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The Similar Funds tool will generate a list of investments that are similar to a user-specified offering. This methodology is based upon several factors including the category, special criteria, portfolio allocation, and performance of the fund provided.

The general process for generating a list of similar funds is as follows:

1. Preliminary Screen: Screen the entire universe of investments from the Open-End, and Exchange-Traded universes based on the category and other attributes of the fund provided.

2. Eliminate multiple share classes of the same investment.

3. Score each investment based on how similar its portfolio is to that of the target investment.

4. Score each investment based on how similar its performance has been relative to the target investment.

5. Calculate the Overall Similarity Score.
Similar Funds

**Step 1: Preliminary Screen**

1. Screening: Perform the following screen on the universe of open-end and exchange-traded investments:
   
   a. Category = Category of ticker provided
   b. If the investment is a bond fund, the sum of its credit ratings % must be > 99 and < 101. Also, its average credit quality cannot be null.

2. Minimum requirements for target investment for portfolio reporting:
   
   a. The portfolio is available for the investment and the date of the portfolio is within the past twelve months of the search date.

3. Minimum requirements for target investment for performance reporting:
   
   a. Investment must have a minimum of 36 months of performance available
      - Note: The investment will receive only a portfolio score when 36 months of performance history is not available.
Similar Funds

4. We are unable to search for most similar investment when the following occurs:
   a. Ticker provided is unrecognized.
   b. Category of ticker provided = Sector Equity, Geographic Equity, Commodity, Retail Venture Capital, Passive Inverse/Leveraged, Alternative Strategies, Miscellaneous, Miscellaneous – Income & Real Property, Miscellaneous – Other, Miscellaneous – Undisclosed Holdings.
   c. No portfolio is available for the investment.

**Step 2: Reduce Multi-share**
Investments are reduced to a single representative share class by considering only those share classes where oldest share class equals “Yes”.

**Step 3: Overall Portfolio Scoring**
Each investment is scored based on a number of factors and weights. These factors vary based on fund type (Domestic stock, U.S. stock, International stock, Sector equity, etc.) as determined by Morningstar (CIFSC) Category. The factors for equity investments are composition, equity sectors, % assets in top 10, equity style box, and regional exposure. The factors for fixed income investments are 12 month yield, credit quality breakdown, fixed-income sectors, duration, maturity, regional exposure, and for preferred share, equity sectors, and, % assets in top 10. The factors for allocation funds are composition, equity sectors, equity style box, regional exposure, duration, credit quality breakdown, maturity, and fixed income sectors. For each factor an investment is given a score from 0 to 10. These individual scores are weighted, summed, and converted into an Overall Portfolio score.
Factors for Equity Investments:

<table>
<thead>
<tr>
<th>Factor/Weight</th>
<th>Domestic Stock</th>
<th>US Stock</th>
<th>International Stock</th>
<th>Sector Equity</th>
<th>Region Specific Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Equity Sectors</td>
<td>40</td>
<td>40</td>
<td>30</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>% Assets in Top 10</td>
<td>20</td>
<td>20</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Equity Style Box</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Regional Exposure</td>
<td>N/A</td>
<td>N/A</td>
<td>30</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

Domestic Stock
Categories: Canadian Equity, Canadian Dividend & Income Equity, Canadian Small/Mid Cap Equity, Canadian Focused Equity, Canadian Focused Small/Mid Cap Equity,

US Stock
Categories: US Equity, US Small/Mid Cap Equity, North American Equity

International Stock
Categories: Asia Pacific Equity, Asia Pacific ex-Japan Equity, European Equity, Emerging Market Equity, Global Equity, Global Small/Mid Cap Equity, International Equity

Sector Equity
Categories: Financial Services Equity, Precious Metals Equity, Natural Resources Equity, Real Estate Equity

Region Specific Equity
Categories: Greater China Equity
Similar Funds

Factors for Fixed Income Investments:

