

Percentile Rank: A Big Problem for Relative TSR Plans with Small Peer Groups

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Introduction

As we've noted in numerous articles before, companies continue to adopt performance-based equity awards with total shareholder return ("TSR") metrics, including both absolute and relative measures, at an amazing pace. As more and more plans enter the marketplace, best practices continue to evolve and solidify. Yet, one important design nuance continues to be overlooked by scores of companies— proper percentile rank calculations for relative TSR outcomes. It's a mathematical detail with big implications, especially for companies with small peer groups. On the following pages, we explore this issue and present several methodologies and plan design tips to avoid mishaps.

You Have a Choice: Percentile Rank Methodologies

Believe it or not, there are a number of methodologies for calculating percentile rank, and in our experience, two stand out as the most accurate and widely used. Both of our preferred methodologies are easily calculated in Microsoft Excel, but utilize very different logical foundations. We describe these methods, respectively called discrete and continuous percentile rank calculations, in detail below.

The Discrete Percentile Rank Calculation

Under this model, a company is ranked against its peers in an evenly stacked fashion, placing the top performer at the 100th percentile and the bottom performer at the 0th percentile. Every percentile is evenly spaced, creating an easily understood distribution of results. The exact formula for discrete calculations is presented below:

$$P\% = 1 - \frac{(R - 1)}{(N - 1)}$$

In this case, *R* equals the company's rank against its peers and *N* equals the total number of peers, *including* the company. For example, if the subject company was competing against ten peers and was ranked in the 6th position, *N* would equal 11 and *R* would equal 6, yielding mid-point performance, otherwise known at the 50th percentile. When you insert the values from our example into the formula, the calculation works as follows:

$$P\% = 1 - \frac{(6 - 1)}{(11 - 1)} = 50\%$$

To conduct this calculation in Microsoft Excel, you use the PERCENTILERANK function, including the subject company in your data array. A sample calculation is depicted below, and a real world example can be viewed in this [disclosure filing](#) from Covidien plc.

| Rank | Company | TSR |
|------|---------|-----|
| 1 | Peer 1 | 50% |
| 2 | Peer 2 | 48% |
| 3 | Peer 3 | 43% |
| 4 | Peer 4 | 39% |
| 5 | Peer 5 | 38% |
| 6 | Company | 36% |
| 7 | Peer 6 | 31% |
| 8 | Peer 7 | 30% |
| 9 | Peer 8 | 28% |
| 10 | Peer 9 | 25% |
| 11 | Peer 10 | 19% |

Percentile Rank
 =PERCENTRANK(D4:D14,D9,5)

The Continuous Percentile Rank Calculation

The continuous approach is very similar in design, except for one key factor: the subject company is excluded from the calculation of percentile rank for the peers. The exact formula for continuous calculations is presented below:

$$P\%_{Peer} = 1 - \frac{(R - 1)}{(N - 1)}$$

In this case, R equals the peer's rank against all other peers, and N equals the total number of peers, *excluding* the subject company. The subject company's percentile rank is then calculated using linear interpolation between the percentile ranks of the peers just above and below the subject company (ranked based on each peer's specific TSR outcomes). The interpolation formula works as follows:

$$P\%_{Company} = P\%_a + (P\%_b - P\%_a) \times \frac{(TSR_a - TSR_{Company})}{(TSR_a - TSR_b)}$$

In this case, $P\%_a$ and TSR_a equal the percentile rank and TSR for the company performing just above the subject company. Conversely, $P\%_b$ and TSR_b equal the percentile rank and TSR for the company performing just below the subject company. And as one might easily deduce, $P\%_{Company}$ and $TSR_{Company}$ represent the percentile rank and TSR for the subject company.

Using similar values as the discrete calculation completed above, 10 peer companies and subject company rank of 6th place, we would create the following data layout in Microsoft Excel:

| Rank | Company | TSR |
|------|---------|-----|
| 1 | Peer 1 | 50% |
| 2 | Peer 2 | 48% |
| 3 | Peer 3 | 43% |
| 4 | Peer 4 | 39% |
| 5 | Peer 5 | 38% |
| 7 | Peer 6 | 31% |
| 8 | Peer 7 | 30% |
| 9 | Peer 8 | 28% |
| 10 | Peer 9 | 25% |
| 11 | Peer 10 | 19% |

| | | |
|---|---------|-----|
| 6 | Company | 36% |
|---|---------|-----|

Percentile Rank
`=PERCENTRANK(D4:D13,D15,5)`

As you can see in the image above, our sample subject company (with a TSR result of 36%) achieved a 6th place ranking within its peer group, but pulled out of the data array used to calculate percentile ranks with the peer group. To start the continuous calculation, the first step is to determine the specific percentile ranks for the peer companies ranking in 5th and 7th place. These values are the 44% and 56% respectively. Next, the subject company's percentile rank is interpolated between these two data points, yielding a percentile rank of 52%. A sample set of calculations with values in their proper place is below:

$$P\%_a = 1 - \frac{(5 - 1)}{(10 - 1)} = 56\%$$

$$P\%_b = 1 - \frac{(6 - 1)}{(10 - 1)} = 44\%$$

$$P\%_{Company} = 56\% + (44\% - 56\%) \times \frac{(38\% - 36\%)}{(38\% - 31\%)} = 52\%$$

As you may have already noticed, the example above uses the same PERCENTILERANK function in Microsoft Excel. The sole difference is the exclusion of the subject company's results from the data array.

