standard deviation measures risk, coefficient of variation (CV) may be a better measurement as it measures risk relative to its mean. While MVP generates the lowest standard deviation, the 50/50 portfolio has the lowest CV. CV lets potential investors to compare one strategy to one another and assess which one is the safest. The lower the CV means that the less volatile the portfolio's performance relative to its mean return. In other words, CV considers both standard deviation and average return so that it may tell which one is the safest investment.

Risk-averse investors should opt with either MVP or 50/50 portfolio since both have low standard deviation and CV. To be more specific, MVP should be chosen if investors are defensive, and 50/50 suits those who are more aggressive. Risk-neutral investors, who wish to generate higher return regardless the standard deviation, should opt with CSX-only portfolio.

CONCLUSION

Overall performance of CSX shows that the stock is worth buying. Depending on risk aversion of investors, mixing CSX with CSCO should diversify risk caused by market's volatility. Behavior of CSX, which is more volatile than the market, is neutralized if it is combined with CSCO, which is less volatile than the market, according to beta calculation of CSCO performed in this paper. CSX manages to outperform the industrials sector, but it underperforms the logistics industry. CSCO outperforms both the technology sector and hardware industry. Both CSX and CSCO yield positive average return for the past 3 years.

From the perspective of business performance, both CSX Corporation and Cisco Systems have shown that both companies are healthy. The former has growing revenue and reduce cost since 2015[5]. With 40.18% debt-to-asset ratio[6], CSX Corporation is in a good shape due to its stably increasing positive cash flow from operation. Cisco Systems has 23.50% debt-to-asset ratio[7] and consistent positive cash flow from operating activities.

The research performed in this paper shows that it is safe to diversify a CSX-only portfolio by adding CSCO. The proportion of each stock depends on the risk aversion of investor. Risk-seeking investors should choose less amount of CSCO, but will consequently face more risk. Risk-averse investors should opt with either 50/50 portfolio or MVP, but are likely to generate lower return. Investing less than 28% in CSX makes portfolio becomes inefficient.

Potential investors should understand that this paper is written based on key assumptions of market model, linear regression, and capital asset pricing model. Actual results may be different from calculated and expected results developed using these concepts.

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[5] Yahoo Finance: https://finance.yahoo.com/quote/CSX
[6] Bloomberg: https://www.bloomberg.com/quote/CSX:US
[7] Bloomberg: https://www.bloomberg.com/quote/CSCO:US

APPENDIX A – CSX 36-Month Returns (1/2016 – 1/2019)

	CSX	CSX Corporation							
	Date	Open	High	Low	Close	Volume	Div	1	Split
January-19	1/1/2019	$ 60.76	$ 67.77	$ 60.02	$ 65.70	125,003,700		1	
December-18	12/1/2018	$ 73.81	$ 73.90	$ 58.47	$ 62.13	117,695,600	$ 0.18	1	
November-18	11/1/2018	$ 69.13	$ 73.61	$ 68.58	$ 72.63	103,595,700		1	
October-18	10/1/2018	$ 74.38	$ 75.66	$ 63.65	$ 68.86	167,502,500		1	
September-18	9/1/2018	$ 74.16	$ 74.91	$ 72.69	$ 74.05	101,051,700	$ 0.18	1	
August-18	8/1/2018	$ 70.74	$ 76.24	$ 70.09	$ 74.16	96,383,600		1	
July-18	7/1/2018	$ 63.54	$ 72.22	$ 63.23	$ 70.68	135,592,400		1	
June-18	6/1/2018	$ 65.22	$ 67.69	$ 62.72	$ 63.78	101,756,100	$ 0.18	1	
May-18	5/1/2018	$ 59.29	$ 65.93	$ 57.97	$ 64.65	93,000,400		1	
April-18	4/1/2018	$ 55.48	$ 61.50	$ 53.53	$ 59.39	137,809,300		1	
March-18	3/1/2018	$ 53.95	$ 58.40	$ 53.13	$ 55.71	132,385,000	$ 0.18	1	
February-18	2/1/2018	$ 56.10	$ 57.10	$ 48.43	$ 53.72	146,417,300		1	
January-18	1/1/2018	$ 55.63	$ 60.04	$ 55.02	$ 56.77	144,635,300		1	
December-17	12/1/2017	$ 55.23	$ 58.35	$ 51.50	$ 55.01	203,374,000	$ 0.18	1	
November-17	11/1/2017	$ 50.73	$ 56.17	$ 48.26	$ 55.75	119,909,100		1	
October-17	10/1/2017	$ 52.81	$ 54.99	$ 50.39	$ 50.43	133,710,300		1	
September-17	9/1/2017	$ 50.38	$ 54.30	$ 48.69	$ 54.26	111,915,500	$ 0.20	1	
August-17	8/1/2017	$ 49.29	$ 51.38	$ 47.99	$ 50.20	150,514,800		1	
July-17	7/1/2017	$ 54.75	$ 55.48	$ 48.86	$ 49.34	177,432,900		1	
June-17	6/1/2017	$ 54.21	$ 55.06	$ 51.76	$ 54.56	165,083,100		1	
May-17	5/1/2017	$ 50.87	$ 54.43	$ 48.77	$ 54.17	164,288,700		1	
April-17	4/1/2017	$ 46.66	$ 51.66	$ 46.04	$ 50.84	149,492,600		1	
March-17	3/1/2017	$ 49.20	$ 50.31	$ 45.41	$ 46.55	216,151,100	$ 0.20	1	
February-17	2/1/2017	$ 46.55	$ 49.60	$ 46.10	$ 48.56	189,647,400		1	
January-17	1/1/2017	$ 36.15	$ 49.13	$ 35.59	$ 46.39	390,248,100		1	
December-16	12/1/2016	$ 36.07	$ 37.42	$ 35.79	$ 35.93	153,646,500	$ 0.22	1	
November-16	11/1/2016	$ 30.64	$ 36.09	$ 30.15	$ 35.81	212,182,900		1	
October-16	10/1/2016	$ 30.33	$ 31.73	$ 30.01	$ 30.51	182,030,700		1	
September-16	9/1/2016	$ 28.37	$ 30.60	$ 27.89	$ 30.50	145,000,900	$ 0.22	1	
August-16	8/1/2016	$ 28.33	$ 28.88	$ 27.46	$ 28.28	107,443,800		1	
July-16	7/1/2016	$ 26.11	$ 29.41	$ 25.33	$ 28.33	153,978,300		1	
June-16	6/1/2016	$ 26.18	$ 27.41	$ 24.43	$ 26.08	149,576,900	$ 0.22	1	
May-16	5/1/2016	$ 27.27	$ 27.54	$ 24.93	$ 26.43	139,244,400		1	
April-16	4/1/2016	$ 25.64	$ 27.97	$ 24.36	$ 27.27	203,549,200		1	
March-16	3/1/2016	$ 24.45	$ 27.27	$ 24.26	$ 25.75	209,820,900	$ 0.22	1	
February-16	2/1/2016	$ 22.60	$ 25.71	$ 21.64	$ 24.14	214,364,500		1	
January-16	1/1/2016	$ 25.37	$ 25.99	$ 21.33	$ 23.02	197,807,900		1	

