

Fractional Weighting in Morningstar Data, Ranks, and Ratings

In August 2017, Morningstar® will begin calculating many of its category percentile ranks and category averages using fractional weighting. In this document, you will learn about the following:

- ▶ what fractional weighting is
- ▶ why Morningstar is making this change
- ▶ how fractional weighting will be used to calculate percentage ranks and category averages for all types of returns and returns-based data points, and
- ▶ how fractional weighting affects percentage ranks and category averages compared to equal weighting.

 Note: Historical values will not be recalculated.

Overview

Many investment funds are available in multiple share classes, due to different features, loads, and expenses. Because of these features and differences, it is likely that each share class has different returns over a given time period. But fundamentally, they are all the same fund because they share the same underlying portfolio of investments.

In a group of funds, when the share classes are fractionally weighted within a fund, the following occurs:

- ▶ When calculating category ranks, each distinct fund occupies the same amount of space, and
- ▶ In category averages, each fund has the same influence.

What is fractional weighting?

	A	B	C	D	E
1	Distinct		3-Year	Fractional	Equal
2	Fund	Fund Name	Return	Weight	Weight
3	1	AB Fund	9.148	1	1
4	2	CD Fund	5.244	1	1
5	3	EF Fund	10.385	1	1
6	4	GH Fund	8.282	1	1
7	5	IJ Fund	10.769	0.2	1
8		IJ Fund Series F	12.150	0.2	1
9		IJ Fund Series G	10.959	0.2	1
10		IJ Fund Series I	13.604	0.2	1
11		IJ Fund Series T	10.923	0.2	1

This illustration shows fractional weight versus equal weight in five distinct funds

Currently, with one exception, when Morningstar category rankings, returns, and averages are calculated, all share classes are treated equally. This means that averages are calculated by simply adding the values in a category, and then dividing by the number of share classes.

For example, when funds are ranked by percentile to determine quartiles, the typical result is an equal number of share classes in each quartile (with exceptions such as where a breakpoint occurs among identically ranked values). All share classes are weighted equally in the calculations.

The one exception (mentioned above) is the Morningstar Rating™ (also known as the Star rating). The Morningstar Risk Adjusted Return (MRAR) of each rated fund is ranked in up to three time periods (three, five, and 10 years), using a symmetrical bell-shaped distribution that is divided into five rating bands as follows:

Percentile	Star Rating
Top 10%	5 stars
22.5%	4 stars
Middle 35%	3 stars
22.5%	2 stars
Bottom 10%	1 star

Because the MRAR for the share classes of a fund could be very similar, funds with multiple share classes could crowd the top rating band, resulting in the possibility of very few distinct funds with five stars, even in large fund categories. This situation is addressed by using fractional weights.

Under fractional weighting, each of a fund's share classes receives a fraction of the weight of that one fund. For example, if a fund has four share classes, each share class has a weight of 0.25. When the weights of all the share classes are added together, the total is the number of distinct funds. When calculating quartiles using fractional weights, the objective is to have the same number of distinct funds in each quartile.

Why is Morningstar making this change?

Table 1 displays the following information about the Large Value Equity Income fund category:

- ▶ the category has 16 distinct funds
- ▶ the three-year return for each fund
- ▶ number of share classes within each fund (38 total)
- ▶ weight of each share class when fractional weighting is used, and
- ▶ weight of each share class when equal weighting is used.

How does fractional weighting affect quartile percentages?