We'd be remiss if we did not remind all readers that two other percentile rank formulas exist in Microsoft Excel. They are PERCENTRANK.INC and PERCENTRANK.EXC.

The PERCENTRANK.INC function matches the PERCENTRANK formula illustrated above, and the PERCENTRANK.EXC differs drastically from the PERCENTRANK formula, especially when used for the continuous approach. It should not be used to calculate percentile rank.

Other Methodologies

The two approaches outlined above are used by a large majority of relative TSR plans observed in the marketplace, yet other approaches exist. We consider all other approaches to be flawed in some manner when used in the context of calculating relative TSR results, even if they are mathematically valid. For a brief summary of these plans, please see the appendix of this article.

Discrete vs. Continuous

Now that we've established the mathematical basis for discrete and continuous percentile rank calculations, let's see how they differ in terms of use across the two markets with the widest adoption of relative TSR plans. In the table below, our research of public filings and *PeerTracker* client data shows the prevalence of methodologies in the US and UK. As you'll soon see, the discrete methodology is vastly more popular in the US vs. the UK.

| Location | Percentile Rank Approach | Peer Group Size | | |
|-----------------------------|--------------------------|-----------------|----------|--------------|
| | | Less than 20 | 21 to 50 | More than 50 |
| United States ¹ | Discrete | 87% | 94% | 95% |
| | Continuous | 9% | 4% | 3% |
| | Other | 4% | 2% | 2% |
| United Kingdom ² | Discrete | 5% | 40% | 85% |
| | Continuous | 90% | 55% | 10% |
| | Other | 5% | 5% | 5% |

1. This information was provided through Radford's PeerTracker client base, covering over 400 outstanding relative TSR plans in the United States, representing a significant sampling of plans in the United States. Please visit www.relativeTSR.com for more information.
2. This information was provided through Radford's sister company, New Bridge Street, the premier compensation consulting firm in the United Kingdom. Please visit www.newbridgestreet.com for more information.

Why is the case? How can the US and UK be so different (all jokes and puns aside)? The answer likely lies in the differences between actual outcomes of discrete vs. continuous percentile rank calculations and the implications of each formula when using peer groups of different sizes. Let's consider several examples below using a sample firm named "Company ABC" and the following payout schedule where payouts are interpolated linearly between maximum, target and threshold performance hurdles:

| Relative TSR Percentile Rank | Payout as a Percentage of Target |
|---|----------------------------------|
| Maximum – 90 th Percentile | 200% |
| Target – 50 th Percentile | 100% |
| Threshold – 25 th Percentile | 50% |
| Below 25 th Percentile | 0% |

For our first example, Company ABC arrives in 3rd place against a 10 company peer group. Using the discrete percentile rank approach, it receives a percentile rank of 80% and using the continuous percentile rank approach it lands at 87%. As a result, the discrete formula yields a final payout of 175% of

target and the continuous formula yields a final payout of 193% of target. The difference in percentile ranks is seven percentage points and the difference in payouts is 18 percentage points.

| Example 1 – 10 Peers | | | | | | |
|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----|------------------------|
| Percentile Rank Approach | 1 st Place | 2 nd Place | 3 rd Place | 4 th Place | ... | 11 th Place |
| Discrete | 100.0% | 90.0% | 80.0% | 70.0% | ... | 0.0% |
| Continuous | 100.0% | 88.9% | 87.3% | 77.8% | ... | 0.0% |

In our second example, Company ABC arrives in 6th place against a 20 company peer group. Using the discrete percentile rank approach, it receives a percentile rank of 75% and, using the continuous percentile rank approach, it lands at 78%. As a result, the discrete formula yields a final payout of 163% of target and the continuous formula yields a final payout of 170% of target. The difference in percentile ranks is three percentage points and the difference in payouts is 7 percentage points.

| Example 2 – 20 Peers | | | | | | |
|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----|------------------------|
| Percentile Rank Approach | 4 th Place | 5 th Place | 6 th Place | 7 th Place | ... | 21 st Place |
| Discrete | 85.0% | 80.0% | 75.0% | 70.0% | ... | 0.0% |
| Continuous | 84.2% | 79.0% | 78.1% | 73.7% | ... | 0.0% |

In our third example, Company ABC arrives in 9th place against a 50 company peer group. Using the discrete percentile rank approach, it receives a percentile rank of 84% and, using the continuous percentile rank approach, it lands at 85%. As a result, the discrete formula yields a final payout of 185% of target and the continuous formula yields a final payout of 188% of target. The difference in percentile ranks is one percentage point and the difference in payouts is three percentage points.

