

# Strategic Risk Assessment - Costco

ANLY 515 - 90 Late Fall – Risk Modelling and Assessment

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**Abstract:** Strategic Risk assessment and Stock assessment of Costco and its competitors. Calculating risks of Costco and its competitors by running the simulations by including uncertainty in key performance indicators using the ModelRisk software.

## Introduction

As a part of course project work, I have chosen Costco company as core company and Target, Walmart, Sears Holdings as its competitors. I have applied all my knowledge gained through this course while performing the analysis. I have used ModelRisk software(Excel-add-in) to run the simulations. In this analysis, my computations include Montecarlo techniques, fitting the distributions, identifying key performance indicators, including the uncertainty, calculating the rate of returns, the cost of equity, proforma statement and multivariate time series analysis, Portfolio Optimization using Markowitz Method, etc.

This report contains the risk analysis intuitions and interpretations on chosen Costco company and its competitors. The required financial documents i.e. Income Statement, Balance Sheet, Cash flow statement and Stock prices are collected from the yahoo finance (<https://ca.finance.yahoo.com>). The financial documents are gathered for the last three years i.e. 2014, 2015 and 2016. The Daily Stock Prices are downloaded for the previous five years i.e. 2011, 2012, 2013, 2014, 2015 and 2016. Though, I have downloaded daily high and low stock prices, I have considered only “adjusted close” for my analysis.

In this analysis, I have performed a strategic risk assessment on Costco and its competitors; and rate of returns from each company stocks. To accomplish these tasks, I have started with an Exploratory Analysis of the data followed by VAR Analysis, Proforma Analysis, Correlation Analysis, Time Series Analysis and Portfolio Optimization.

## Exploratory Analysis

When it comes to the exploratory analysis, I have computed basic descriptive analysis of the collected data. The average (mean) total revenue of Costco company for the last 3 years is \$115,852,667, mean cost of revenue is \$100,808,000 and mean Selling General & Administrative cost is \$11,470,667. The median and mode values for the daily adjusted stock price for the Costco company is \$111.30 and \$150.55 respectively. The average daily adjusted closing stock price (last

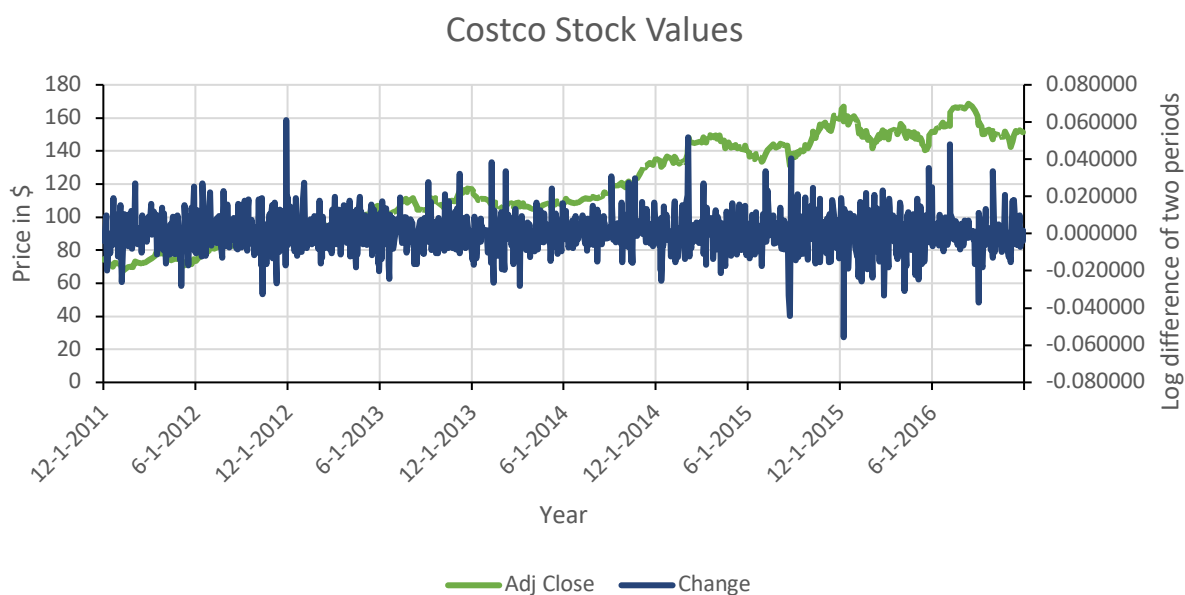
five years) for the Costco company is \$118.00 with a standard deviation of \$28.24. The minimum adjusted stock price is \$67.55 and the maximum adjusted stock price is \$168.52.

The average Total Revenue of Walmart company for the last three years is \$481,358,333, mean value for Cost of Revenue is \$361,379,667 and mean Selling General & Administrative cost is \$93,937,333. The average daily adjusted closing stock price (last five years) for the company Walmart is \$67.42 with a standard deviation of \$7.07. The minimum and maximum adjusted stock prices for the company Walmart are \$50.60 and \$85.54 respectively. The median and mode values for the company Walmart are \$68.88 and \$69.97 respectively.

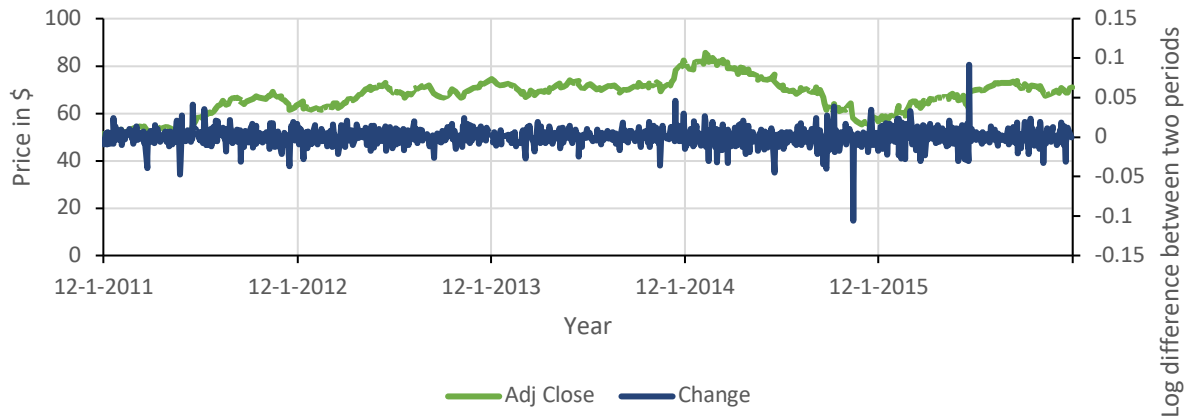
The average (mean) Total revenue of Target company for the last 3 years is \$72,560,667, mean Cost of Revenue is \$51,104,667 and mean Selling General & Administrative cost is \$14,602,000. The median and mode values for the daily adjusted stock price for the Target company is \$60.60 and \$80.64 respectively. The average daily adjusted closing stock price (last five years) for the Target company is \$62.65 with a standard deviation of \$9.84. The minimum adjusted stock price is \$42.24, and the maximum adjusted stock price is \$81.99.

The average Total Revenue of the Sears Holdings company for the last three years is \$30,844,000, the mean value for Cost of Revenue is \$23,606,000 and mean Selling General & Administrative cost is \$8,153,667. The average daily adjusted closing stock price (last five years) for the company Sears Holdings is \$31.81 with a standard deviation of \$10.80. The minimum and maximum adjusted stock prices for the enterprise Sears Holdings are \$10.58 and \$62.97 respectively. The median and mode values for the enterprise Sears Holdings are \$33.97 and \$13.00 respectively.