Table 1. Distinct Funds and Fractional Weights

	A	B	C	D	E
1	Distinct		3-Year	Fractional	Equal
2	Fund	Fund Name	Return	Weight	Weight
3	1	AB Fund	9.148	1	1
4	2	CD Fund	5.244	1	1
5	3	EF Fund	10.385	1	1
6	4	GH Fund	8.282	1	1
7	5	IJ Fund	10.769	0.2	1
8		IJ Fund Series F	12.150	0.2	1
9		IJ Fund Series G	10.959	0.2	1
10		IJ Fund Series I	13.604	0.2	1
11		IJ Fund Series T	10.923	0.2	1
12	6	KL Fund Sr A	11.989	0.33333	1
13		KL Fund Sr B	12.243	0.33333	1
14		KL Fund Sr F	13.533	0.33333	1
15	7	MN Fund Cl A	12.029	0.33333	1
16		MN Fund Cl B	12.236	0.33333	1
17		MN Fund Cl F	13.500	0.33333	1
18	8	OP ETF	8.766	1	1
19	9	QR Fund Cl A	7.926	0.33333	1
20		QR Fund Cl F	9.808	0.33333	1
21		QR Fund Cl R	8.766	0.33333	1
22	10	ST ETF Adv	5.225	0.5	1
23		ST ETF Comm	6.060	0.5	1
24	11	UV ETF	9.954	1	1
25	12	WX Fund A	11.712	0.16667	1
26		WX Fund B	11.602	0.16667	1
27		WX Fund C	11.500	0.16667	1
28		WX Fund J NL	11.858	0.16667	1
29		WX Fund U	13.278	0.16667	1
30		WX Fund J DSC	12.037	0.16667	1
31	13	YZ Fund CL A	11.755	0.2	1
32		YZ Fund CL B	11.679	0.2	1
33		YZ Fund Cl U	13.309	0.2	1
34		YZ Fund Cl J DSC	12.056	0.2	1
35		YZ Fund Cl J NL	11.940	0.2	1
36	14	123 Fund Adv	8.539	0.5	1
37		123 Fund Comm	9.416	0.5	1
38	15	456 Fund	9.684	1	1
39	16	789 Fund Cl A	6.705	0.5	1
40		789 Fund Cl F	7.865	0.5	1

Table 2 shows the following:

- ▶ the same funds as Table 1, but with three-year returns sorted in descending order, and
- ▶ the distribution of the different weightings of share classes.

Table 2. Funds in Category Sorted by Three-Year Returns

	A	B	C	D
1	3-Year Fractional Equal			
2	Fund Name	Return	Weight	Weight
3	IJ Fund Series I	13.604	0.2	1
4	KL Fund Sr F	13.533	0.33333	1
5	MN Fund Cl F	13.500	0.33333	1
6	YZ Fund Cl U	13.309	0.2	1
7	WX Fund U	13.278	0.16667	1
8	KL Fund Sr B	12.243	0.33333	1
9	MN Fund Cl B	12.236	0.33333	1
10	IJ Fund Series F	12.150	0.2	1
11	YZ Fund Cl J DSC	12.056	0.2	1
12	WX Fund J DSC	12.037	0.16667	1
13	MN Fund Cl A	12.029	0.33333	1
14	KL Fund Sr A	11.989	0.33333	1
15	YZ Fund Cl J NL	11.940	0.2	1
16	WX Fund J NL	11.858	0.16667	1
17	YZ Fund CL A	11.755	0.2	1
18	WX Fund A	11.712	0.16667	1
19	YZ Fund CL B	11.679	0.2	1
20	WX Fund B	11.602	0.16667	1
21	WX Fund C	11.500	0.16667	1
22	IJ Fund Series G	10.959	0.2	1
23	IJ Fund Series T	10.923	0.2	1
24	IJ Fund	10.769	0.2	1
25	EF Fund	10.385	1	1
26	UV ETF	9.954	1	1
27	QR Fund Cl F	9.808	0.33333	1
28	456 Fund	9.684	1	1
29	123 Fund Comm	9.416	0.5	1
30	AB Fund	9.148	1	1
31	OP ETF	8.766	1	1
32	QR Fund Cl R	8.766	0.33333	1
33	123 Fund Adv	8.539	0.5	1
34	GH Fund	8.282	1	1
35	QR Fund Cl A	7.926	0.33333	1
36	789 Fund Cl F	7.865	0.5	1
37	789 Fund Cl A	6.705	0.5	1
38	ST ETF Comm	6.060	0.5	1
39	CD Fund	5.244	1	1
40	ST ETF Adv	5.225	0.5	1

To demonstrate the difference between fractional and equal weighting of the share classes, the quartile ranks as calculated by each method are shown in [Table 3](#).

Note: [Table 3](#) shows the same funds in the same order as in [Table 2](#), but has additional columns to show the results of the calculations.