APPENDIX B – S&P 500 36-Month Returns (1/2016 – 1/2019)

S&P 500	Standard & Poor 500				
Date	Open	High	Low	Close	Volume
1/1/2019	$ 2,476.96	$2,708.95	$2,443.96	$2,704.10	80,391,630,000
12/1/2018	$ 2,790.50	$2,800.18	$2,346.58	$2,506.85	83,519,570,000
11/1/2018	$ 2,717.58	$2,815.15	$2,631.09	$2,760.17	80,080,110,000
10/1/2018	$ 2,926.29	$2,939.86	$2,603.54	$2,711.74	91,327,930,000
9/1/2018	$ 2,896.96	$2,940.91	$2,864.12	$2,913.98	62,492,080,000
8/1/2018	$ 2,821.17	$2,916.50	$2,796.34	$2,901.52	69,238,220,000
7/1/2018	$ 2,704.95	$2,848.03	$2,698.95	$2,816.29	64,542,170,000
6/1/2018	$ 2,718.70	$2,791.47	$2,691.99	$2,718.37	77,439,710,000
5/1/2018	$ 2,642.96	$2,742.24	$2,594.62	$2,705.27	75,617,280,000
4/1/2018	$ 2,633.45	$2,717.49	$2,553.80	$2,648.05	69,648,590,000
3/1/2018	$ 2,715.22	$2,801.90	$2,585.89	$2,640.87	76,369,800,000
2/1/2018	$ 2,816.45	$2,835.96	$2,532.69	$2,713.83	79,579,410,000
1/1/2018	$ 2,683.73	$2,872.87	$2,682.36	$2,823.81	76,860,120,000
12/1/2017	$ 2,645.10	$2,694.97	$2,605.52	$2,673.61	65,251,190,000
11/1/2017	$ 2,583.21	$2,657.74	$2,557.45	$2,584.84	95,142,800,000
10/1/2017	$ 2,521.20	$2,582.98	$2,520.40	$2,575.26	70,871,570,000
9/1/2017	$ 2,474.42	$2,519.44	$2,446.55	$2,519.36	66,337,980,000
8/1/2017	$ 2,477.10	$2,490.87	$2,417.35	$2,471.65	70,616,030,000
7/1/2017	$ 2,431.39	$2,484.04	$2,407.70	$2,470.30	63,169,400,000
6/1/2017	$ 2,415.65	$2,453.82	$2,405.70	$2,423.41	81,002,490,000
5/1/2017	$ 2,388.50	$2,418.71	$2,352.72	$2,411.80	79,607,170,000
4/1/2017	$ 2,362.34	$2,398.16	$2,328.95	$2,384.20	65,265,670,000
3/1/2017	$ 2,380.13	$2,400.98	$2,322.25	$2,362.72	81,547,770,000
2/1/2017	$ 2,285.59	$2,371.54	$2,271.65	$2,363.64	69,162,420,000
1/1/2017	$ 2,251.57	$2,300.99	$2,245.13	$2,278.87	70,483,180,000
12/1/2016	$ 2,200.17	$2,277.53	$2,187.44	$2,238.83	75,251,240,000
11/1/2016	$ 2,128.68	$2,214.10	$2,083.79	$2,198.81	88,299,760,000
10/1/2016	$ 2,164.33	$2,169.60	$2,114.72	$2,126.15	73,196,630,000
9/1/2016	$ 2,171.33	$2,187.87	$2,119.12	$2,168.27	77,270,240,000
8/1/2016	$ 2,173.15	$2,193.81	$2,147.58	$2,170.95	75,610,310,000
7/1/2016	$ 2,099.34	$2,177.09	$2,074.02	$2,173.60	69,530,250,000
6/1/2016	$ 2,093.94	$2,120.55	$1,991.68	$2,098.86	86,852,700,000
5/1/2016	$ 2,067.17	$2,103.48	$2,025.91	$2,096.95	78,883,600,000
4/1/2016	$ 2,056.62	$2,111.05	$2,033.80	$2,065.30	81,124,990,000
3/1/2016	$ 1,937.09	$2,072.21	$1,937.09	$2,059.74	92,639,420,000
2/1/2016	$ 1,936.94	$1,962.96	$1,810.10	$1,932.23	93,049,560,000
1/1/2016	$ 2,038.20	$2,038.20	$1,812.29	$1,940.24	92,409,770,000