<table>
<thead>
<tr>
<th>Factor/Weight</th>
<th>Domestic Bond</th>
<th>Global Bond</th>
<th>High Yield Bond</th>
<th>Preferred Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-Month Yield</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Credit Quality Breakdown</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>N/A</td>
</tr>
<tr>
<td>Fixed Income Sectors</td>
<td>20</td>
<td>15</td>
<td>15</td>
<td>N/A</td>
</tr>
<tr>
<td>Duration</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>N/A</td>
</tr>
<tr>
<td>Maturity</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>N/A</td>
</tr>
<tr>
<td>Regional Exposure</td>
<td>N/A</td>
<td>20</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>% Assets in Top 10</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>10</td>
</tr>
<tr>
<td>Equity Sectors</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>40</td>
</tr>
</tbody>
</table>

Domestic Bond
Categories: Canadian Short Term, Canadian Fixed Income, Canadian Long Term Fixed Income, Canadian Inflation Protected Fixed Income

Global Bond
Categories: Global Fixed Income

High Yield Bond
Categories: High Yield Fixed Income

Preferred Share
Categories: Preferred Share Fixed Income
Similar Funds

Factors for Allocation Funds:

<table>
<thead>
<tr>
<th>Factor/Weight</th>
<th>Domestic Balanced</th>
<th>Global Balanced</th>
<th>Target Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Equity Sectors</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Equity Style Box</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Regional Exposure</td>
<td>10</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Duration</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Credit Quality Breakdown</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Maturity</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Fixed Income Sectors</td>
<td>20</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Domestic Balanced
Categories: Canadian Fixed Income Balanced, Canadian Neutral Balanced, Canadian Equity Balanced

Global Balanced
Categories: Global Fixed Income Balanced, Global Neutral Balanced, Global Equity Balanced, Tactical Balanced

Target Date
Categories: 2015 Target Date Portfolio, 2020 Target Date Portfolio, 2025 Target Date Portfolio, 2025+ Target Date Portfolio
Overall Portfolio Scoring

**Shared Scoring Tools:**

A common method for comparing the contents of two investments is to see how much they overlap. The sum of the lesser values (SLV) is a way of measuring the degree of overlay. Simply stated, for each attribute being analyzed, the smaller value between the target investment and the universe of investments will be selected.

1. Let $S$ be the score for a given factor.

Let $D$ be the absolute value of the difference between the value for the target fund ($T$) and the value for the fund being scored ($F$). That is, $D = |T - F|$

2. Let $P$ be the percentage higher or lower the target fund’s value ($T$) is relative to the value for the fund being scored ($F$). Specifically, $P = (F - T) / T$.

3. Let $X$ be the percent that the value for the fund being scored ($F$) represents of the target fund ($T$). Specifically, $X = F / T$.

4. Let SLV be the Sum of Lessers.

\[
SLV = \sum_{i=1}^{n} \min(w_{Ai}, w_{Bi})
\]

Where

\[
\begin{align*}
  w_{Ai} &= \text{investment A’s weight in breakdown component } i \\
  w_{Bi} &= \text{investment B’s weight in breakdown component } i 
\end{align*}
\]
Overall Portfolio Scoring

Use the SAt function below to score the result from any of SLV routines. The SLV results should always be scored with the following SAt parameters.

<table>
<thead>
<tr>
<th>SLV</th>
<th>98</th>
<th>94</th>
<th>89</th>
<th>83</th>
<th>76</th>
<th>68</th>
<th>59</th>
<th>49</th>
<th>38</th>
<th>26</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

“SAt function”: This function assigns a score, S, to a value (D,P,X,or SLV) based on a rough table of what the score should be for certain ranges. This function will assign a score to any possible value based on a sloping line from one breakpoint to another.

SLV scoring curve with sum of lesser (SLV) on the x axis and score S on the y axis:

When the SLV falls in between the values listed in the above parameters the value of S will be linearly interpolated. Linear interpolation calculates the unknown rate as if it lies on a straight line between two known rates.
Overall Portfolio Scoring

Individual Factor Scores

Portfolio Reporting
Score each data point as follows:

1. Composition
   Find SLV, the Sum of Lessers value, and then find S using the SAt function. For Sum of Lessers, 
   \( n = 12 \)
   Cash (Long), Canadian Bond (Long), Canadian Equity (Long), Foreign Bond (Long), US Equity
   (Long), International Equity (Long), Cash (Short), Canadian Bond (Short), Canadian Equity
   (Short), Foreign Bond (Short), US Equity (Short), International Equity (Short).