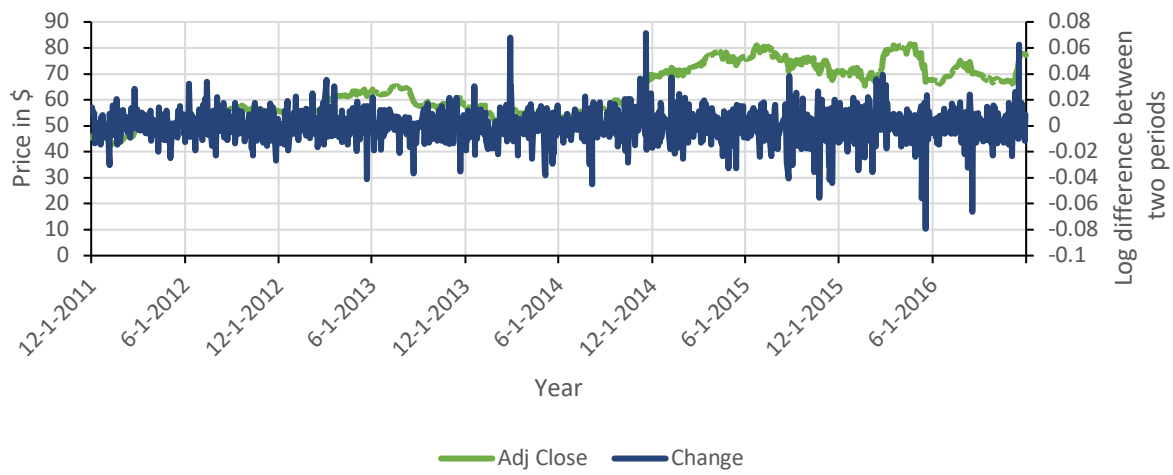
When we look at the below graphs for daily adjusted stock values for all companies, we can draw insights from the charts as:



### Walmart Stock Values



### Traget Stock Values



### Sears Stock Values

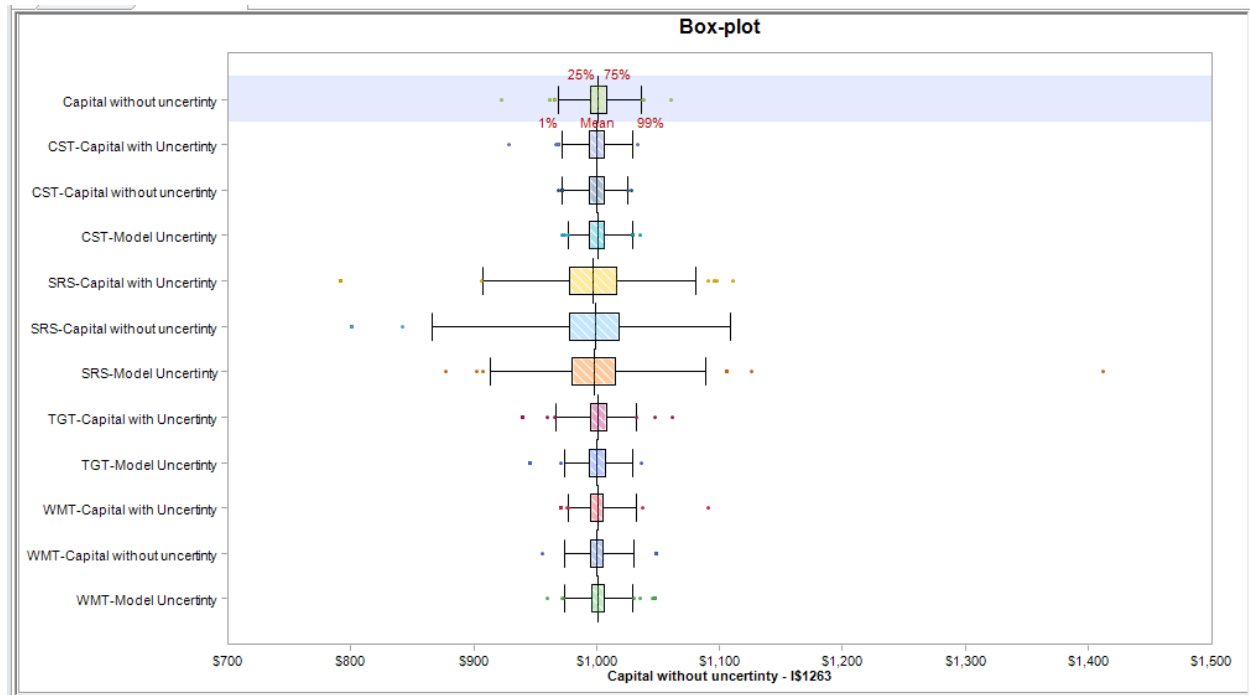


- Sears Holdings is underperforming since the last five years when it is compared with all other companies. The stock value for this company was fluctuating between the year 2011 and 2015, but after that the stock price had a downfall.
- Walmart has very slight growth rate when it is compared with Costco and Target companies. When we compare Walmart and Sears companies, Walmart has better growth in their stock values.
- Target has a significant growth rate in the last five years. When we compare Target share prices with other companies i.e. Walmart and Sears, Target company has a significant growth rate in their stock prices.
- Costco has exceptional growth in their stock prices from the year 2011 to 2016. When we compare Costco stock prices with other company stock prices (Walmart, Target, Sears), Costco has the highest growth rate in their stock prices.

With the above information, we can say that Costco company is performing well though it has few hiccups between the year 2015 and 2016. Sears Holdings is completely underperforming.

## **VAR Analysis**

To obtain the rate of return from the company stock values, I have performed value at risk analysis (VAR). I have considered \$1000.00 as an investment for the next day and based on that, I have calculated returns and losses for the next one year (considering 252 days as a year as per stock market). When we find model uncertainty, Costco Corporation has more rate of returns and less risk when compared with other companies. When we compare the rate of returns from the stocks, Costco rate of return is higher when compared with Costco competitors (Walmart, Sears) except Target. When we see the below box and whiskers plot, there are three different plots for each company. These plots represent capital without uncertainty, capital with uncertainty and model uncertainty. To know about best returns and fewer risks, we can check for 1% value at each box and whisker plot. When we observe 1% value, Costco has a return value of \$ 977.26 for \$1000.00 capital (considering the worst scenario). With this information, we can say that Costco company has less risk when it is compared with other companies(Walmart). Other than that, we can say that VAR is not a value, it is a distribution. In the below-mentioned graph, CST represents Costco company, TGT represents Target company, WMT represents Walmart company and SRS represents Sears holdings company.



## Proforma Analysis

I have created proforma statements for Costco and its competitors (Target, Walmart, Sears) till the year 2025. I have identified few key performance indicators like terminal growth, annual cost decrease, cost of revenue and beta value to implement the uncertainty. While inserting the uncertainty into identified key variables (Beta value, annual cost decrease, and terminal growth), I have assumed few scenarios. As this is an academic project and don't have access to get the experts weightage, I have assumed weights as 0.4, 0.4 and 0.2.

For annual cost decrease, I have considered minimal, most likely and maximum values with minimal deviation from the actual value. I have used "triangle distribution" to compute the distribution as it is perfect for this kind of analysis. As, variance in min and max values will affect the triangle distribution, I have used very minimal deviation values around the actual value.

While preparing Proforma statements of all companies, I have taken sales growth for the next year from Yahoo finance analyst forecasted values. For the cost of revenue, I have considered the average cost of revenue from the income statements. For SG&A, I have found last three years average administrative cost from the income statements. For terminal growth, I have assumed that terminal growth is equal to the last three years' average sales growth from company financial statements. I have calculated a Beta value based on the rate of returns from the stocks (chosen four companies) and closing stocks of S&P 500 values. For riskless, I have used US Treasury bonds ten years' yield value. I have assumed risk premium as 8% for all the companies. I have used 33% tax rate for all the companies while computing Proforma statements.

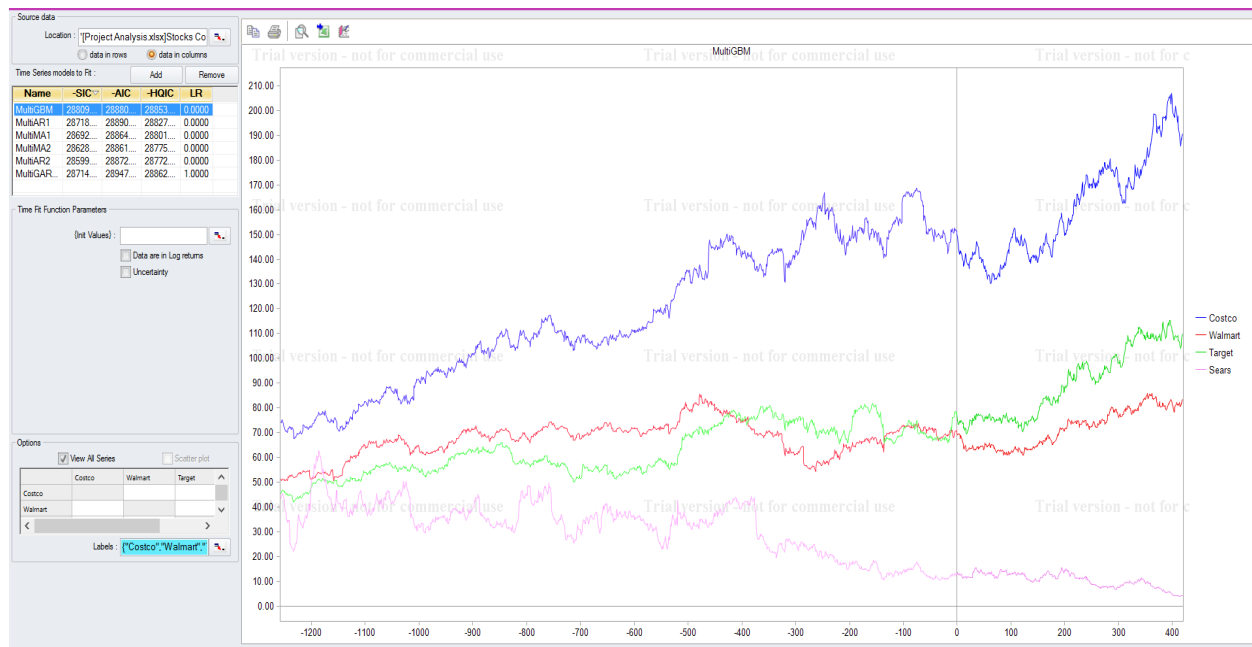
I have used the cost of equity to calculate the Proforma statements. When I calculated the Proforma statements for all the companies using above mentioned values, after 1,000 simulations, the Total value and percentage of Terminal values are as follows. For the Costco Corporation, Total value and percentage of Terminal value are \$173,222,597.60 and 64.27% respectively. These calculations and simulation results can be found in “Costco – Analysis” spreadsheet under “Project Analysis” workbook. For Walmart company, Total value and percentage of Terminal value are \$478,882,263.44 and 66.51% respectively. These calculations and simulation results can be found in “WMT – Analysis” spreadsheet under “Project Analysis” workbook. For the Target company, Total value and percentage of Terminal value are \$330,958,057.83 and 56.18% respectively. These calculations and simulation results can be found in “TGT – Analysis” spreadsheet under “Project Analysis” workbook. For Sears Holdings company, Total value and percentage of Terminal value are \$171,846,327.94, 32.64% respectively. These calculations and simulation results can be found in “SHLD – Analysis” spreadsheet under “Project Analysis” workbook.