APPENDIX C – 3-Month Treasury Bill 36-Month Returns (1/2016 – 1/2019)

TB3MS	3 Month T-Bill
Date	Rate
January-19	2.37
December-18	2.37
November-18	2.33
October-18	2.25
September-18	2.13
August-18	2.03
July-18	1.96
June-18	1.90
May-18	1.86
April-18	1.76
March-18	1.70
February-18	1.57
January-18	1.41
December-17	1.32
November-17	1.23
October-17	1.07
September-17	1.03
August-17	1.01
July-17	1.07
June-17	0.98
May-17	0.89
April-17	0.80
March-17	0.74
February-17	0.52
January-17	0.51
December-16	0.51
November-16	0.45
October-16	0.33
September-16	0.29
August-16	0.30
July-16	0.30
June-16	0.27
May-16	0.27
April-16	0.23
March-16	0.29
February-16	0.31
January-16	0.26

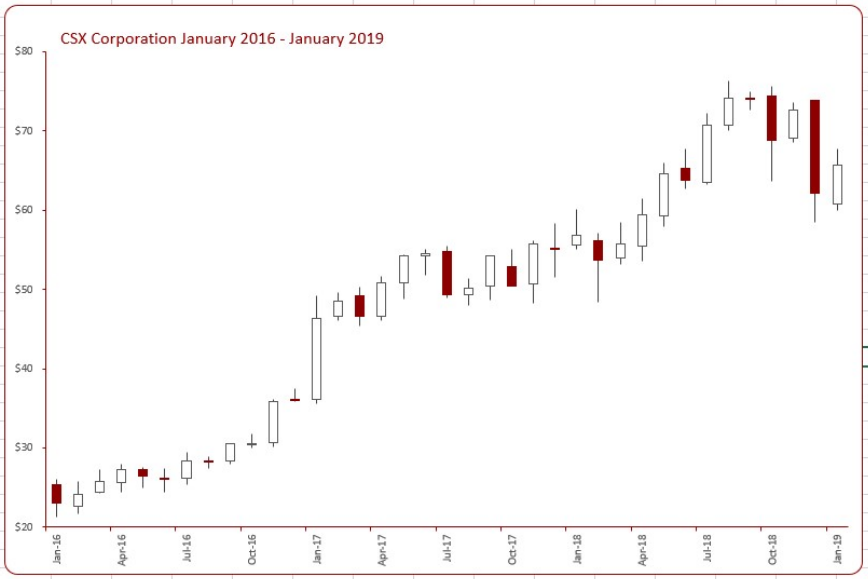
APPENDIX D – CSCO 36-Month Returns (1/2016 – 1/2019)

CSCO	Cisco System							
Date	Open	High	Low	Close	Volume	Div	1	Split
January-19	$ 42.28	$ 47.38	$ 40.96	$ 47.29	442,759,300	0.3	1	
December-18	$ 48.32	$ 49.14	$ 40.25	$ 43.33	606,735,800	0	1	
November-18	$ 45.67	$ 48.44	$ 44.08	$ 47.87	526,861,100	0	1	
October-18	$ 49.00	$ 49.47	$ 42.94	$ 45.75	549,746,900	0.3	1	
September-18	$ 47.84	$ 49.06	$ 46.44	$ 48.65	365,543,500	0	1	
August-18	$ 41.99	$ 47.83	$ 41.20	$ 47.77	441,219,800	0	1	
July-18	$ 42.56	$ 43.83	$ 40.94	$ 42.29	450,479,900	0.3	1	
June-18	$ 42.91	$ 44.81	$ 41.81	$ 43.03	463,650,000	0	1	
May-18	$ 43.91	$ 46.37	$ 42.52	$ 42.71	500,442,100	0	1	
April-18	$ 42.52	$ 45.34	$ 40.19	$ 44.29	491,494,900	0.3	1	
March-18	$ 44.68	$ 46.16	$ 41.58	$ 42.89	597,830,400	0	1	
February-18	$ 41.09	$ 45.89	$ 37.35	$ 44.78	703,752,400	0	1	
January-18	$ 38.67	$ 42.98	$ 38.43	$ 41.54	504,531,300	0.3	1	
December-17	$ 37.09	$ 38.99	$ 36.73	$ 38.30	373,030,900	0	1	
November-17	$ 34.29	$ 38.03	$ 33.67	$ 35.88	687,178,700	0	1	
October-17	$ 33.61	$ 34.73	$ 33.17	$ 34.15	336,242,900	0.3	1	
September-17	$ 32.22	$ 34.10	$ 31.46	$ 33.63	415,433,800	0	1	
August-17	$ 31.59	$ 32.47	$ 30.36	$ 32.21	505,595,400	0	1	
July-17	$ 31.09	$ 32.25	$ 30.67	$ 31.45	344,250,200	0	1	
June-17	$ 31.52	$ 32.50	$ 31.09	$ 31.30	480,696,300	0	1	
May-17	$ 34.11	$ 34.60	$ 30.37	$ 31.53	548,285,400	0	1	
April-17	$ 33.70	$ 34.11	$ 32.42	$ 34.07	323,232,200	0.3	1	
March-17	$ 34.28	$ 34.53	$ 33.65	$ 33.80	404,059,400	0	1	
February-17	$ 30.85	$ 34.32	$ 30.42	$ 34.18	476,103,300	0	1	
January-17	$ 30.37	$ 31.05	$ 29.80	$ 30.72	388,860,500	0.3	1	
December-16	$ 29.84	$ 31.07	$ 29.12	$ 30.22	439,906,100	0	1	
November-16	$ 30.85	$ 31.89	$ 29.55	$ 29.82	568,074,900	0	1	
October-16	$ 31.31	$ 31.68	$ 29.86	$ 30.68	368,478,100	0.3	1	
September-16	$ 31.42	$ 31.95	$ 30.60	$ 31.72	439,073,300	0	1	
August-16	$ 30.70	$ 31.70	$ 30.06	$ 31.44	545,109,400	0	1	
July-16	$ 28.78	$ 31.15	$ 28.17	$ 30.53	441,859,300	0.3	1	
June-16	$ 28.84	$ 29.41	$ 27.13	$ 28.69	498,282,700	0	1	
May-16	$ 27.48	$ 29.08	$ 25.81	$ 29.05	542,288,700	0	1	
April-16	$ 28.30	$ 28.70	$ 26.95	$ 27.49	442,744,600	0.3	1	
March-16	$ 26.45	$ 28.68	$ 26.24	$ 28.47	498,048,600	0	1	
February-16	$ 23.46	$ 26.91	$ 22.46	$ 26.18	677,066,400	0	1	
January-16	$ 26.39	$ 26.66	$ 22.47	$ 23.79	786,139,500	0.2	1	