2. Equity Style Box
   Step 1: Rescale each investment’s raw x and raw y to get rescaled x and rescaled y. See
   Appendix A.

   Step 2: Determine the distance between these points on the style box. The simple distances
   between the centroids’ x coordinates and y coordinates form the sides of a theoretical right
   triangle with the hypotenuse representing overall distance.

   Let
   \( x_1 = \) the rescaled x score of the target investment
   \( x_2 = \) the rescaled x score of the investment being evaluated
   \( y_1 = \) the rescaled y score of the target investment
   \( y_2 = \) the rescaled y score of the investment being evaluated
   \( H = \) the distance between the two investments’ centroids (i.e. the length of the
   hypotenuse)

   \[ H = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \]
Overall Portfolio Scoring

Step 3: Find H and then find S using the SAt function and the parameters below.

<table>
<thead>
<tr>
<th>H</th>
<th>7</th>
<th>18</th>
<th>33</th>
<th>49</th>
<th>69</th>
<th>92</th>
<th>117</th>
<th>146</th>
<th>177</th>
<th>211</th>
<th>247</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Examples:

- Funds with (rescaled) x and y differences of 25 each will get a score of 7.
- Funds with (rescaled) x and y differences of 50 each will get a score of 5.
- Funds with (rescaled) x and y differences of 75 each will get a score of 4.
- Funds with (rescaled) x and y differences of 100 each will get a score of 3.

3. Equity Sectors

Find SLV, the Sum of Lessers value, and then find S using the SAt function. For Sum of Lessers, \( n = 11 \) (Basic Materials, Consumer Cyclical, Financial Services, Real Estate, Consumer Defensive, Healthcare, Utilities, Consumer Services, Energy, Industrials and Technology)

4. % Assets in Top Holdings

Find D (absolute value of the difference between the value for the target fund (T)) and then find S (the score for this factor) using the SAt function and the parameters below.

<table>
<thead>
<tr>
<th>D</th>
<th>4</th>
<th>8</th>
<th>13</th>
<th>20</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
Overall Portfolio Scoring

5. Regions
   a) The database lists 13 regions:

   1 - United States   8 – Africa
   2 – Canada   9 – Middle East
   3 – Latin America  10 – Japan
   4 – United Kingdom  11 – Australasia
   5 – Eurozone  12 – Asia Developed
   6 – Europe ex-Euro  13 – Asia Emerging
   7 – Europe Emerging

   b) Take each fund’s 13-region breakdown and break it down as follows. Note that China needs to be broken out of Asia Emerging

   1 - Canada  7 – Africa/Middle East
   2 – United States  8 – Japan
   3 – Latin America  9 – Australasia
   4 – United Kingdom  10 – Asia Developed ex Japan
   5 – Europe Developed  11 – China
   6 – Europe Emerging  12 – Asia Emerging ex China

   c) Find SLV (the Sum of Lessers value) and then find S using the SAt function. For SL, n=12.
Overall Portfolio Scoring

6. Fixed-Income Maturity

There are 4 maturity ranges:

- Cash and cash equivalents
- Short-term (1-5 years)
- Medium-Term (5-10 years)
- Long-term (10+ years)

If the maturity ranges of the two funds are:

- Identical, then $S = 10$
- Adjacent, then $S = 5$
- Otherwise, $S = 0$
Overall Portfolio Scoring

7. Duration
Find D and then find S using the SAt function and the parameters below.

\[
\begin{array}{c|ccccc}
D & 0.5 & 1.0 & 1.5 & 2.5 & 4.0 \\
S & 10 & 8 & 5 & 3 & 0 \\
\end{array}
\]

8. Credit Quality Breakdown
Find SLV (the Sum of Lessers value) and then find S using the SAt function. For Sum of Lessers, \(n=10\) (AAA, AA, A, BBB, BB, B, CCC, CC, C, NR)

9. Fixed-Income Sectors
Find SLV (the Sum of Lessers value) and then find S using the SAt function. For Sum of Lessers, \(n=6\) (Government, Government Related, Corporate, MBS, ABS, Preferred)

10. 12 Month Yield
Find X and then find S using the SAt function and the parameters below.