## **Correlation**

In this analysis, the correlation analysis has been performed using copula object. I have used four companies i.e. Costco, Target, Walmart and Sears stock values to identify the correlation copulas. To compute copula values, I have considered the change in daily stock prices (the logarithmic difference between two consecutive stock values). I have used multivariate copula fit distribution to find out the correlation patterns. In this scenario, T model is the best-fit model for the correlation between the four companies. Later, I have used these copula values as U values in my distribution. By including U value in the model, we are taking care of historical values correlation while modeling forecasted or predicting future values. As this correlation, can be taken care by time series analysis, I have not mentioning any correlation result in this section. The time series analysis will be discussed in the next section.

## **Time Series Analysis**

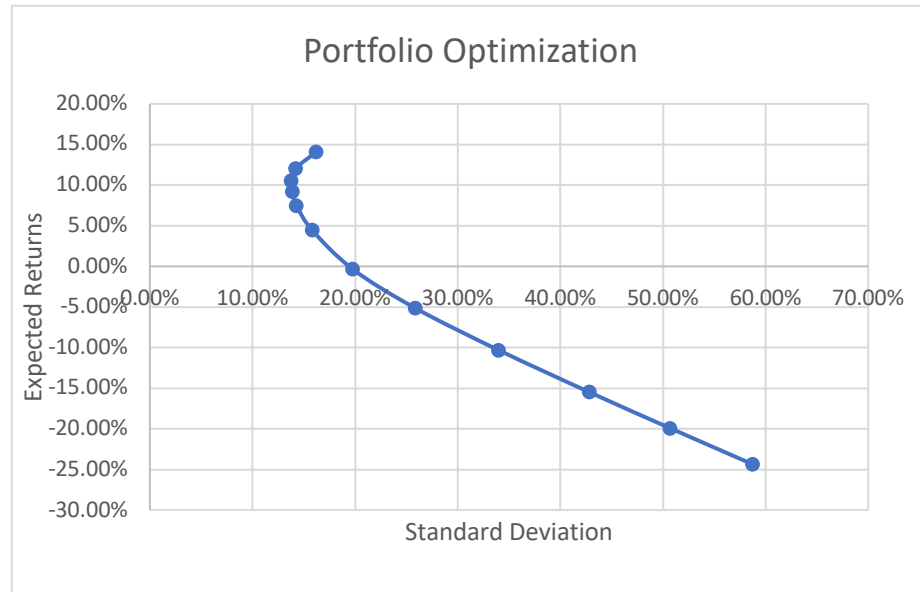
All the companies in the same market (Retail, Healthcare, Services, Consumer goods, etc.) have similar kind of effects regarding government rules, taxes, etc. for that market sector. When we consider the Costco and its competitors, we can assume that these companies will have some correlation between them. If we forecast the returns or stock prices from the historical stock values without considering the correlation and time factor, the predicted results may lead to biased or incorrect results. To handle correlation and time factor, I have used “Multivariate Time Series Model fit” to select best-fit distribution. When I use this method and consider SIC metric, Multi-Variate Geometric Brownian Motion (Multi GBM) model is the best fit for the historical stock prices for Costco, Walmart, Target and Sears companies. The output of this model (forecasted values) has been copied in the form of an array for seven months’ in “Stocks Correlation – Forecasting” spreadsheet of “Project Analysis” workbook. Apart from these forecasting, multivariate time series fit model handles correlation and time factor in time series data. Below graph represents 491 days forecast of four companies stock prices.



## Optimization

I have used Markowitz method to perform portfolio optimization. I have used Excel solver to compute this analysis. I have used returns from the stocks to calculate optimization values. As mentioned in the previous section, I have taken the output of stock returns in the form of an object which will give an average of daily returns and covariance matrix. I have multiplied each value of the time series model output with the value 252; because the generated output is a daily stock value returns which should be converted into annual returns. After that, I have used portfolio optimization template to compute optimal values and plot the graph. When I converted the daily returns into annual returns, Costco, Walmart, Target and Sears companies returns are 14.06%, 6.26%, 10.65% and -24.35% respectively. I have used the below constraints while using solver. These constraints are mentioned in “Stocks Correlation-Forecasting” spreadsheet of “Project Analysis” workbook.

1. Minimize the variance in the returns.
2. Weights as changeable variables (N1264: Q1264).
3. Weights should be lesser than 1.
4. Weights should be greater than 0.
5. The return value should be equal to the target value.
6. Weights total should be equal to 1.



Parabola in the above graph shows the risks and returns ratio. An investor can go with higher returns with a similar amount of risk which is 10.06% returns with 16.20% risk when compared with 4.45% returns with 15.81% risk. If an investor would like to go with less risk, an investor can choose 10.50% returns with 13.76% risk factor.

**Solver Parameters**

Set Objective:

To: ☐ Max ☒ Min ☐ Value Of:

By Changing Variable Cells:

Subject to the Constraints:

- 
- 
- 
- 

☐ Make Unconstrained Variables Non-Negative

Select a Solving Method:

**Solving Method**  
Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

## Conclusion & Final Thoughts

With all the above-mentioned analysis, we can make few conclusions based on the analysis results. They are:

1. Costco company is performing better than its competitors.
2. Costco is having the highest rate of returns from their stocks.



3. Walmart has the highest terminal value than Costco, which means that Walmart has good growth rate in the proforma statement.
4. The forecasted stock prices represent that Costco will have higher returns in the future followed by Target and Walmart. Sears does not have any growth in the future.
5. An investor can use below-mentioned stocks portfolio to make investments in the selected four companies to get higher returns.

Risk	Returns	Costco Weight	Walmart Weight	Target Weight	Sears Weight]
58.70%	-24.35%	0.00%	0.00%	0.00%	100.00%
50.69%	-19.92%	0.00%	14.46%	0.00%	85.54%
42.84%	-15.50%	0.00%	28.90%	0.00%	71.10%
33.99%	-10.32%	0.00%	45.83%	0.00%	54.17%
25.87%	-5.15%	0.00%	62.72%	0.00%	37.28%
19.77%	-0.35%	0.00%	78.40%	0.00%	21.60%
15.81%	4.45%	12.40%	63.65%	13.01%	10.94%
14.28%	7.50%	27.92%	50.60%	16.11%	5.37%
13.86%	9.20%	36.57%	43.33%	17.84%	2.27%
13.76%	10.50%	43.62%	37.26%	19.13%	0.00%
14.18%	12.02%	62.74%	17.47%	19.80%	0.00%
16.20%	14.06%	100.00%	0.00%	0.00%	0.00%

6. Though Walmart has the highest growth rate in the company terminal value, investing in Costco company will give a higher rate of returns with less risk.
7. If an investor would like to take the minimal risk (13.76% risk and 10.50% returns), he/she can distribute the total investment across Costco, Walmart, and Target companies. The distribution percentage would be 43.62%, 37.26%, and 19.13% respectively.

