



RADFORD BRIEF

Relative TSR Plans: Valuation 102 – The Impact of Volatility on Valuation

More than 400 of the Fortune 1000 companies have adopted a Relative Total Shareholder Return (TSR) program, making it one of the fastest-growing types of plans.* For these companies, and those that are currently considering implementing TSR-based plans, it is important to understand the role that modeling assumptions – the company's and its peers – play in driving plan valuation.

Radford released [Relative Total Shareholder Return Plans: Valuation 101](#) in 2009, which provided an overview of the required valuation for TSR plans. This Brief focuses specifically on how expected volatility, as well as other assumptions in the value model, impacts the cost of the plans.

Overview of ASC Topic 718 Valuation

Topic 718 (formerly FAS 123R) requires that valuations of TSR-based performance shares take into account expected price movement, a calculation frequently performed through a Monte Carlo simulation. The valuation is built upon the following assumptions: performance period term, risk-free rate, dividend yield, expected volatility (for the company and each peer), and a correlation coefficient (for each peer company). See [Valuation 101](#) for a more in-depth review. Each of these assumptions, especially volatility and correlation coefficient, can significantly alter the valuation. For example, if the issuing company's volatility is significantly above or below the volatility of its peer companies, it will skew the distribution, down or up respectively, and affect the ultimate payout under the Relative TSR plan.

As described in Radford's Theorem on Relative TSR valuation (see Appendix 1), the net effect of these differences illustrates the importance of selecting peers, for valuation purposes, with similar volatility and correlation coefficients:

"If all companies are perfectly correlated (correlation coefficient of 1.0) and all economic assumptions (expected volatility of each) are the same, then a Relative TSR share equals a regular share."

Radford's Theorem underscores the importance of selecting an appropriate peer group because the valuations can fluctuate dramatically depending on the actual peers chosen. To illustrate the impact, we will refer to the example below about Company X.

“If all companies are perfectly correlated (correlation coefficient of 1.0) and all economic assumptions (expected volatility of each) are the same, then a Relative TSR share equals a regular share.”

Company X Example

Company X grants performance units with a future payout ranging from 0% to 200%, depending on Company X’s three-year TSR performance, as compared to a 400-member index. The payouts are defined as follows:

Percentile Rank	Payout Percentage ¹
75 th and above	200%
50 th	100%
Below 25 th	0%

¹ Payout Percentage is linearly interpolated between percentiles

We used the following assumptions in the Monte Carlo simulation model:

- > Stock Price = \$10.00
- > Volatility = 50% (for all 401 companies)
- > Risk Free Rate of Return = 3%
- > Correlation Coefficient = 0.60 (for all 401 companies)

After performing the Monte Carlo simulations, the results are:

Percentile Rank	Percentage of Time
0 to 25 th Quartile	25%
26 th to 49 th Quartile	25%
50 th to 74 th Quartile	25%
75 th or greater Quartile	25%
Total	100%
Fair Value	\$14.79
Fair Value as a % of Grant	147.9%

The probability distribution for each quartile is exactly 25% each because each company has the same volatility and correlation coefficient, yielding a perfectly random distribution. The Fair Value for this scenario is approximately 148% of the initial Grant Price.

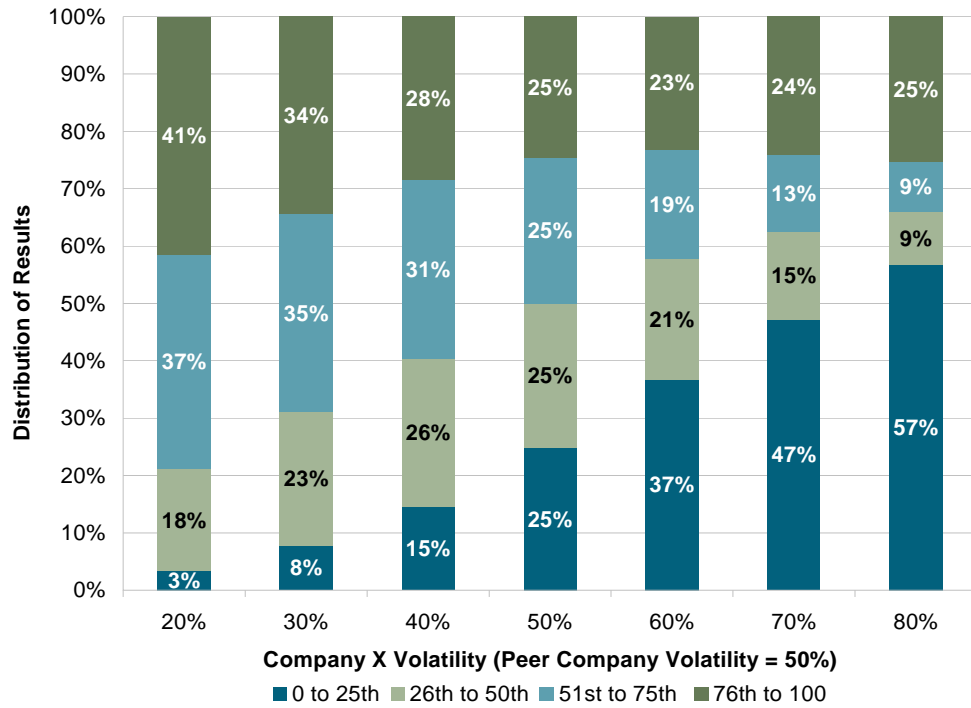
Impact of Changes In Expected Volatility

Charts 1 and 2 below illustrate the impact that changes in expected volatility for Company X have on the distribution of percentile rankings and the associated fair value. The x-axis of **Chart 1** is Company X’s volatility. Since each peer company uses an assumed 50% volatility, 20% in the x-axis means that Company X’s volatility is 0.30 less than the peer’s volatility.