APPENDIX E – CANDLESTICK CHART OF CSX

CSX	CSX Corporation			
Date	Open	High	Low	Close
January-19	$ 60.76	$ 67.77	$ 60.02	$ 65.70
December-18	$ 73.81	$ 73.90	$ 58.47	$ 62.13
November-18	$ 69.13	$ 73.61	$ 68.58	$ 72.63
October-18	$ 74.38	$ 75.66	$ 63.65	$ 68.86
September-18	$ 74.16	$ 74.91	$ 72.69	$ 74.05
August-18	$ 70.74	$ 76.24	$ 70.09	$ 74.16
July-18	$ 63.54	$ 72.22	$ 63.23	$ 70.68
June-18	$ 65.22	$ 67.69	$ 62.72	$ 63.78
May-18	$ 59.29	$ 65.93	$ 57.97	$ 64.65
April-18	$ 55.48	$ 61.50	$ 53.53	$ 59.39
March-18	$ 53.95	$ 58.40	$ 53.13	$ 55.71
February-18	$ 56.10	$ 57.10	$ 48.43	$ 53.72
January-18	$ 55.63	$ 60.04	$ 55.02	$ 56.77
December-17	$ 55.23	$ 58.35	$ 51.50	$ 55.01
November-17	$ 50.73	$ 56.17	$ 48.26	$ 55.75
October-17	$ 52.81	$ 54.99	$ 50.39	$ 50.43
September-17	$ 50.38	$ 54.30	$ 48.69	$ 54.26
August-17	$ 49.29	$ 51.38	$ 47.99	$ 50.20
July-17	$ 54.75	$ 55.48	$ 48.86	$ 49.34
June-17	$ 54.21	$ 55.06	$ 51.76	$ 54.56
May-17	$ 50.87	$ 54.43	$ 48.77	$ 54.17
April-17	$ 46.66	$ 51.66	$ 46.04	$ 50.84
March-17	$ 49.20	$ 50.31	$ 45.41	$ 46.55
February-17	$ 46.55	$ 49.60	$ 46.10	$ 48.56
January-17	$ 36.15	$ 49.13	$ 35.59	$ 46.39
December-16	$ 36.07	$ 37.42	$ 35.79	$ 35.93
November-16	$ 30.64	$ 36.09	$ 30.15	$ 35.81
October-16	$ 30.33	$ 31.73	$ 30.01	$ 30.51
September-16	$ 28.37	$ 30.60	$ 27.89	$ 30.50
August-16	$ 28.33	$ 28.88	$ 27.46	$ 28.28
July-16	$ 26.11	$ 29.41	$ 25.33	$ 28.33
June-16	$ 26.18	$ 27.41	$ 24.43	$ 26.08
May-16	$ 27.27	$ 27.54	$ 24.93	$ 26.43
April-16	$ 25.64	$ 27.97	$ 24.36	$ 27.27
March-16	$ 24.45	$ 27.27	$ 24.26	$ 25.75
February-16	$ 22.60	$ 25.71	$ 21.64	$ 24.14
January-16	$ 25.37	$ 25.99	$ 21.33	$ 23.02