## Risks & Assumptions

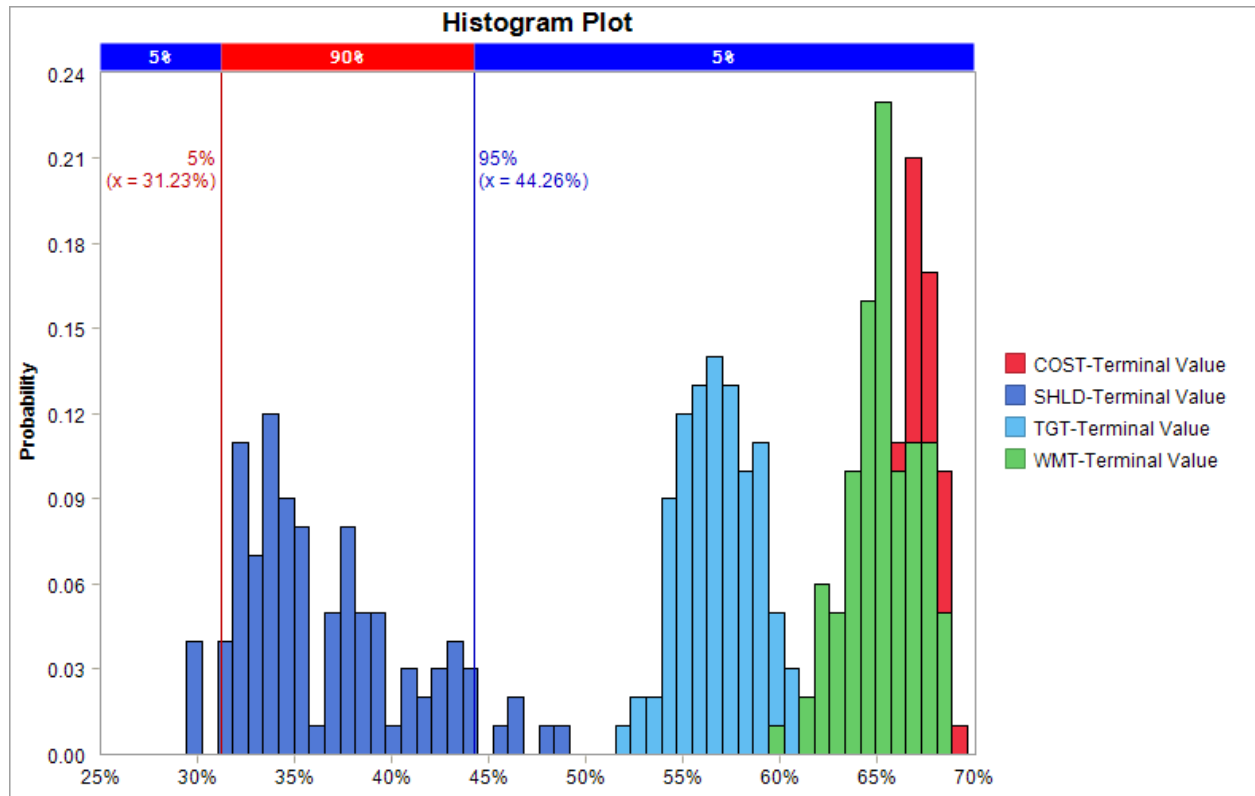
- The data has been collected from internet source with an assumption that everything is being correct.
- Tax rates are considered as 33% for all the companies.
- The risk premium is assumed as 8% for all the companies.
- Riskless is considered as ten years' yield rate of US treasury bonds.

## Appendix - I

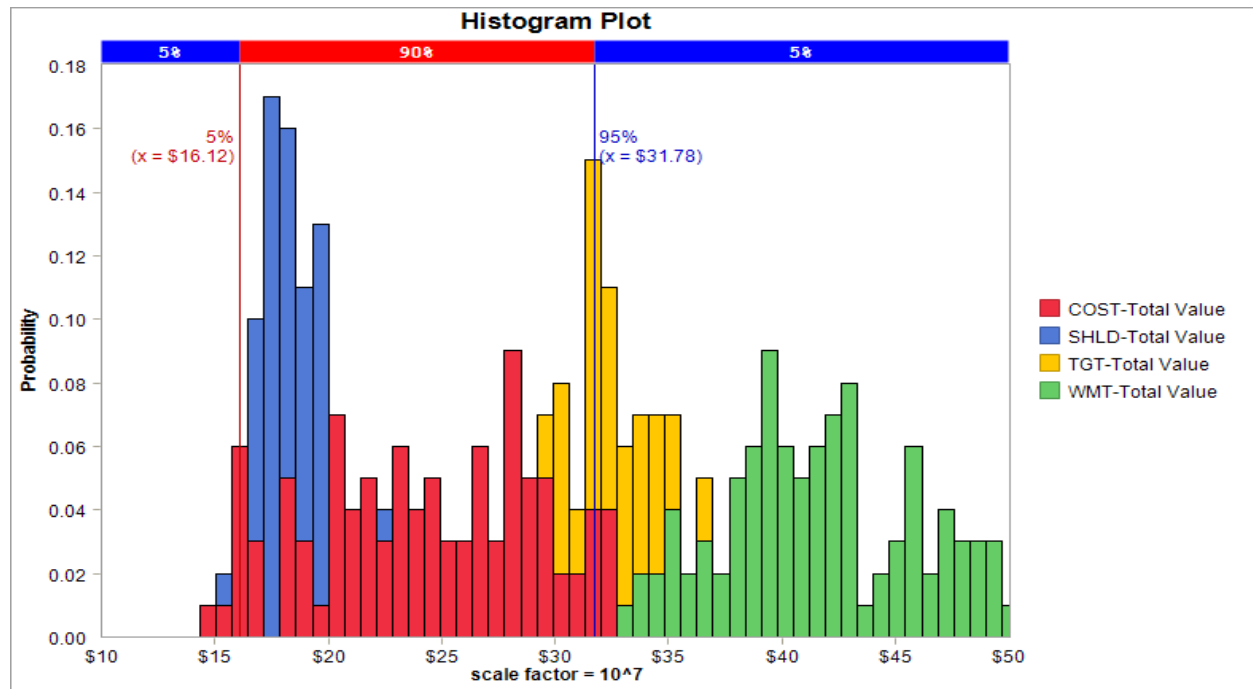
### Different graphs which support the analysis report:

In this section, several graphs have been attached. Each graph is used to interpret the performance or distribution of companies. These plots which are relevant to this report have been pasted here.