| Example 3 – 50 Peers | | | | | | |
|--------------------------|-----------------------|-----------------------|-----------------------|------------------------|-----|------------------------|
| Percentile Rank Approach | 7 th Place | 8 th Place | 9 th Place | 10 th Place | ... | 51 st Place |
| Discrete | 88.0% | 86.0% | 84.0% | 82.0% | ... | 0.0% |
| Continuous | 87.8% | 85.7% | 85.4% | 83.7% | ... | 0.0% |

As the three examples above illustrate, variations between the discrete and continuous percentile rank calculations become more significant as peer groups shrink. Both approaches calculate percentile ranks evenly within a given data set, but with and without the peer company included, respectively. And the impact of an extra company is magnified when fewer companies are considered. Conversely, as peer group sizes increase, the spacing between percentile ranks converges, creating less room for divergence between the percentile rank methodologies. Returning to our big question about the US vs. the UK, peer groups in the UK tend to be smaller, which is why UK firms opt for the continuous approach more often—a point we'll explore further in our conclusion below.

Conclusions and Recommendations

Given that there can be significant differences between the discrete and continuous percentile rank approaches as peer group sizes change, your choice of methodology should generally be dictated by peer group size.

In the US, the discrete approach is favored because it is more transparent and works well with larger peer groups, which are easier to develop in the US. There are usually more peers to select from when developing custom peer groups and stock market indices tend to be larger (e.g., the S&P 500 in the US vs. the FTSE 100 in the UK). In small peer groups, a change in TSR as little as 2% can create large changes in final payouts when the discrete calculation is used, an effect that is very hard to produce when peer groups approach 50 companies or more.

The continuous approach is more prevalent in the UK because peer groups tend to be smaller. The most profound advantage of the continuous approach is that it serves to eliminate situations where a very small change in TSR has an excessive effect on final payouts. This approach captures the magnitude of a company's TSR performance relative to its closest peers, and, as a result, allows changes in payouts to better align with small changes in TSR. All of these effects are more pronounced with smaller peer groups. Of course, the continuous approach is more complex, and likely not worth the effort unless truly needed.

In our opinion, it is best practice to choose percentile rank methodologies based on peer group size, in an effort to balance plan simplicity and reasonable changes in payouts for small changes in performance. This is an appropriate and relatively easy plan design step that protects award holders and shareholders from unintended plan design consequences. It's worth the effort even if there is a fairly narrow range of results where differences between the methodologies are noticeable.

To learn more about the Equity Valuation Services practice at Aon Hewitt and Radford, visit our website: <https://www.radford.com/home/valuation/>

Appendix

Several other methods for calculating percentile rank exist in the marketplace. However, these approaches contain a few obvious flaws. Please note, in the formulas below, R stands for the rank of the company, while N equals the number of peer companies (including the company).

- **Floor Percentile** – This approach is likely the easiest to calculate, and it is named the “floor” approach because it allows for a 0th percentile. However, with this setup, the highest ranking company can never actually rank at the 100th percentile, which is our main point of concern with the formula. The exact formula is as follows:

$$P\% = 1 - \frac{R}{N}$$

- **Ceiling Percentile** – Similarly, the formula below is called the “ceiling” approach because it allows for a 100th percentile; however, the lowest ranking company can never rank at the 0th percentile, which again is an area of concern. The exact formula is as follows:

$$P\% = \frac{(N - R + 1)}{N}$$

- **Average Percentile** – Another possible approach is to take the average of the “floor” and “ceiling” calculations. This approach allows for more balance around the median; however, it magnifies the flaws of the floor and ceiling approaches, as the highest ranking company can never be at the 100th percentile and the lowest ranking company can never be at the 0th percentile. The exact formula is as follows:

$$P\% = \frac{(N - R + \frac{1}{2})}{N}$$

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About *PeerTracker*

PeerTracker is a product of the [Equity Valuation Services](#) practice at [Aon Hewitt](#) and [Radford](#). It leverages the team's extensive background in valuing, designing and supporting complex equity compensation instruments to provide relative TSR award holders with real-time information in a highly accessible and easy-to-understand format. *PeerTracker* takes the guess work out of relative TSR plans, saving time, reducing communication expense, and minimizing confusion about what it takes to drive peak performance results. To request more information, please [click here](#).

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The [Equity Valuation Services](#) practice at [Aon Hewitt](#) and [Radford](#) works with top HR and finance leaders at technology, life sciences and general industry companies to design, value and communicate equity awards and other complex compensation programs. With a team of valuation and actuarial professionals across the US and global markets, the practice provides a full suite of advisory services covering equity expensing, financial reporting assistance for ASC Topic 718 and IFRS2, relative TSR plan design, proxy advisor policy modeling, golden parachute calculations, sabbatical plan valuations and more. To learn more, please [click here](#).