Table 3. Calculation of Quartile Ranks

	A	B	C	D	E	F	G	H	I	J
1				Cum.	Equal	Equal		Cum.	Frac.	Frac.
2		3-Year	Equal	Equal	Percent	Quartile		Frac.	Percent	Quartile
3	Fund Name	Return	Weight	Rank	Rank	Rank	Frac.	Rank	Rank	Rank
4	IJ Fund Series I	13.604	1	1	1	1	0.2	0.2	1	1
5	KL Fund Sr F	13.533	1	2	3	1	0.33333	0.53333	3	1
6	MN Fund Cl F	13.500	1	3	6	1	0.33333	0.86666	5	1
7	YZ Fund Cl U	13.309	1	4	9	1	0.2	1.06666	6	1
8	WX Fund U	13.278	1	5	11	1	0.16667	1.23333	7	1
9	KL Fund Sr B	12.243	1	6	14	1	0.33333	1.56666	9	1
10	MN Fund Cl B	12.236	1	7	17	1	0.33333	1.89999	11	1
11	IJ Fund Series F	12.150	1	8	19	1	0.2	2.09999	13	1
12	YZ Fund Cl J DSC	12.056	1	9	22	1	0.2	2.29999	14	1
13	WX Fund J DSC	12.037	1	10	25	1	0.16667	2.46666	15	1
14	MN Fund Cl A	12.029	1	11	28	2	0.33333	2.79999	17	1
15	KL Fund Sr A	11.989	1	12	30	2	0.33333	3.13332	19	1
16	YZ Fund Cl J NL	11.940	1	13	33	2	0.2	3.33332	20	1
17	WX Fund J NL	11.858	1	14	36	2	0.16667	3.49999	21	1
18	YZ Fund CL A	11.755	1	15	38	2	0.2	3.69999	23	1
19	WX Fund A	11.712	1	16	41	2	0.16667	3.86666	24	1
20	YZ Fund CL B	11.679	1	17	44	2	0.2	4.06666	25	1
21	WX Fund B	11.602	1	18	46	2	0.16667	4.23333	26	2
22	WX Fund C	11.500	1	19	49	2	0.16667	4.4	27	2
23	IJ Fund Series G	10.959	1	20	52	3	0.2	4.6	28	2
24	IJ Fund Series T	10.923	1	21	55	3	0.2	4.8	30	2
25	IJ Fund	10.769	1	22	57	3	0.2	5	31	2
26	EF Fund	10.385	1	23	60	3	1	6	37	2
27	UV ETF	9.954	1	24	63	3	1	7	44	2
28	QR Fund Cl F	9.808	1	25	65	3	0.33333	7.33333	46	2
29	456 Fund	9.684	1	26	68	3	1	8.33333	52	3
30	123 Fund Comm	9.416	1	27	71	3	0.5	8.83333	55	3
31	AB Fund	9.148	1	28	73	3	1	9.83333	61	3
32	OP ETF	8.766	1	29	76	4	1	10.83333	68	3
33	QR Fund Cl R	8.766	1	30	79	4	0.33333	11.16666	70	3
34	123 Fund Adv	8.539	1	31	82	4	0.5	11.66666	73	3
35	GH Fund	8.282	1	32	84	4	1	12.66666	79	4
36	QR Fund Cl A	7.926	1	33	87	4	0.33333	12.99999	82	4
37	789 Fund Cl F	7.865	1	34	90	4	0.5	13.49999	85	4
38	789 Fund Cl A	6.705	1	35	92	4	0.5	13.99999	88	4
39	ST ETF Comm	6.060	1	36	95	4	0.5	14.49999	91	4
40	CD Fund	5.244	1	37	98	4	1	15.49999	97	4
41	ST ETF Adv	5.225	1	38	100	4	0.5	16	100	4

Note the following values in columns C–F when equal weighting is used:

- In column C (Equal Weight), each share class is assigned a weight of 1
- Column D (Cum. Equal Rank) shows each share class's cumulative rank from lowest to highest

Note: For example, to arrive at the cumulative equal rank for KL Fund Sr F (row 5), take its equal weight (1) and add it to the cumulative equal rank of the previous row (IJ Fund Series I), which is 1. Because $1+1=2$, the cumulative equal weight of KL Fund Sr F is 2. Using the same formula for row 6, MN Fund Cl F, $1+2=3$.

- ▶ In the last row, ST ETF Adv, column D (Cum. Equal Rank) shows the total number of share classes (38) in the category
- ▶ Column E (Equal Percent Rank) shows the percentile rank assigned to each share class, and
- ▶ Column F (Equal Quartile Rank) shows the quartile rank assigned to each share class.