### *The overlay chart of All companies Terminal values:*

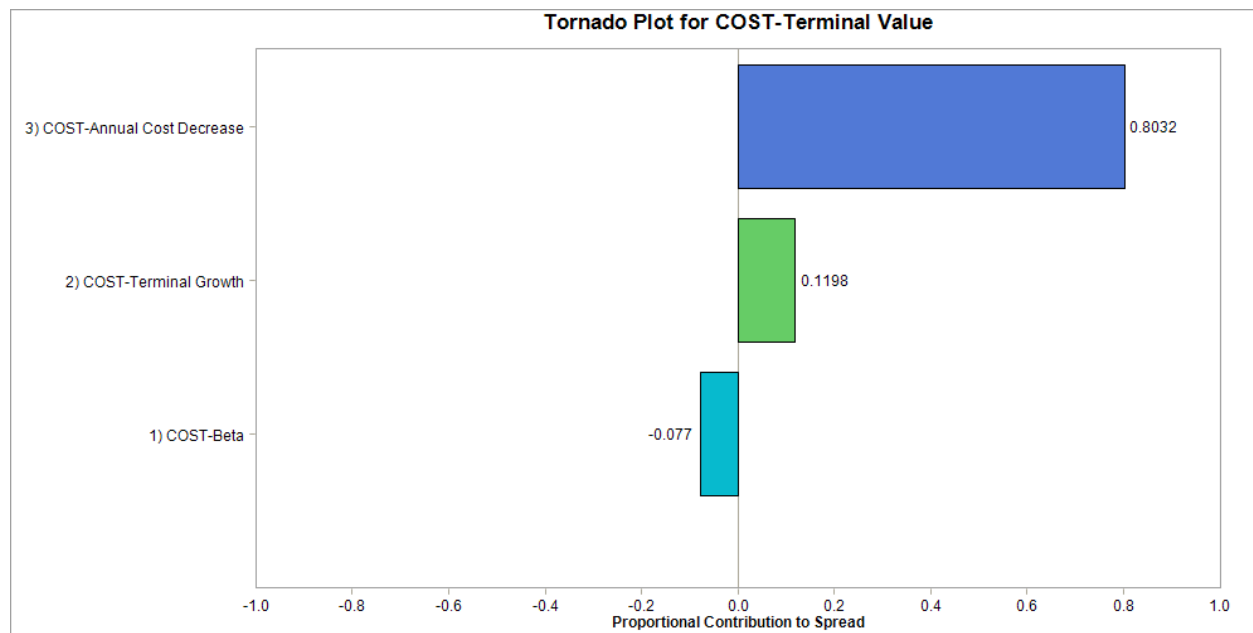


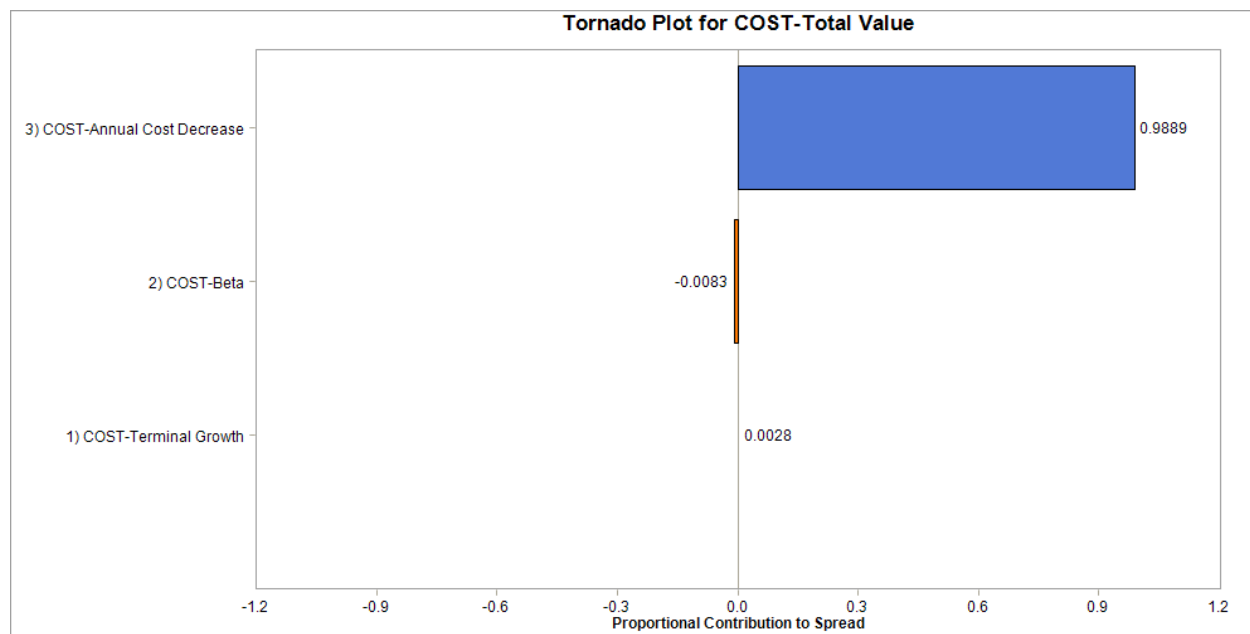
**Overlay chart for “Total Value” of all the companies:**



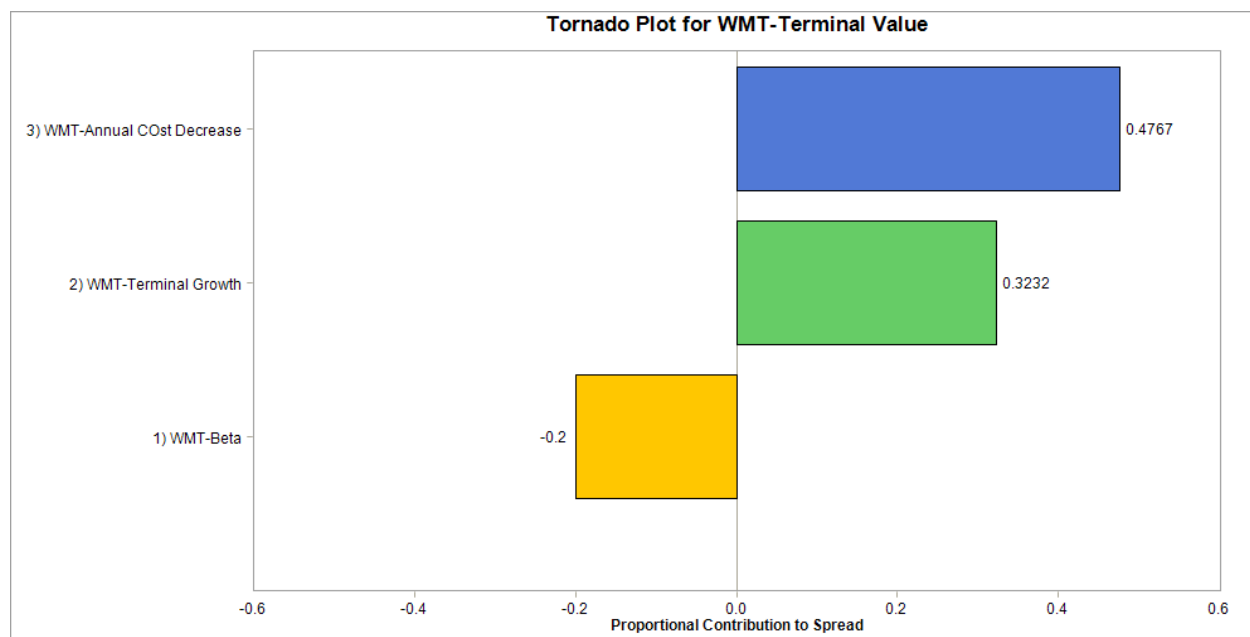
Key variables (Terminal growth, Beta and Annual cost decrease) Proportional contribution to spread