CSX Corporation January 2016 - January 2019



APPENDIX F – RATES OF RETURN

	Rates of Return					
	3 Month T-Bi	Standard & Poor 5	CSX	CSCO	50/50 Portfoli	MVP
January-19	0.198%	7.868%	5.746%	9.901%	7.823%	8.737%
December-18	0.198%	-9.178%	-14.209%	-9.484%	-11.847%	-10.807%
November-18	0.194%	1.786%	5.475%	4.634%	5.054%	4.869%
October-18	0.188%	-6.940%	-7.009%	-5.283%	-6.146%	-5.766%
September-18	0.178%	0.429%	0.094%	1.842%	0.968%	1.353%
August-18	0.169%	3.026%	4.924%	12.958%	8.941%	10.708%
July-18	0.163%	3.602%	10.818%	-0.953%	4.933%	2.343%
June-18	0.158%	0.484%	-1.067%	0.749%	-0.159%	0.241%
May-18	0.155%	2.161%	8.857%	-3.567%	2.645%	-0.089%
April-18	0.147%	0.272%	6.606%	4.034%	5.320%	4.754%
March-18	0.142%	-2.688%	4.039%	-4.221%	-0.091%	-1.908%
February-18	0.131%	-3.895%	-5.373%	7.800%	1.214%	4.111%
January-18	0.118%	5.618%	3.199%	9.217%	6.208%	7.532%
December-17	0.110%	3.434%	-1.004%	6.745%	2.870%	4.575%
November-17	0.103%	0.372%	10.549%	5.066%	7.808%	6.601%
October-17	0.089%	2.219%	-7.059%	2.409%	-2.325%	-0.242%
September-17	0.086%	1.930%	8.486%	4.409%	6.447%	5.550%
August-17	0.084%	0.055%	1.743%	2.417%	2.080%	2.228%
July-17	0.089%	1.935%	-9.567%	0.479%	-4.544%	-2.334%
June-17	0.082%	0.481%	0.720%	-0.729%	-0.005%	-0.324%
May-17	0.074%	1.158%	6.550%	-7.455%	-0.453%	-3.534%
April-17	0.067%	0.909%	9.216%	1.657%	5.436%	3.773%
March-17	0.062%	-0.039%	-3.727%	-1.112%	-2.420%	-1.844%
February-17	0.043%	3.720%	4.678%	11.263%	7.970%	9.419%
January-17	0.043%	1.788%	29.112%	2.515%	15.814%	9.962%
December-16	0.043%	1.820%	0.949%	1.341%	1.145%	1.232%
November-16	0.038%	3.417%	17.371%	-2.803%	7.284%	2.846%
October-16	0.028%	-1.943%	0.033%	-2.459%	-1.213%	-1.761%
September-16	0.024%	-0.123%	8.628%	0.891%	4.759%	3.057%
August-16	0.025%	-0.122%	-0.176%	2.981%	1.402%	2.097%
July-16	0.025%	3.561%	8.627%	7.320%	7.973%	7.686%
June-16	0.023%	0.091%	-0.492%	-1.239%	-0.866%	-1.030%
May-16	0.023%	1.532%	-3.080%	5.675%	1.297%	3.223%
April-16	0.019%	0.270%	5.903%	-2.529%	1.687%	-0.168%
March-16	0.024%	6.599%	7.581%	8.747%	8.164%	8.421%
February-16	0.026%	-0.413%	4.865%	10.046%	7.456%	8.596%
N:	36	36	36	36	36	36
Mean:	0.093%	0.978%	3.389%	2.313%	2.851%	2.614%
Standard Deviaton:	0.061%	3.233%	7.816%	5.352%	5.112%	4.756%
Coefficient of Variati	0.65369	3.30614	2.30621	2.31402	1.79319	1.81948
			CSX		50%	28%
				CSCO	50%	72%

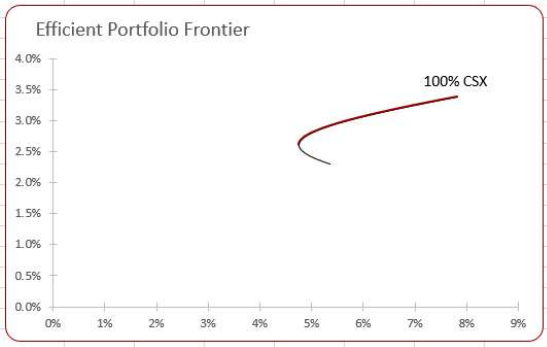
APPENDIX G – EFFICIENT PORTFOLIO FRONTIER

Inputs		
	CSX	CSCO
N:	36	36
Mean:	3.389%	2.313%
Standard Deviaton:	7.816%	5.352%
Correlation Coefficient:		0.17704

Minimum Variance Portfolio	
Minimum Variance:	4.756%
Observation:	75
CSX	28%
CSCO	72%

Portfolios				
CSX	CSCO	E[R]	Risk	EPF
100%	0%	3.389%	7.816%	7.816%
99%	1%	3.378%	7.747%	7.747%
98%	2%	3.368%	7.679%	7.679%
97%	3%	3.357%	7.611%	7.611%
96%	4%	3.346%	7.544%	7.544%
95%	5%	3.335%	7.477%	7.477%
94%	6%	3.324%	7.411%	7.411%
93%	7%	3.314%	7.344%	7.344%
92%	8%	3.303%	7.279%	7.279%
91%	9%	3.292%	7.213%	7.213%
90%	10%	3.281%	7.148%	7.148%
89%	11%	3.271%	7.084%	7.084%
88%	12%	3.260%	7.020%	7.020%
87%	13%	3.249%	6.957%	6.957%
86%	14%	3.238%	6.894%	6.894%
85%	15%	3.228%	6.831%	6.831%
84%	16%	3.217%	6.770%	6.770%
83%	17%	3.206%	6.708%	6.708%
82%	18%	3.195%	6.648%	6.648%
81%	19%	3.185%	6.587%	6.587%
80%	20%	3.174%	6.528%	6.528%
79%	21%	3.163%	6.469%	6.469%
78%	22%	3.152%	6.410%	6.410%
77%	23%	3.142%	6.353%	6.353%
76%	24%	3.131%	6.296%	6.296%
75%	25%	3.120%	6.239%	6.239%
74%	26%	3.109%	6.184%	6.184%
73%	27%	3.098%	6.129%	6.129%
72%	28%	3.088%	6.074%	6.074%
29%	71%	2.625%	4.757%	4.757%
28%	72%	2.614%	4.756%	4.756%
27%	73%	2.603%	4.758%	#N/A
26%	74%	2.593%	4.761%	#N/A
25%	75%	2.582%	4.765%	#N/A
24%	76%	2.571%	4.771%	#N/A
23%	77%	2.560%	4.779%	#N/A
22%	78%	2.550%	4.788%	#N/A
21%	79%	2.539%	4.799%	#N/A
20%	80%	2.528%	4.811%	#N/A
19%	81%	2.517%	4.825%	#N/A
18%	82%	2.506%	4.840%	#N/A
17%	83%	2.496%	4.857%	#N/A
16%	84%	2.485%	4.875%	#N/A
15%	85%	2.474%	4.894%	#N/A
14%	86%	2.463%	4.916%	#N/A
13%	87%	2.453%	4.938%	#N/A
12%	88%	2.442%	4.962%	#N/A
11%	89%	2.431%	4.988%	#N/A
10%	90%	2.420%	5.014%	#N/A
9%	91%	2.410%	5.042%	#N/A
8%	92%	2.399%	5.072%	#N/A
7%	93%	2.388%	5.102%	#N/A
6%	94%	2.377%	5.134%	#N/A
5%	95%	2.367%	5.168%	#N/A
4%	96%	2.356%	5.202%	#N/A
3%	97%	2.345%	5.238%	#N/A
2%	98%	2.334%	5.275%	#N/A
1%	99%	2.323%	5.313%	#N/A
0%	100%	2.313%	5.352%	#N/A