If \(X \geq 1.0\), use

\[
\begin{array}{c|ccccc}
X & 1.035 & 1.08 & 1.135 & 1.20 & 1.2975 \\
S & 10 & 7 & 5 & 3 & 0 \\
\end{array}
\]

If \(X < 1.0\), use

\[
\begin{array}{c|ccccc}
X & 0.965 & 0.92 & 0.865 & 0.80 & 0.7025 \\
S & 10 & 7 & 5 & 3 & 0 \\
\end{array}
\]
Overall Portfolio Scoring

**Overall Portfolio Score**

To determine the Overall Portfolio score for each fund:

1. Multiply each of its scores by the relevant total factor (from the tables above).
2. Sum each product.
Overall Performance Scoring

Euclidean Distance is a way to measure the magnitude, correlation (direction), and average returns of two funds.

Let:

\[ m \] = Unique time period (one of 36 months)
\[ r_{tm} \] = Monthly return of target investment \( (\text{the user specified offering}) \)
\[ r_{jm} \] = Monthly return of investment that is being compared \( (\text{the potential similar fund}) \)
\[ ED_f \] = The Euclidean distance between the target investment and the subject investment
\[ ED \] = The average Euclidean distance between each investment’s returns and the category average returns.

\[
\text{Euclidean Distance} = \sqrt{\sum_{m=1}^{36} (r_{tm} - r_{jm})^2}
\]

If

\[ ED_f < \sqrt{2} \times ED \]

Then,

\[ S = 10 - 5 \left| \frac{ED_f}{ED} \right| \]

For all other cases,

\[ S = 0 \]
## Overall Performance Scoring

Category average Euclidean distance

The following is a chart of $ED$ (the average Euclidean distance between each fund’s returns and the category average returns). These should be rerun every 12 months.

### Money Market Funds:
- Canadian Money Market
- U.S. Money Market
- Canadian Synthetic
- Money Market

### Fixed Income Funds:
- Canadian Short Term Fixed Income
- Canadian Fixed Income
- Canadian Long Term Fixed Income
- Canadian Inflation Protected Fixed Income
- Global Fixed Income
- High Yield Fixed Income
- Preferred Share Fixed Income

### Balanced Funds:
- Canadian Equity Balanced
- Canadian Neutral Balanced
- Canadian Fixed Income Balanced
- Global Equity Balanced
- Global Neutral Balanced
- Global Fixed Income Balanced

### Target Date Funds:
- 2015 Target Date Portfolio
- 2020 Target Date Portfolio
- 2025 Target Date Portfolio

### Equity Funds:
- Canadian Dividend & Income Equity
- Canadian Equity
- Canadian Small/Mid Cap Equity
- Canadian Focused Equity
- Canadian Focused Small/Mid Cap Equity
- U.S. Equity
- U.S. Small/Mid Cap Equity
- North American Equity
- Asia Pacific Equity
- Asia Pacific ex-Japan Equity
- Greater China Equity
- European Equity
- Emerging Markets Equity
- Global Equity
- Global Small/Mid Cap Equity
- International Equity
- Financial Services Equity
- Precious Metals Equity
- Natural Resources Equity
- Real Estate Equity
- Energy Equity
Overall Similarity Scoring

**Step 5: Overall Similarity Score**

If \( \text{Score}_O \) is the overall similarity score, \( \text{Score}_P \) is the portfolio score, and \( \text{Score}_R \) is the performance score, then:

\[
\text{Score}_O = \frac{\text{Score}_P}{2} + \frac{\text{Score}_R}{2}
\]

If the fund does not have a performance score due to lack of 36 months of performance data then the overall similarity score will equal the portfolio score.

Display the top results (ordered by Overall Similarity Score).