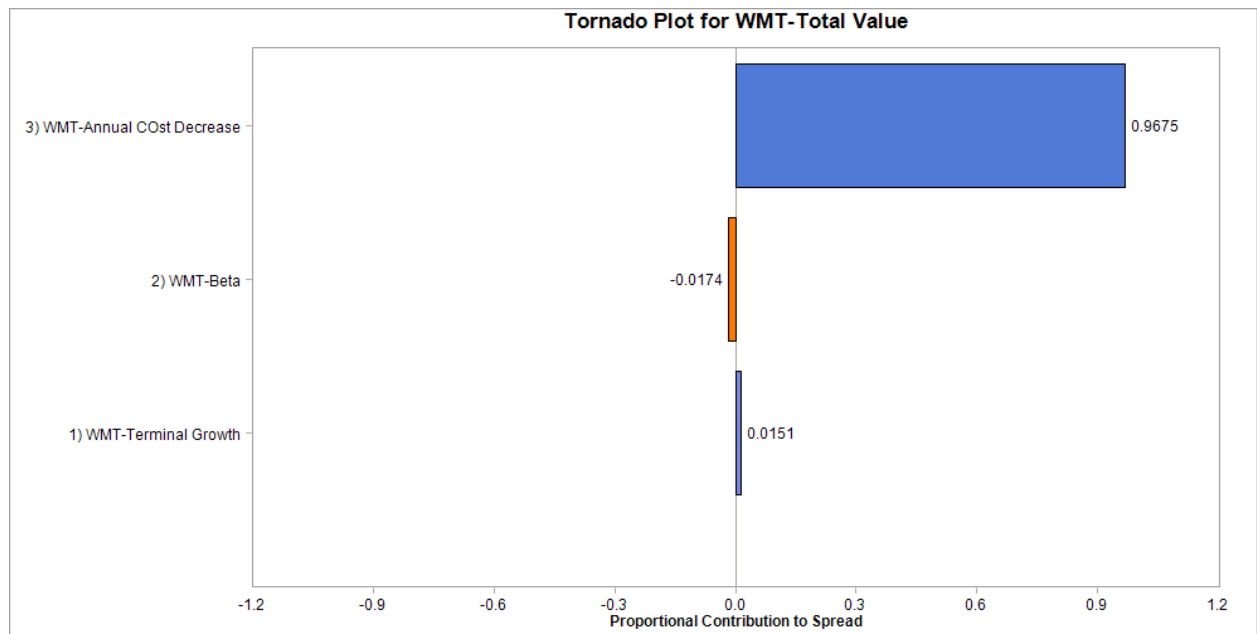
**For Costco company:**



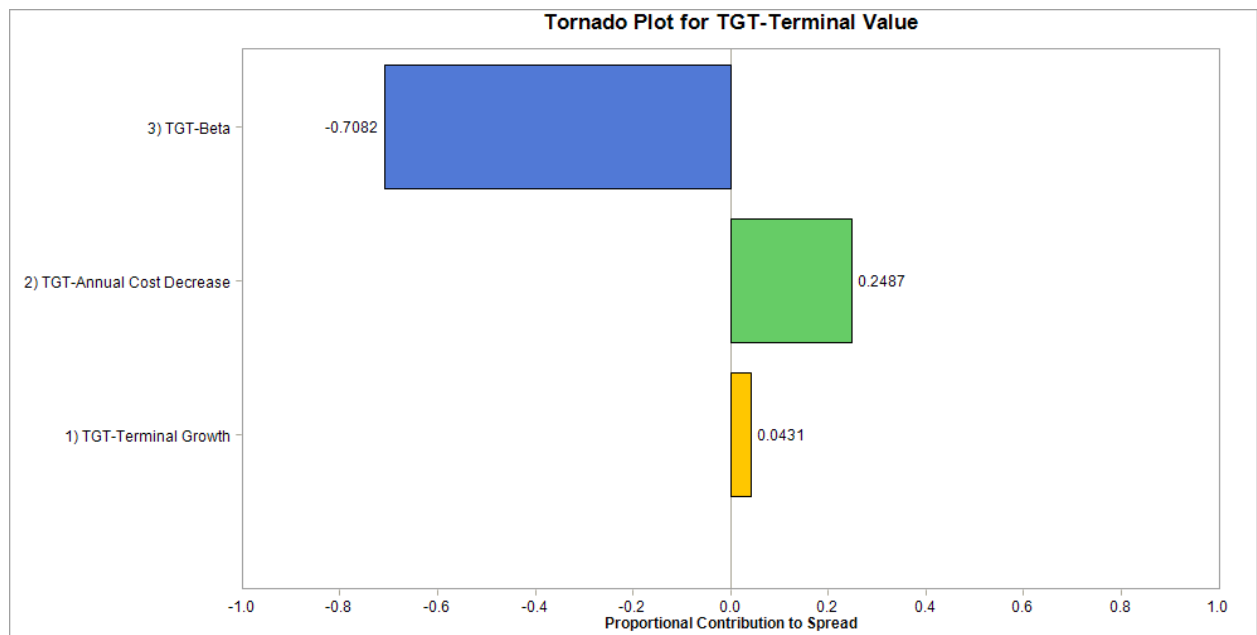


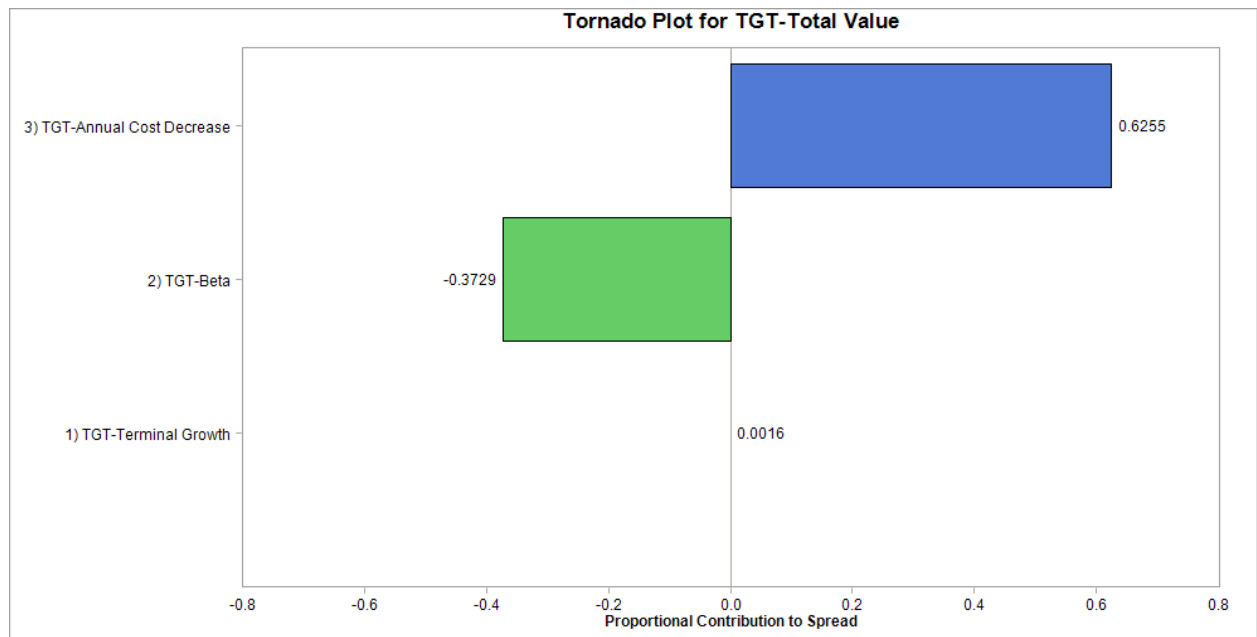
***For Walmart:***



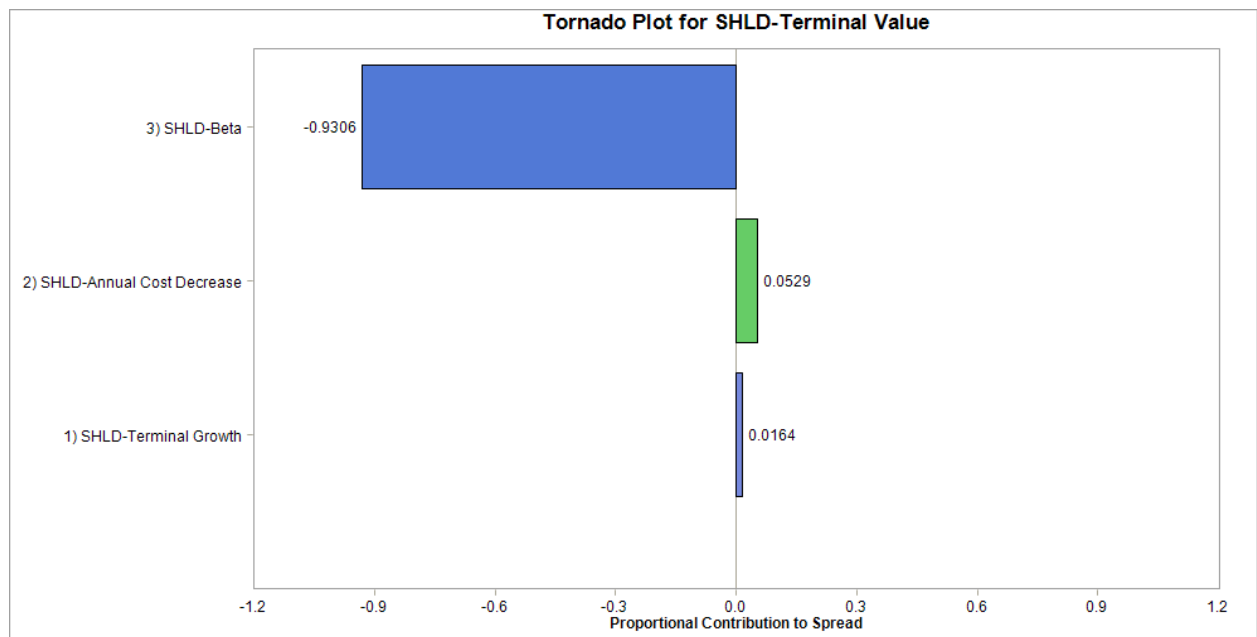


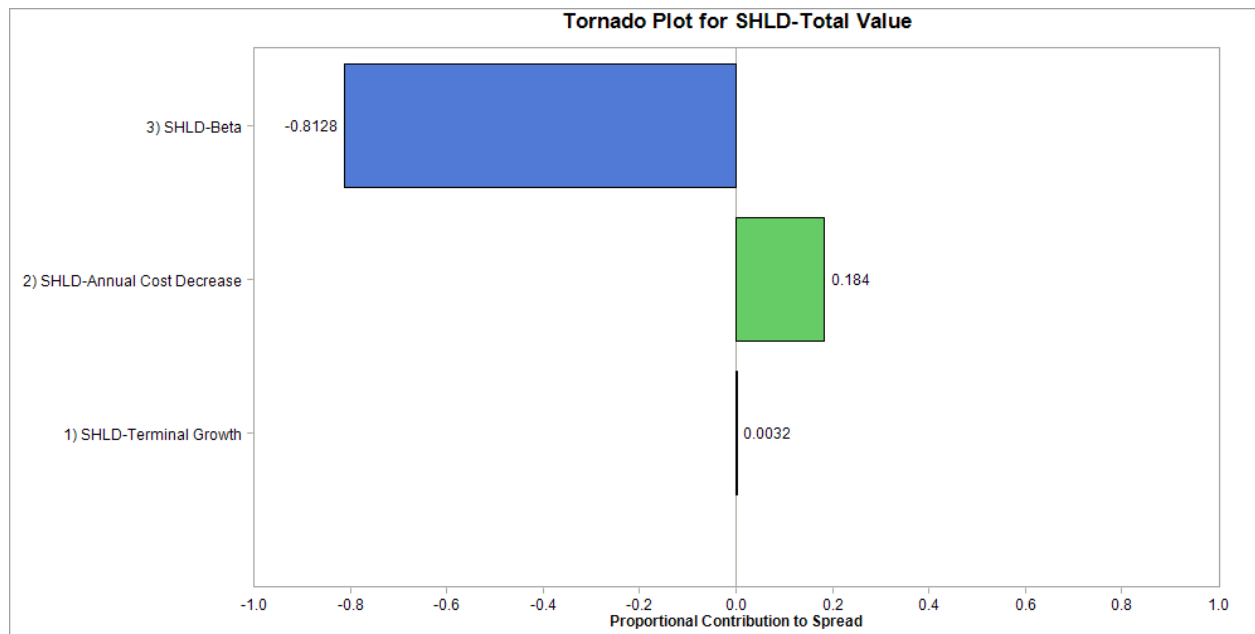
***For Target:***





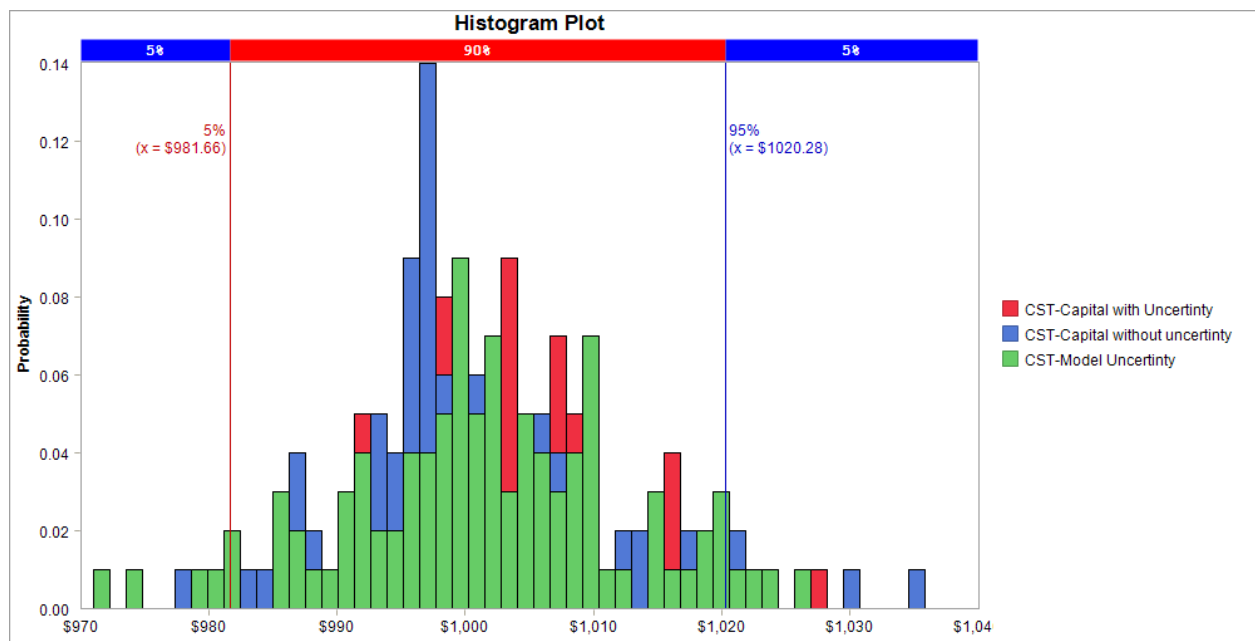