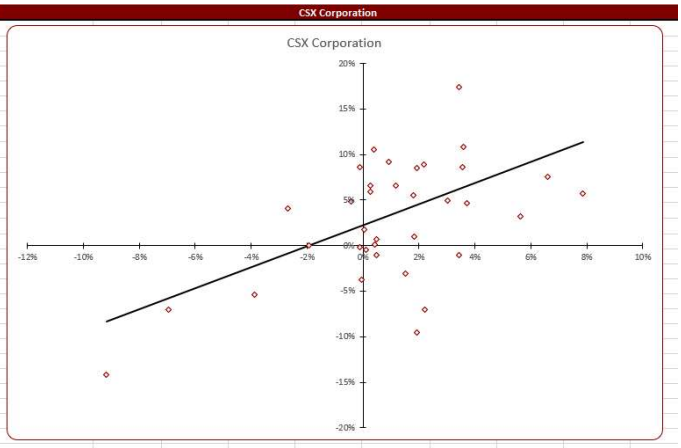
Efficient Portfolio Frontier



APPENDIX H – RETURNS OF CSX

	Rates of Return		
	3 Month T-Bill	Standard & Poor 500	CSX
January-19	0.198%	7.868%	5.746%
December-18	0.198%	-9.178%	-14.209%
November-18	0.194%	1.786%	5.475%
October-18	0.188%	-6.940%	-7.009%
September-18	0.178%	0.429%	0.094%
August-18	0.169%	3.026%	4.924%
July-18	0.163%	3.602%	10.818%
June-18	0.158%	0.484%	-1.067%
May-18	0.155%	2.161%	8.857%
April-18	0.147%	0.272%	6.606%
March-18	0.142%	-2.688%	4.039%
February-18	0.131%	-3.895%	-5.373%
January-18	0.118%	5.618%	3.199%
December-17	0.110%	3.434%	-1.004%
November-17	0.103%	0.372%	10.549%
October-17	0.089%	2.219%	-7.059%
September-17	0.086%	1.930%	8.486%
August-17	0.084%	0.055%	1.743%
July-17	0.089%	1.935%	-9.567%
June-17	0.082%	0.481%	0.720%
May-17	0.074%	1.158%	6.550%
April-17	0.067%	0.909%	9.216%
March-17	0.062%	-0.039%	-3.727%
February-17	0.043%	3.720%	4.678%
January-17	0.043%	1.788%	29.112%
December-16	0.043%	1.820%	0.949%
November-16	0.038%	3.417%	17.371%
October-16	0.028%	-1.943%	0.033%
September-16	0.024%	-0.123%	8.628%
August-16	0.025%	-0.122%	-0.176%
July-16	0.025%	3.561%	8.627%
June-16	0.023%	0.091%	-0.492%
May-16	0.023%	1.532%	-3.080%
April-16	0.019%	0.270%	5.903%
March-16	0.024%	6.599%	7.581%
February-16	0.026%	-0.413%	4.865%

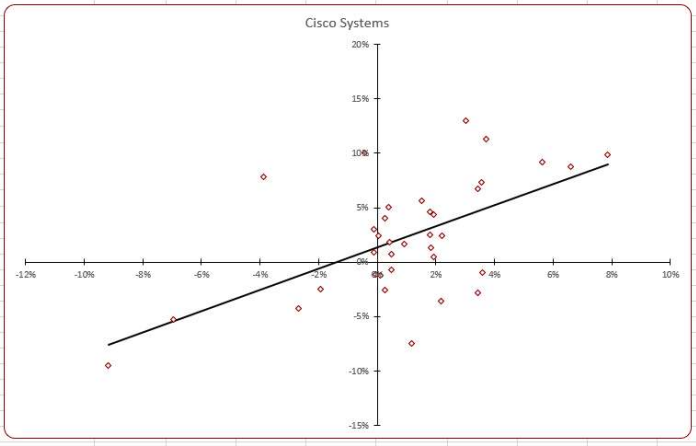
Market Model		
Regression Statistics		
Multiple R	rho	0.476504769
R Square	RR	0.227056795
Adjusted R Square		0.204323171
Standard Error		0.069718251
Observations	N	36
Estimated Parameters	k	2
Regression Coefficients		
Alpha	alpha	0.022625841
Beta	beta	1.152129136
t Statistics		3.160333523
Characteristic Line		
	Rm	E[R]
Minimum	-9.178%	-8.311%
Mean	0.978%	3.389%
Maximum	7.868%	11.328%