Note the following values in columns G–J when fractional weighting is used:

- ▶ Column G (Frac. Weight) shows each share class's fractional weight
- ▶ Column H (Cum. Frac. Rank) shows each share class's cumulative rank from lowest to highest

 Note: For example, to arrive at the cumulative fractional rank for KL Fund Sr F (row 5), take its fractional weight (0.33333) and add it to the cumulative fractional weight of the previous row (IJ Fund Series I), which is 0.2. Because $0.33333 + 0.2 = 0.53333$, the cumulative fractional rank of KL Fund Sr F is 0.53333. Using the same formula for row 6, MN Fund Cl F, $0.33333 + 0.53333 = 0.86666$.

- ▶ In the last row, ST Fund ETF Adv, column H (Cum. Frac. Rank) shows the number of distinct funds (16)
- ▶ Column I (Frac. Percent Rank) shows the percentile ranks assigned to each share class, and
- ▶ Column J (Frac. Quartile Rank) shows the quartile rank assigned to each share class.

Once the share classes are ranked by percentile, it is easy to group them into quartiles, as follows:

This quartile...	Includes share classes ranked...
First	1–25
Second	26–50
Third	51–75
Fourth	76–100

The following formula is used to calculate the percentile ranks in both equal and fractional weighting, which are then assigned to quartiles.

$$pctRank(v[i]) = RoundUp\left(100 \times \frac{(C[i] - Cmin)}{(Cmax - Cmin)}\right)$$

where:

$Cmin$	= the minimum of the cumulative weights rank	$Cmin$ will always be 1 for equal weights, but will be less than 1 for fractional weights if the first-ranked fund is one share class of many, as shown in Table 3 on page 5 .
$Cmax$	= the maximum of the cumulative weights rank	The number of share classes for equal weighting or the number of distinct funds for fractional weighting. In Table 3 on page 5 , the value of $Cmax$ is 16 for fractional weights and 38 for equal weights.
$C[i]$	= the cumulative weight rank of share class i	
$V[i]$	= the value being ranked for share class i	
$pctRank(v[i])$	= the percentile rank of share class i	
$RoundUp$	= a function that rounds up to the nearest integer	Note: If $pctRank(v[i]) = 0$, then assign $pctRank(v[i]) = 1$.

In [Table 3 on page 5](#), look at MN Fund CI F (row 6). Use the numbers in that row to populate the formula and determine its equal weight percentile rank. According to the table, the values to be used in the calculation are:

$C[i] = 3$ (cumulative weight rank of MN Fund CI F)

$Cmin = 1$ (minimum of the cumulative weight rank, which is always 1 for equal weights)

$Cmax = 38$ (number of distinct share classes)

$$5.405 = \left(100 \times \frac{(3 - 1)}{(38 - 1)}\right)$$

When rounded up, 5.405 is 6 (the percentile rank).

In [Table 3 on page 5](#), column I (Frac. Percent Rank) shows the percentile ranks for the fractional weights as calculated by the above formula. Column E (Equal Percent Rank) shows the percentile ranks for the equal weights. Columns F and J (Equal Quartile Rank and Frac. Quartile Rank) show the quartile ranks for the equal and fractional weights, respectively.

Table 4 shows the distribution of the share classes and distinct funds across quartiles for the funds from Table 3, as calculated using both fractional and equal weights.

Table 4. Distribution of Share Classes and Distinct Funds Across Quartiles

Quartiles Calculated			Quartiles Calculated		
By			By		
Fractional Weight			Equal Weight		
According to Share Class					
Quartile	Number of Share Classes	Percent of Share Classes in Quartile	Quartile	Number of Share Classes	Percent of Share Classes in Quartile
1	17	44.7%	1	10	26.3%
2	8	21.1%	2	9	23.7%
3	6	15.8%	3	9	23.7%
4	7	18.4%	4	10	26.3%
38		Number of Share Classes		38	
According to Distinct Funds					
Quartile	Number of Distinct Funds	Percent of Distinct Funds in Quartile	Quartile	Number of Distinct Funds	Percent of Distinct Funds in Quartile
1	4.1	25.4%	1	2.5	15.4%
2	3.3	20.4%	2	1.9	12.1%
3	4.3	27.1%	3	5.4	34.0%
4	4.3	27.1%	4	6.2	38.5%
16		Number of Distinct Funds		16	

On the basis of 38 share classes, we can see that equal weighting has distributed them fairly evenly, but fractional weighting has placed almost half the share classes in the first quartile.

However, on the basis of 16 distinct funds, the distribution by fractional weighting is much more even. Equal weighting resulted in approximately one quarter of the distinct funds populating the first two quartiles.