***For Sears Holdings:***



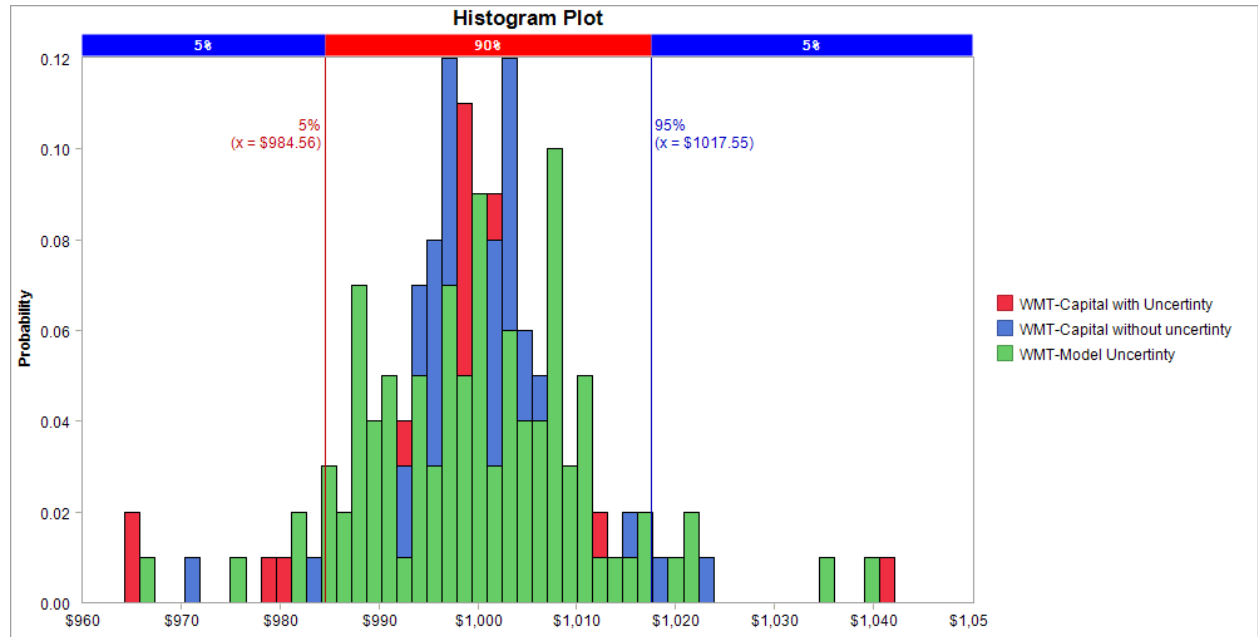


Stock prices distributions for all the companies with and without uncertainty

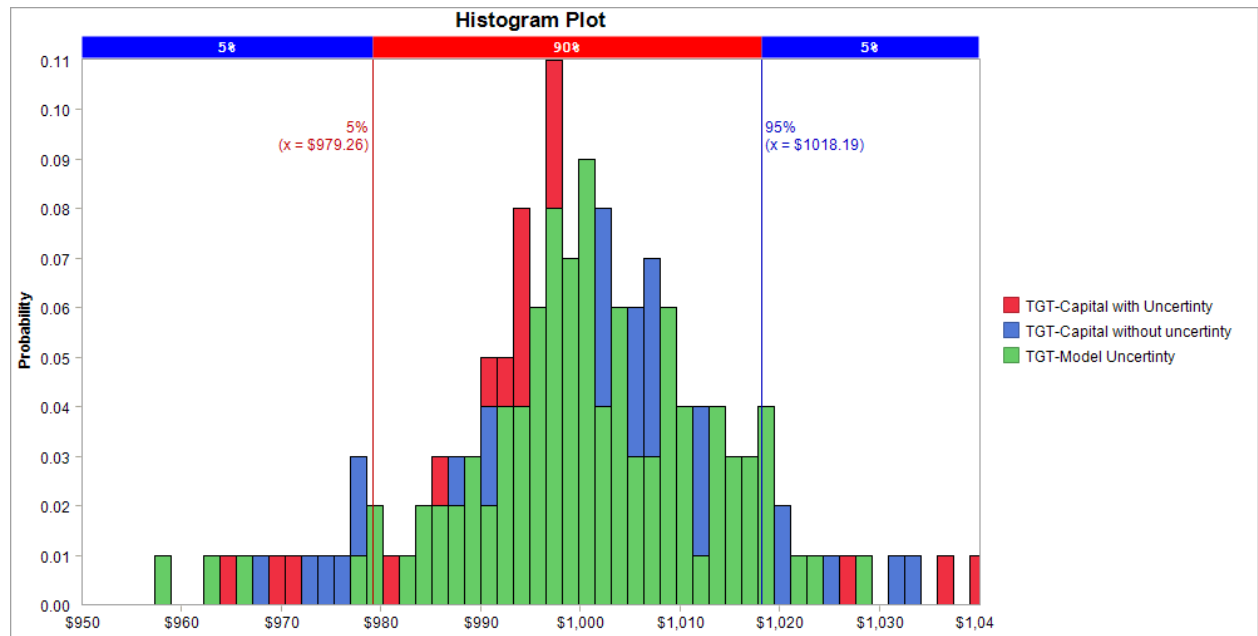
**For Costco:**



### For Walmart:

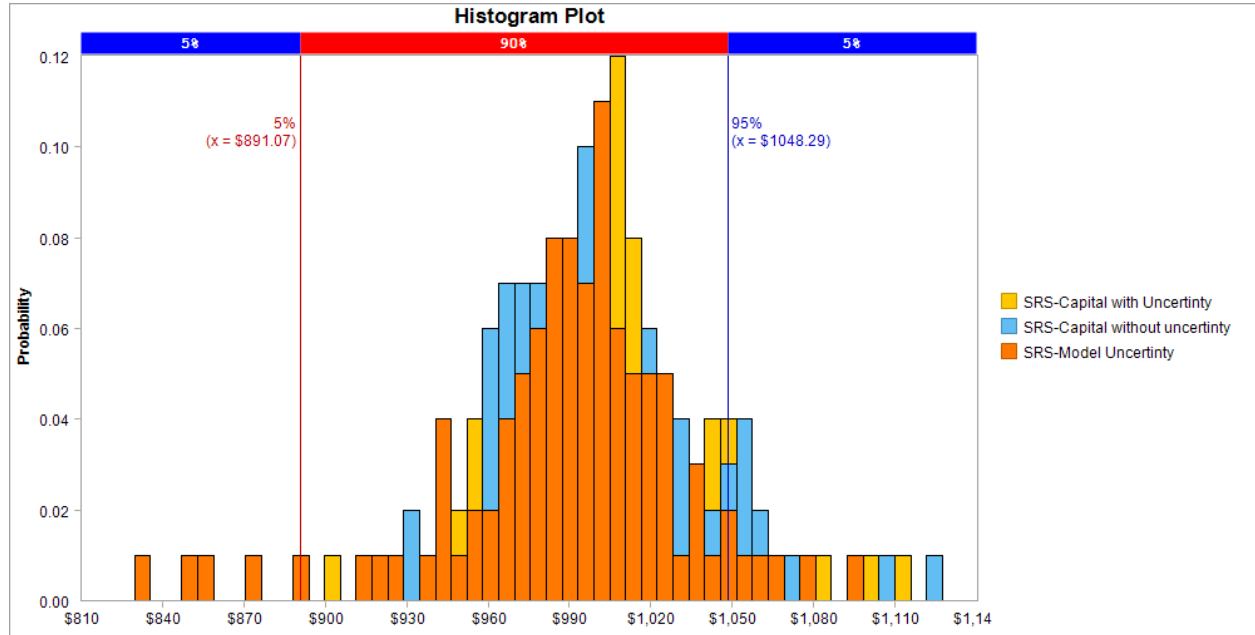


