

Absolute Ranks, Percentile Ranks, and Fractional Ranks Methodology

Morningstar Manager Research
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Absolute Ranks

In order to assign percentile ranks to funds, Morningstar first assigns an absolute rank.

The following procedure is used for assigning absolute ranks to funds:

1. Pull in the returns for the time period being ranked for all funds in a category.
2. Sort the returns in descending order.
3. Assign a value of 1 to the highest return value.
4. When two share classes or two distinct portfolios share the same return, assign the same absolute rank to the share class or distinct portfolio.

Exhibit 1 Assigning the Same Rank

Name	Total Return Annualized 3-Year	Absolute Rank
AXP Global Technology A	1.8386	36
AXP Global Technology Y	1.8386	36

Source: Morningstar Direct

5. For the next return that has a different value, assign a rank equal to the absolute rank of the previous fund, plus the number of share classes or distinct portfolios that shared the same return. In the example below, two share classes shared the same return of 1.8386.

Exhibit 2 Assigning Rank Equally

Name	Total Return Annualized 3-Year	Absolute Rank
AXP Global Technology A	1.8386	36
AXP Global Technology Y	1.8386	36
Fidelity Select Software & Comp	1.7194	38

Source: Morningstar Direct

6. Continue counting until the last absolute rank is assigned. The last absolute rank value should be equal to the number of share classes in the category (n). This value will be used in the formula for calculating the percentile rank.

Please note that Morningstar freezes absolute ranks and counts at the end of each month. If a discrepancy is found in a fund return, Morningstar may recalculate the fund's percentile rank by using breakpoints. By using breakpoints, Morningstar does not have to recalculate the percentile ranking for

the entire peer group. Recalculation is not possible with absolute ranks; therefore, instances may occur where absolute rank and percentile rank do not match. We expect these instances to occur very seldom.

Percentile Ranks

Morningstar uses the following formula to determine the percentile rank of an item in a series. It is commonly used for calculating an investment's total return percentile rank against others in its Morningstar Category. With this method, percentile ranks always range from 1 (best) to 100 (worst), with all intermediate values spread evenly over that range.

All observations are ranked in the desired order (usually descending). Percentile ranks are assigned as follows:

If $i = 1$ PctRank = 1

If $i > 1$ PctRank = $\text{FLOOR}[99*(i-1)/(n-1)+1]$

where:

n = The total number of observations

i = The absolute rank of each observation

Floor = A function that rounds down to the next integer (for example, 89.83 rounds down to 89)

Morningstar does not require a minimum number of items in order to percentile-rank a set of data. For example, if there are only three funds in a category for a certain time period, we will percentile-rank those three (1, 50, 100).

Exhibit 3 Percentile Ranks Can Be Mapped Into Deciles and Quartiles

Range	Decile	Range	Quartile
0 < Percentile Rank <=10	1	0 < Percentile Rank <=25	1
10 < Percentile Rank <=20	2	25 < Percentile Rank <=50	2
20 < Percentile Rank <=30	3	50 < Percentile Rank <=75	3
30 < Percentile Rank <=40	4	75 < Percentile Rank <=100	4
40 < Percentile Rank <=50	5		
50 < Percentile Rank <=60	6		
60 < Percentile Rank <=70	7		
70 < Percentile Rank <=80	8		
80 < Percentile Rank <=90	9		
90 < Percentile Rank <=100	10		

Source: Morningstar Direct

Fractional Ranks

When ranking the Morningstar Risk-Adjusted Return, in order to derive the Morningstar Star Rating, Morningstar ranks investments based on the number of distinct portfolios in a category, rather than giving equal weight to each share class. This ensures that funds with multiple share classes do not have a disproportionate weight compared with single-share funds. When several funds are merely different share classes of the same underlying portfolio, each share class is counted as a fraction of a fund (in the case of Master/Feeder funds).

For example, if a fund has five share classes with three years of returns available, each share class will get a weight of 0.20 for ranking three-year returns. The first step in assigning ranks is to assign a fractional weight to each fund in the category.

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Exhibit 4 First, Assign a Fractional Weight for Each Fund in the Category

Name	Oldest Share Class	3-Year Return %	Fractional Weight
Convertible A	Yes	-5.412	0.2
Convertible Adv	No	-5.412	0.2
Convertible B	No	-6.125	0.2
Convertible C	No	-6.107	0.2
Convertible I	No	-5.178	0.2
US Convertible I	Yes	-3.91	0.5
US Convertible II	No	-3.809	0.5
Convertible Securities A	Yes	-10.835	0.33
Convertible Securities B	No	-10.835	0.33
Convertible Securities C	No	-11.484	0.33
Convertible Securities Adv	No	—	—

Source: Morningstar Direct

The fractional weight is assigned based on the number of share classes and whether each share class has a return available. In this example, Convertible Securities is assigned a fractional weight based on three share classes because the fourth share class, the Adv share class, does not have a three-year return.

There are three distinct portfolios in the example above: Convertible, U.S. Convertible, and Convertible Securities.

The next step is to sort all the funds in the category with the highest value first and the lowest value last.

Exhibit 5 Next, Sort Total Return (and Most Other Data Points) in Descending Order

Name	Oldest Share Class	3-Year Return %	Fractional Weight
US Convertible II	No	-3.809	0.5
US Convertible I	Yes	-3.91	0.5
Convertible I	No	-5.178	0.2
Convertible A	Yes	-5.412	0.2
Convertible Adv	No	-5.412	0.2
Convertible C	No	-6.107	0.2
Convertible B	No	-6.125	0.2
Convertible Securities A	Yes	-10.835	0.33
Convertible Securities B	No	-10.835	0.33
Convertible Securities C	No	-11.484	0.33

Source: Morningstar Direct

We then calculate the cumulative weight for each share class. There are three steps to assigning the cumulative weight.