In Table 3 on page 5, you can see the following:

- ▶ Seven share classes that are in the first quartile when weighted fractionally are in the second quartile when weighted equally
- ▶ Six share classes that are in the second quartile when weighted fractionally are in the third quartile when weighted equally, and
- ▶ Three share classes that are in the third quartile when weighted fractionally are in the fourth quartile when weighted equally.

While fractional weighting means that percentile ranks, and thus quartiles, are calculated on the basis of distinct funds, it does not mean that the distribution of funds will be perfectly even (although it will be more even than when equal weighting by share class is used).

A further examination of Table 4 on page 8 reveals that even though 16 distinct funds are ranked, the result is not four funds in each quartile. In particular, the second quartile has only 3.3 funds.

In two adjacent rows (rows 28 and 29) in particular from [Table 3 on page 5](#), column H (Cum. Frac. Weight) reveals how the funds in the fractional weight quartiles are distributed:

- ▶ The fund QR Fund CI F shows a cumulative fractional weight of 7.33333 out of 16, resulting in a percent rank of 46, and
- ▶ The fund with the next best return, 456 Fund, is a whole fund, meaning it has only one share class. The resulting cumulative weight is 8.33333 out of 16, which is well over the halfway point and results in a percent rank of 52.

	A	B	C	D	E	F	G	H	I	J
1										
2										
3	Fund Name	3-Year Return	Equal Weight	Cum. Equal Rank	Equal Percent Rank	Equal Quartile Rank	Frac. Weight	Cum. Frac. Rank	Frac. Percent Rank	Frac. Quartile Rank
28	QR Fund CI F	9.808	1	25	65	3	0.33333	7.33333	46	2
29	456 Fund	9.684	1	26	68	3	1	8.33333	52	3
30	123 Fund Comm	9.416	1	27	71	3	0.5	8.83333	55	3

If 456 Fund had another share class, or if a different fund with multiple share classes (such as the 123 Fund Comm) had the next best return, the next fund's cumulative fractional weight could have been 7.83333 out of 16, resulting in at least 3.8 funds in the second quartile and making the final distribution more equal.

However, if another single share class fund at the breakpoint between the third and fourth quartiles causes the same situation, the third quartile will have fewer distinct funds. Various combinations of fractional weights will result in a more or less even distribution across quartiles, depending on how the share classes are sorted on the particular data point being ranked.

It should be noted that when ranking distinct funds with the intention of evenly distributing them across quartiles, each distinct fund may not fall completely within one quartile. In [Table 3 on page 5](#), column J (Frac. Quartile Rank) shows the quartile assignments of funds in the category according to the fractional method. Count how many distinct funds are represented by one or more share classes and you will see that when fractional weighting is used, each quartile has representation from five different funds. Because the category is comprised of only 16 distinct funds, several funds are represented in more than one quartile. When sorting on any returns-related data point, the various share classes can be separated by other funds and fund share classes, forcing them into different quartiles, due to differences in fees between share classes of a fund.

The median value is traditionally the middle value of a list of values, with an equal number of values above and below the median. If a list contains an even number of values, the median is the average of the two middle values. For example, Table 3 (reproduced below) has 38 values; therefore, the median for three-year returns (column B) for equally weighted share classes is 11.23 (the average of the values on rows 22 and 23) **(A)**.

How does fractional weighting affect the median value?

Under fractional weighting, where the share classes do not have the same weights, the median is derived from the percentile rank values. The last value with a percentile rank of 50% is the median value. In this way, all values with a rank of 50% are equal to or above the median. If no value has a percentile rank of 50%, the median is the average of the last value with a rank of less than 50% and the first value with a rank greater than 50%. For example, the table below has no value with a fractionally weighted percentile rank of 50% (column I), so the median for three-year returns is 9.746 (the average of the column B values on rows 28 and 29) **(B)**.

You can also see that the traditional median (column D, Cum. Equal Rank) **(C)** has half of the share classes above it. However, in column H, the cumulative fractional weight shows only 4.4 of the 16 distinct funds above the median **(C)**, and the fractionally weighted median **(D)** in column H has close to half the distinct funds (7.33333 out of 16) above the median. In other words, distinct funds are more equally distributed under fractional weighting **(D)**.