APPENDIX I – RETURN OF CSCO

	Rates of Return		
	3 Month T-Bill	Standard	CSCO
January-19	0.198%	7.868%	9.901%
December-18	0.198%	-9.178%	-9.484%
November-18	0.194%	1.786%	4.634%
October-18	0.188%	-6.940%	-5.283%
September-18	0.178%	0.429%	1.842%
August-18	0.169%	3.026%	12.958%
July-18	0.163%	3.602%	-0.953%
June-18	0.158%	0.484%	0.749%
May-18	0.155%	2.161%	-3.567%
April-18	0.147%	0.272%	4.034%
March-18	0.142%	-2.688%	-4.221%
February-18	0.131%	-3.895%	7.800%
January-18	0.118%	5.618%	9.217%
December-17	0.110%	3.434%	6.745%
November-17	0.103%	0.372%	5.066%
October-17	0.089%	2.219%	2.409%
September-17	0.086%	1.930%	4.409%
August-17	0.084%	0.055%	2.417%
July-17	0.089%	1.935%	0.479%
June-17	0.082%	0.481%	-0.729%
May-17	0.074%	1.158%	-7.455%
April-17	0.067%	0.909%	1.657%
March-17	0.062%	-0.039%	-1.112%
February-17	0.043%	3.720%	11.263%
January-17	0.043%	1.788%	2.515%
December-16	0.043%	1.820%	1.341%
November-16	0.038%	3.417%	-2.803%
October-16	0.028%	-1.943%	-2.459%
September-16	0.024%	-0.123%	0.891%
August-16	0.025%	-0.122%	2.981%
July-16	0.025%	3.561%	7.320%
June-16	0.023%	0.091%	-1.239%
May-16	0.023%	1.532%	5.675%
April-16	0.019%	0.270%	-2.529%
March-16	0.024%	6.599%	8.747%
February-16	0.026%	-0.413%	10.046%

Market Model		
Regression Statistics		
Multiple R	rho	0.586603954
R Square	RR	0.344104198
Adjusted R Square		0.324813145
Standard Error		0.043974938
Observations	N	36
Estimated Parameters	k	2
Regression Coefficients		
Alpha	alpha	0.013631879
Beta	beta	0.971167221
t Statistics		4.223446709
Characteristic Line		
	Rm	E[R]
Minimum	-9.178%	-7.550%
Mean	0.978%	2.313%
Maximum	7.868%	9.005%

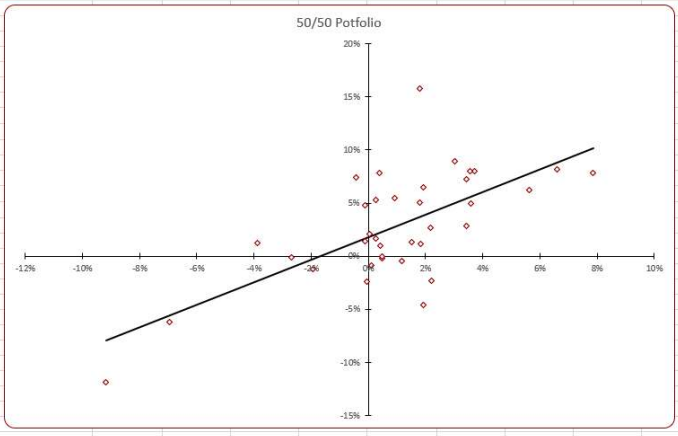


APPENDIX J – RETURNS OF 50/50 PORTFOLIO

	Rates of Return		
	3 Month T-Bill	Standard	50/50 Portfolio
January-19	0.198%	7.868%	7.823%
December-18	0.198%	-9.178%	-11.847%
November-18	0.194%	1.786%	5.054%
October-18	0.188%	-6.940%	-6.146%
September-18	0.178%	0.429%	0.968%
August-18	0.169%	3.026%	8.941%
July-18	0.163%	3.602%	4.933%
June-18	0.158%	0.484%	-0.159%
May-18	0.155%	2.161%	2.645%
April-18	0.147%	0.272%	5.320%
March-18	0.142%	-2.688%	-0.091%
February-18	0.131%	-3.895%	1.214%
January-18	0.118%	5.618%	6.208%
December-17	0.110%	3.434%	2.870%
November-17	0.103%	0.372%	7.808%
October-17	0.089%	2.219%	-2.325%
September-17	0.086%	1.930%	6.447%
August-17	0.084%	0.055%	2.080%
July-17	0.089%	1.935%	-4.544%
June-17	0.082%	0.481%	-0.005%
May-17	0.074%	1.158%	-0.453%
April-17	0.067%	0.909%	5.436%
March-17	0.062%	-0.039%	-2.420%
February-17	0.043%	3.720%	7.970%
January-17	0.043%	1.788%	15.814%
December-16	0.043%	1.820%	1.145%
November-16	0.038%	3.417%	7.284%
October-16	0.028%	-1.943%	-1.213%
September-16	0.024%	-0.123%	4.759%
August-16	0.025%	-0.122%	1.402%
July-16	0.025%	3.561%	7.973%
June-16	0.023%	0.091%	-0.866%
May-16	0.023%	1.532%	1.297%
April-16	0.019%	0.270%	1.687%
March-16	0.024%	6.599%	8.164%
February-16	0.026%	-0.413%	7.456%