Step 1. The cumulative weight for the first share class is equal to that fund's fractional weight. The cumulative weight for the second share class is equal to the fractional weight of the second share class plus the cumulative weight of the first share class, and so forth.

Exhibit 6 Share-Class Cumulative Weight

Name	Oldest Share Class	3-Year Return %	Fractional Weight	Cumulative Weight Step 1
US Convertible II	No	-3.809	0.5	0.5
US Convertible I	Yes	-3.91	0.5	1
Convertible I	No	-5.178	0.2	1.2
Convertible A	Yes	-5.412	0.2	1.4
Convertible Adv	No	-5.412	0.2	1.6
Convertible C	No	-6.107	0.2	1.8
Convertible B	No	-6.125	0.2	2
Convertible Securities A	Yes	-10.835	0.33	2.33
Convertible Securities B	No	-10.835	0.33	2.67
Convertible Securities C	No	-11.484	0.33	3

Source: Morningstar Direct

Step 2. Compare the returns of the share classes. When two or more share classes have the same return, they should be given the cumulative weight of the first tied share class.

In the example above, if we did not undertake this step before assigning the percentile rank, Convertible Securities A and Convertible Securities B would receive different rankings even though they have the same return.

Exhibit 7 Share-Class Return Comparison

Name	Oldest Share Class	3-Year Return %	Fractional Weight	Final Cumulative Weight
US Convertible II	No	-3.809	0.5	0.5
US Convertible I	Yes	-3.91	0.5	1
Convertible I	No	-5.178	0.2	1.2
Convertible A	Yes	-5.412	0.2	1.4
Convertible Adv	No	-5.412	0.2	1.4
Convertible C	No	-6.107	0.2	1.8
Convertible B	No	-6.125	0.2	2
Convertible Securities A	Yes	-10.835	0.33	2.33
Convertible Securities B	No	-10.835	0.33	2.33
Convertible Securities C	No	-11.484	0.33	3

Source: Morningstar Direct

The last share class in the peer group receives a cumulative weight equal to the number of distinct portfolios.

Step 3: Assign a percentile rank to each share class.

The formula used to calculate the percentile ranks for each share class:

$$PctRank(v[i]) = 100 * \left(\frac{(C[i] - C \min)}{(C \max - C \min)} \right)$$

With a special case whereby any PctRank=0 is transformed to PctRank=1

Additionally, if a category only has one share class for any period, that share class should be automatically assigned a rank of 1.

where:

PctRank(v[i]) = Percentile rank for fund i

v[i] = The value being ranked for fund i

C[i] = The cumulative weight of fund i

Cmin = The minimum of the cumulative weight's rank

Cmax = The maximum of cumulative weight's rank

Exhibit 8 Category Share-Class Rank

Name	Oldest Share Class	3-Year Return %	Final Cumulative Weight	Distinct Portfolio Percentile Rank
US Convertible II	No	-3.809	0.5	1
US Convertible I	Yes	-3.91	1	20
Convertible I	No	-5.178	1.2	28
Convertible A	Yes	-5.412	1.4	36
Convertible Adv	No	-5.412	1.4	36
Convertible C	No	-6.107	1.8	52
Convertible B	No	-6.125	2	60
Convertible Securities A	Yes	-10.835	2.33	74
Convertible Securities B	No	-10.835	2.33	74
Convertible Securities C	No	-11.484	3	100

Source: Morningstar Direct

This technique allows Morningstar to rank each fund share class individually, while ensuring that any single portfolio with many versions does not crowd out others within a range. Morningstar does not require a minimum number of items in order to distinct portfolio percentile rank a set of data.

Many funds are offering hedged share classes as part of their funds lineup. These share classes are for investors who want to hold cross-border assets without the foreign exchange risk.

To accommodate funds within the Europe, Asia, and Africa classification region, Morningstar puts the hedged currency share class in a different category, which reflects the fund's investing style as well as the currency-hedging strategy.

For rating purposes, a portfolio with a hedged share class and a nonhedged share class will be represented as distinct portfolios in different categories for rating purposes.

Exhibit 9 Portfolio Example: Investment A

Dollar Bond	Category	Fractional Weight
A1 USD	USD	0.5
A2 EUR	USD	0.5

Source: Morningstar Direct

This example represents one distinct nonhedged portfolio in the USD category. Note the base currency of a class does not have an impact on its classification absent hedging.

Exhibit 10 Portfolio Example: Investment B

Dollar Bond	Category	Fractional Weight
A1 EUR Hedged	EUR	0.5
A2 EUR Hedged	EUR	0.5

Source: Morningstar Direct

This example represents one distinct hedged portfolio in the EUR category. These classes are placed in a different category as they are hedged to euros.

Methodology Changes

The following is a timeline of significant methodology changes to the Morningstar ranking methodologies.

Date: October 2016

Description: Minor adjustment to the fractional ranking formula for ratings. The old formula was:

$$PctRank(v[i]) = \left(\frac{C[i]}{C_{max}} \right) * 100.$$

Where C[i] is the cumulative weight and Cmax is the maximum of the cumulative weighting's rank (total number of funds in the peer group). **III**