	A	B	C	D	E	F	G	H	I	J
1										
2										
3	Fund Name	3-Year Return	Equal Weight	Cum. Equal Rank	Equal Percent Rank	Equal Quartile Rank	Frac. Weight	Cum. Frac. Rank	Frac. Percent Rank	Frac. Quartile Rank
4	IJ Fund Series I	13.604	1	1	1	1	0.2	0.2	1	1
5	KL Fund Sr F	13.533	1	2	3	1	0.33333	0.53333	3	1
6	MN Fund CI F	13.500	1	3	6	1	0.33333	0.86666	5	1
7	YZ Fund CI U	13.309	1	4	9	1	0.2	1.06666	6	1
8	WX Fund U	13.278	1	5	11	1	0.16667	1.23333	7	1
9	KL Fund Sr B	12.243	1	6	14	1	0.33333	1.56666	9	1
10	MN Fund CI B	12.236	1	7	17	1	0.33333	1.89999	11	1
11	IJ Fund Series F	12.150	1	8	19	1	0.2	2.09999	13	1
12	YZ Fund CI J DSC	12.056	1	9	22	1	0.2	2.29999	14	1
13	WX Fund J DSC	12.037	1	10	25	1	0.16667	2.46666	15	1
14	MN Fund CI A	12.029	1	11	28	2	0.33333	2.79999	17	1
15	KL Fund Sr A	11.989	1	12	30	2	0.33333	3.13332	19	1
16	YZ Fund CI J NL	11.940	1	13	33	2	0.2	3.33332	20	1
17	WX Fund J NL	11.858	1	14	36	2	0.16667	3.49999	21	1
18	YZ Fund CL A	11.755	1	15	38	2	0.2	3.69999	23	1
19	WX Fund A	11.712	1	16	41	2	0.16667	3.86666	24	1
20	YZ Fund CL B	11.679	1	17	44	2	0.2	4.06666	25	1
21	WX Fund B	11.602	1	18	46	2	0.16667	4.23333	26	2
22	WX Fund C	11.500	1	19	49	2	0.16667	4.4	27	2
23	IJ Fund Series G	10.959	1	20	52	3	0.2	4.6	28	2
24	IJ Fund Series T	10.923	1	21	55	3	0.2	4.8	30	2
25	IJ Fund	10.769	1	22	57	3	0.2	5	31	2
26	EF Fund	10.385	1	23	60	3	1	6	37	2
27	UV ETF	9.954	1	24	63	3	1	7	44	2
28	QR Fund CI F	9.808	1	25	65	3	0.33333	7.33333	46	2
29	456 Fund	9.684	1	26	68	3	1	8.33333	52	3
30	123 Fund Comm	9.416	1	27	71	3	0.5	8.83333	55	3
31	AB Fund	9.148	1	28	73	3	1	9.83333	61	3
32	OP ETF	8.766	1	29	76	4	1	10.83333	68	3
33	QR Fund CI R	8.766	1	30	79	4	0.33333	11.16666	70	3
34	123 Fund Adv	8.539	1	31	82	4	0.5	11.66666	73	3
35	GH Fund	8.282	1	32	84	4	1	12.66666	79	4
36	QR Fund CI A	7.926	1	33	87	4	0.33333	12.99999	82	4
37	789 Fund CI F	7.865	1	34	90	4	0.5	13.49999	85	4
38	789 Fund CI A	6.705	1	35	92	4	0.5	13.99999	88	4
39	ST ETF Comm	6.060	1	36	95	4	0.5	14.49999	91	4
40	CD Fund	5.244	1	37	98	4	1	15.49999	97	4
41	ST ETF Adv	5.225	1	38	100	4	0.5	16	100	4

The fractional weighting factors that determine quartile percentage ranks are also applied to category averages.

To obtain a fractionally weighted category average, multiply the return of each share class by its fractional weight (the same one used to calculate fractional ranks), then add the values of the weighted returns and divide the total by the number of distinct funds.

The formula is shown here.

For each share class:

$$RW[i] = R[i] \times W[i]$$

where:

$R[i]$ = return of share class i

$W[i]$ = fractional weight of share class i

$RW[i]$ = fractionally weighted return of share class i

Then:

$$R_{avg} = \frac{\sum_{i=1}^N RW[i]}{N}$$

where:

N = number of distinct funds

R_{avg} = fractionally weighted average return

Note that for an equally weight average:

$W[i]$ = 1 for all share classes

N = number of share classes

R_{avg} = equally weighted average return

How does fractional weighting affect category averages?

In Table 5, the returns are grouped by distinct funds to demonstrate how fractional weighting impacts the category average.