### For Target:



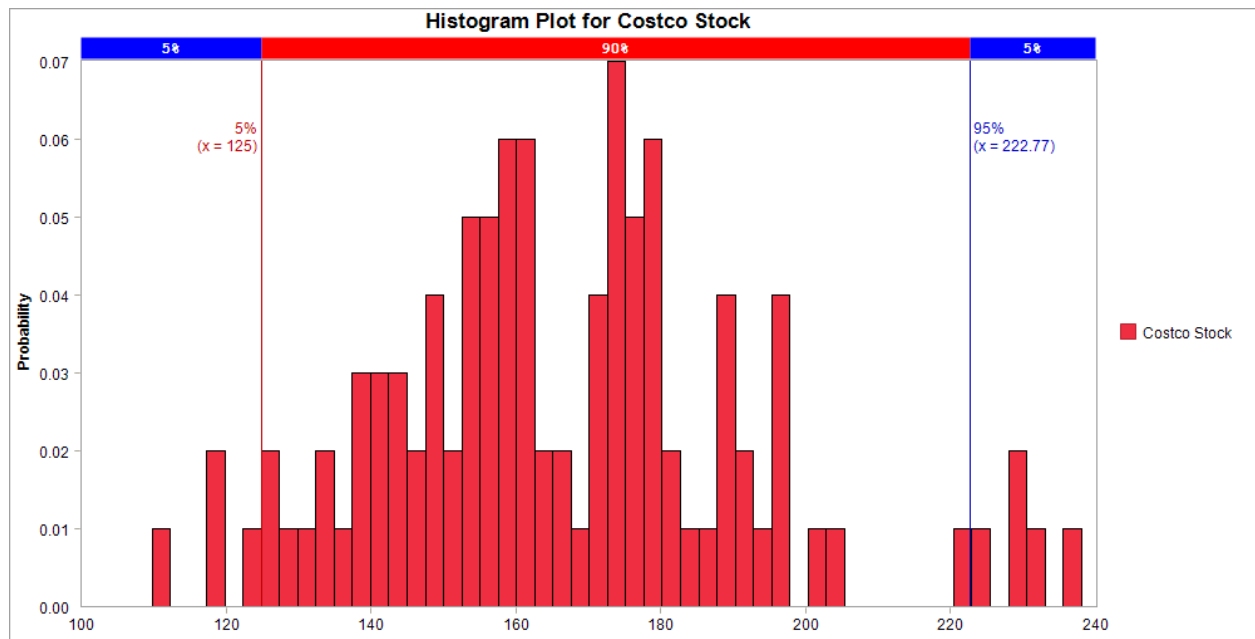


### For Sears Holdings:

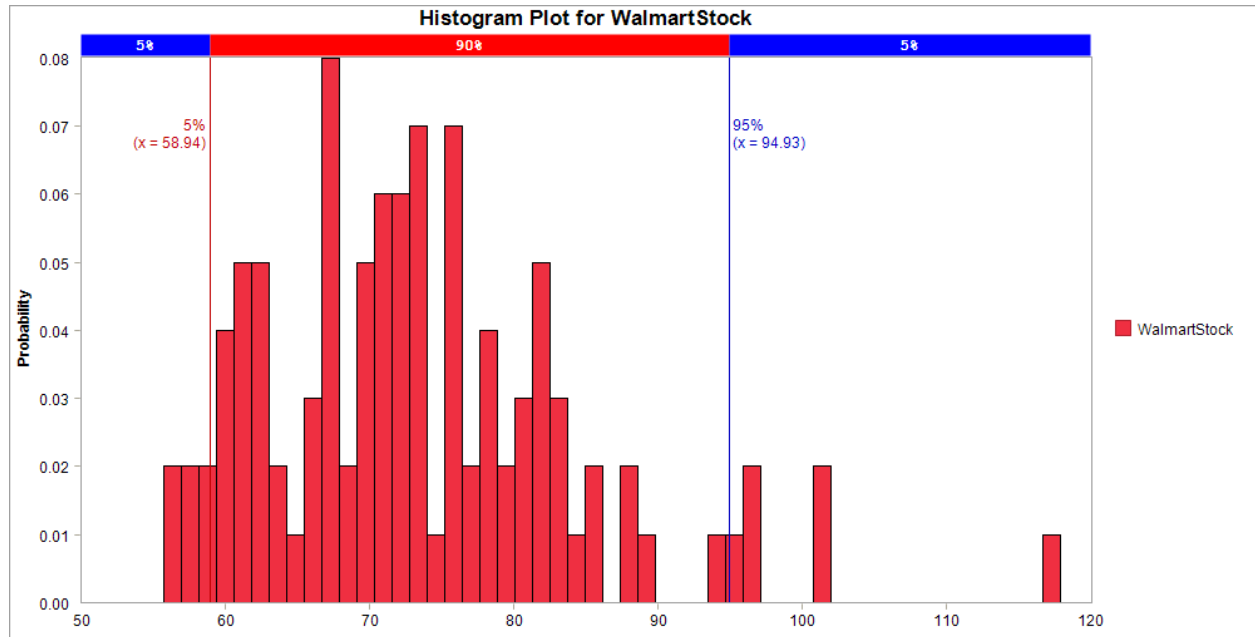


All companies forecasted stock values distribution after simulation

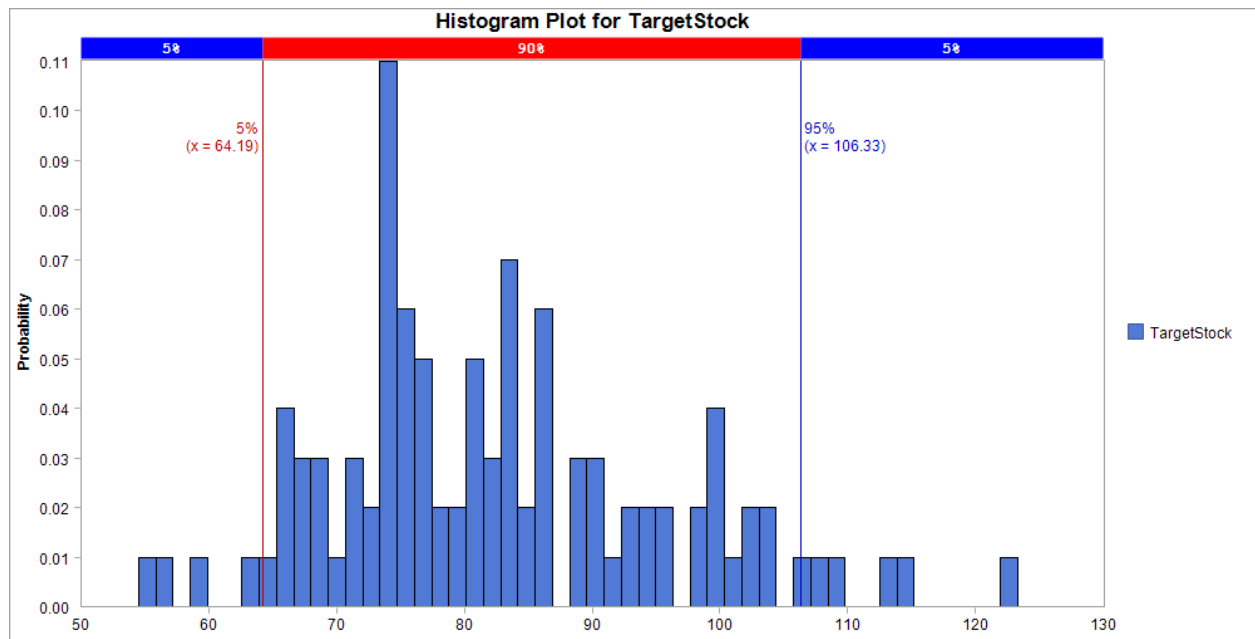
### For Costco:



**For Walmart:**



**For Target:**



**For Sears:**