As the volatility of Company X decreases (relative to the peers), it becomes more likely that Company X ends up with a TSR ranking in the upper quartiles (over-performing). Likewise, as Company X’s volatility increases (relative to the peers), it becomes more likely that Company X ends up with a TSR ranking in the bottom quartiles (i.e., under-performing).

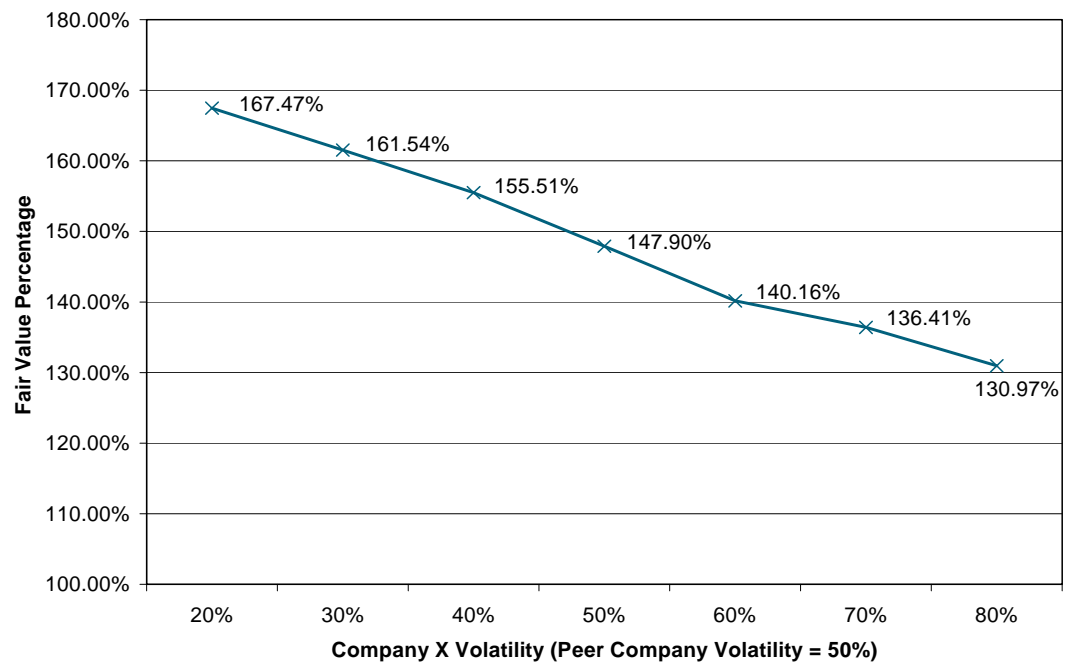
“Just choosing an index to use as peers can significantly alter the cost of a Relative TSR plan”

Chart 1: Impact Company X’s Volatility has on the Probability Distribution (All Peers Constant 50% Volatility)



The distribution of percentile ranking directly affects the fair value of the award. The fair value increases as the distribution above the median percentile increases since there is a greater probability of payouts above 100%.

Chart 2: Impact Company X’s Volatility has on the Fair Value (All Peers Constant 50% Volatility)



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Summary

Changing assumptions can have a large impact on the fair value of a plan. The following chart provides a summary of how increases in the individual assumptions affect the fair value.

Increase in Assumption	Effect
Term of Performance Period	↑ Increase due to greater probability of higher Payouts
Risk-Free Rate	↑ Increase due to higher payouts
Dividend Yield	↓ Decrease due to smaller payouts
Expected Volatility (and all peers stay the same)	↓ Decrease due to lower probability of appreciation; Partially offset by Increase due to increase in Volatility
Peer Expected Volatility (and company stays the same)	↑ Increase due to greater probability of higher Payouts
Correlation Coefficients (closer to 1.0)	↓ Decrease due to less distribution in payouts

Plan design decisions such as choosing the target, minimum, and maximum payouts have a significant impact on the cost of a Relative TSR plan. While there are many factors to consider when choosing the peer group, such as industry, company size, capitalization, geographic location, the peers selected also play a major role in determining the cost of a plan. Companies should carefully review the peer group and consider filtering the group for companies with similar volatility and correlation coefficients in addition to the items mentioned above. Learn more about examining peers based on stock price correlation at www.PeerPicker.com.

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Locations

Atlanta, Austin, Boston, Chicago, Denver, London, New York, Philadelphia, San Diego, San Francisco, San Jose, Singapore, Washington, DC.

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Appendix 1: Radford's Relative TSR Theorem

Definition of variable names:

Variable	Definition
$\Delta\sigma_n = (\sigma_c - \sigma_n)$	For each of n companies in a peer group, where σ represents the expected volatility of the company, c , and the n peers
$\rho_{c,n}$	Represents the correlation coefficient between the company c , and each of the n members of the peer group
$FV\% = \frac{FV}{GV}$	FV represents the Fair Value under ASC Topic 718, and GV is the Grant Value

Radford's Relative TSR Theorem (in actuary):

$$\text{Lim}FV\% = 100\%GV$$

$$\Delta\sigma_n \rightarrow 0.0$$

$$\Delta\rho_{c,n} \rightarrow 1.0$$

Radford's Relative TSR Theorem (in English):

If all companies are perfectly correlated (correlation coefficient of 1.0) and all economic assumptions (expected volatility equal) are the same, then a relative TSR share equals a regular share.

Radford's Corollary: *Companies who design Relative TSR plans should carefully consider their comparator companies based upon the economic similarities (expected volatility and correlation coefficient) with their own*