Table 5. Share Class Returns Grouped as Distinct Funds

	A	B	C	D	E	F
		3-Year	Equal	Fractional	3-Year Return	Distinct
		Return	Weight	Weight	* Fractional	Fund
	Fund Name				Weight	Returns
4	AB Fund	9.148	1	1	9.148	9.148
5	CD Fund	5.244	1	1	5.244	5.244
6	EF Fund	10.385	1	1	10.385	10.385
7	GH Fund	8.282	1	1	8.282	8.282
8						
9	IJ Fund	10.769	1	0.2	2.154	
10	IJ Fund Series F	12.150	1	0.2	2.430	
11	IJ Fund Series G	10.959	1	0.2	2.192	
12	IJ Fund Series I	13.604	1	0.2	2.721	
13	IJ Fund Series T	10.923	1	0.2	2.185	
14	Fractionally-weighted average			1	11.681	11.681
15						
16	KL Fund Sr A	11.989	1	0.33333	3.996	
17	KL Fund Sr B	12.243	1	0.33333	4.081	
18	KL Fund Sr F	13.533	1	0.33333	4.511	
19	Fractionally-weighted average			1	12.588	12.588
20						
21	MN Fund Cl A	12.029	1	0.33333	4.009	
22	MN Fund Cl B	12.236	1	0.33333	4.079	
23	MN Fund Cl F	13.500	1	0.33333	4.500	
24	Fractionally weighted average			1	12.588	12.588
25						
26	OP ETF	8.766	1	1	8.766	8.766
27						
28	QR Fund Cl A	7.926	1	0.33333	2.642	
29	QR Fund Cl F	9.808	1	0.33333	3.269	
30	QR Fund Cl R	8.766	1	0.33333	2.922	
31	Fractionally weighted average			1	8.833	8.833
32						
33	ST ETF Adv	5.225	1	0.5	2.612	
34	ST ETF Comm	6.060	1	0.5	3.030	
35	Fractionally weighted average			1	5.642	5.642
36						
37	UV ETF	9.954	1	1	9.954	9.954
38						
39	WX Fund A	11.712	1	0.16667	1.952	
40	WX Fund B	11.602	1	0.16667	1.934	
41	WX Fund C	11.500	1	0.16667	1.917	
42	WX Fund J NL	11.858	1	0.16667	1.976	
43	WX Fund U	13.278	1	0.16667	2.213	
44	WX Fund J DSC	12.037	1	0.16667	2.006	
45	Fractionally weighted average			1	11.998	11.998
46						
47	YZ Fund CL A	11.755	1	0.2	2.351	
48	YZ Fund CL B	11.679	1	0.2	2.336	
49	YZ Fund Cl U	13.309	1	0.2	2.662	
50	YZ Fund Cl J DSC	12.056	1	0.2	2.411	
51	YZ Fund Cl J NL	11.940	1	0.2	2.388	
52	Fractionally weighted average			1	12.148	12.148
53						
54	123 Fund Adv	8.539	1	0.5	4.269	
55	123 Fund Comm	9.416	1	0.5	4.708	
56	Fractionally weighted average			1	8.978	8.978
57						
58	456 Fund	9.684	1	1	9.684	9.684
59						
60	789 Fund Cl A	6.705	1	0.5	3.352	
61	789 Fund Cl F	7.865	1	0.5	3.933	
62	Fractionally weighted average			1	7.285	7.285
63						
64	Total:	398.432			Total:	153.203
65	Equally Weighted				Fractionally Weighted	
66	Category Average:	10.485			Category Average:	9.575

Column B (3-Year Return) shows the three-year return for each fund. Divide the sum of the column (398.432) by the number of share classes (38) to get the simple (equal-weighted) category average (10.485).

Column D (Fractional Weight) shows the fractional weight of each share class, and column E (3-Year Return * Fractional Weight) shows the result of multiplying the 3-year return by its fractional weight. The sum of the column (153.203, in column F) is divided by the number of distinct funds (16), resulting in the fractionally weighted category average (9.575).

This difference between the category average for equal weighting versus fractional weighting is explained by a closer examination of the funds and their share classes.

To go deeper into the meaning of a fractionally weighted category average, examine [Table 6](#) (an extract from [Table 5](#), in which IJ Fund is the first fund that has multiple share classes.)