Market Model		
Regression Statistics		
Multiple R	rho	0.671297927
R Square	RR	0.450640907
Adjusted R Square		0.434483286
Standard Error		0.038444326
Observations	N	36
Estimated Parameters	k	2
Regression Coefficients		
Alpha	alpha	0.01812886
Beta	beta	1.061648179
t Statistics		5.281126928
Characteristic Line		
	Rm	E[R]
Minimum	-9.178%	-7.931%
Mean	0.978%	2.851%
Maximum	7.868%	10.166%

50/50 Portfolio

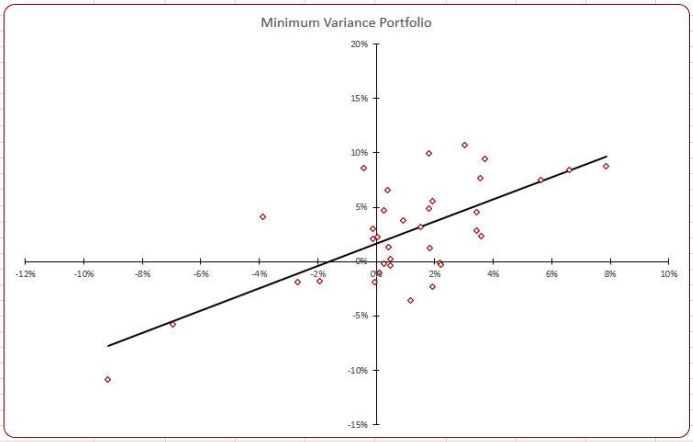


APPENDIX K – RETURNS OF MINIMUM VARIANCE PORTFOLIO

	Rates of Return		
	3 Month T-Bill	Standard	MVP
January-19	0.198%	7.868%	8.737%
December-18	0.198%	-9.178%	########
November-18	0.194%	1.786%	4.869%
October-18	0.188%	-6.940%	-5.766%
September-18	0.178%	0.429%	1.353%
August-18	0.169%	3.026%	10.708%
July-18	0.163%	3.602%	2.343%
June-18	0.158%	0.484%	0.241%
May-18	0.155%	2.161%	-0.089%
April-18	0.147%	0.272%	4.754%
March-18	0.142%	-2.688%	-1.908%
February-18	0.131%	-3.895%	4.111%
January-18	0.118%	5.618%	7.532%
December-17	0.110%	3.434%	4.575%
November-17	0.103%	0.372%	6.601%
October-17	0.089%	2.219%	-0.242%
September-17	0.086%	1.930%	5.550%
August-17	0.084%	0.055%	2.228%
July-17	0.089%	1.935%	-2.334%
June-17	0.082%	0.481%	-0.324%
May-17	0.074%	1.158%	-3.534%
April-17	0.067%	0.909%	3.773%
March-17	0.062%	-0.039%	-1.844%
February-17	0.043%	3.720%	9.419%
January-17	0.043%	1.788%	9.962%
December-16	0.043%	1.820%	1.232%
November-16	0.038%	3.417%	2.846%
October-16	0.028%	-1.943%	-1.761%
September-16	0.024%	-0.123%	3.057%
August-16	0.025%	-0.122%	2.097%
July-16	0.025%	3.561%	7.686%
June-16	0.023%	0.091%	-1.030%
May-16	0.023%	1.532%	3.223%
April-16	0.019%	0.270%	-0.168%
March-16	0.024%	6.599%	8.421%
February-16	0.026%	-0.413%	8.596%

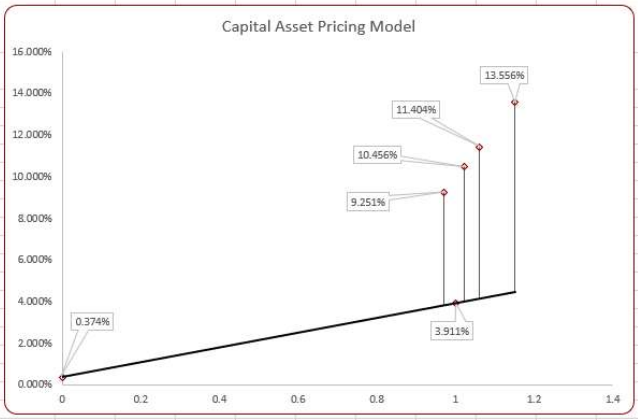
Market Model		
Regression Statistics		
Multiple R	rho	0.694473244
R Square	RR	0.482293087
Adjusted R Square		0.467066413
Standard Error		0.034722156
Observations	N	36
Estimated Parameters	k	2
Regression Coefficients		
Alpha	alpha	0.016150188
Beta	beta	1.021836557
t Statistics		5.627985822
Characteristic Line		
	Rm	E[R]
Minimum	-9.178%	-7.763%
Mean	0.978%	2.614%
Maximum	7.868%	9.655%

Minimum Variance Portfolio



APPENDIX L – CAPITAL ASSET PRICING MODEL

Capital Asset Pricing Model

Asset		Observed Monthly Return	SML Calculations (Annual Returns)			
			Beta	Observed Annual	Calculated	Abnormal
3 Month T-Bill	TB3MS	0.093%	0	0.374%	0.374%	0.000%
Standard & Poor 500	S&P 500	0.978%	1	3.911%	3.911%	0.000%
CSX Corporation	CSX	3.389%	1.152	13.556%	4.449%	9.107%
Cisco System	CSCO	2.313%	0.971	9.251%	3.809%	5.442%
50/50 Portfolio		2.851%	1.062	11.404%	4.129%	7.275%
Minimum Variance Portfoli	MVP	2.614%	1.022	10.456%	3.988%	6.468%

Capital Asset Pricing Model