Table 6. An Examination of a Fund with Multiple Share Classes

	A	B	C	D	E
1					3-Year Return
2		3-Year	Equal	Fractional	* Fractional
3	Fund Name	Return	Weight	Weight	Weight
9	IJ Fund	10.769	1	0.2	2.154
10	IJ Fund Series F	12.150	1	0.2	2.430
11	IJ Fund Series G	10.959	1	0.2	2.192
12	IJ Fund Series I	13.604	1	0.2	2.721
13	IJ Fund Series T	10.923	1	0.2	2.185
14	Fractionally-weighted average			1	11.681

With five share classes, each has a weight of 1/5 or 0.2 (column D, Fractional Weight). Multiply the three-year return of each share class (column B) by its fractional weight (column D) to arrive at the value in column E (3-Year Return * Fractional Weight). Add all the values in column E. This is the fractionally weighted average of IJ Fund, shown at the bottom of column E (11.681). This is also the simple average of the values in column B for the five individual share classes.

Stated simply, when the returns of all the share classes of a fund are fractionally weighted and summed, the result is a simple average. (This is illustrated in the formula on [page 11](#).)

As explained earlier, when all the share classes of a fund are fractionally weighted, that set of share classes is assigned a weight of one, which is also the assigned weight of a fund that only has one share class. In addition, when a fund has multiple share classes and the individual share classes are fractionally weighted, only the number of distinct funds is considered. In essence, the return of a fund that has multiple share classes can be represented by a single return, which itself is the simple average of the returns of the individual share classes.

Returning to [Table 5](#), as previously noted, column E (3-Year Return * Fractional Weight) shows the fractionally weighted share class returns. The weighted returns of the funds with multiple share classes are added together and shown in the row "Fractionally weighted average" at the end of each distinct fund's section.

Column F (Distinct Fund Returns) shows a single return for each distinct fund. For those funds that don't have multiple share classes, the number matches that in column B (3-Year Return). For the funds with multiple share classes, column F shows the average return for that fund. When the average fund returns in column F are added together, the total is the same as the sum of the fund's fractionally weighted three-year returns (column E). When that number is divided by the number of distinct funds (16), the result is the category average (shown in the last row of the table).

The fractionally weighted category average return (9.575) is the simple average of the returns of the distinct funds in the category, where the funds with multiple share classes are represented by the simple average of the returns of each of their share classes.

[Table 5](#) also shows how equal weighting can result in a skew in the category average when some funds have multiple share classes. Compare the two averages shown in [Table 5](#). The equally weighted average is 10.485, while the fractionally weighted average is 9.575, a difference of 91 basis points.

This difference is explained by a closer examination of the funds and their share classes. In a group of data, when some values are larger or smaller than the rest of the values, the average of the group can be shifted up or down. This situation occurs in the data for the Large Value Equity Income fund category.

You can see this effect in [Table 5](#), where the funds with multiple share classes that have relatively high returns are as follows:

- ▶ IJ Fund
- ▶ KL Fund
- ▶ MN Fund Class
- ▶ WX Fund, and
- ▶ YZ Fund.

Together, they represent 22 share classes out of the total 38, or 58% of the category. When presented as distinct funds, those five funds out of the total 16 represent only 31% of the category.

In fractional weighting, each of the five funds is represented only once by the average of the returns of their share classes. As a result, the remaining 11 funds have a greater impact on the calculation of the category average because they represent 69% of the category (11 distinct funds out of the total 16). When calculated on an equally weighted basis, the remaining 11 funds represent 42% of the category (seven single-share class funds plus four multi-share class funds with a combined nine share classes, resulting in 16 share classes out of the total 38).

When evaluating this data, it is important to understand that each method reveals different information. [Table 5](#) shows 16 distinct funds, nine of which have multiple share classes while the remaining seven are whole funds (funds with a single share class). The seven whole funds represent seven share classes, while the other nine funds represent 31 of the 38 share classes in the category. The seven whole funds represent 44% of the category on the basis of distinct funds, but only 18% of the category on an equal weighted share class basis.

On balance, Morningstar Analysts believe that fractional weighting of distinct funds results in a more representative category average than equal weighting of share classes, because it prevents funds with multiple share classes from having a greater influence than single-share class funds.

Note that the influence of multiple share classes can also work in another way. If the five funds with multiple share classes had returns that were well below those of the other funds, the equally weighted category average would be lower than the fractionally weighted category average. In the end, fractional weighting is a fairer way of looking at category averages because the influence caused by variable numbers of share classes is removed.