

Time-Weighted ROI Standards and Calculations

AIMR/GIPS Investment Performance Reporting Standards

Since the AIMR/GIPS standards are lengthy and detailed, we will make no attempt to reproduce them here, except to highlight the key points regarding ROI calculation methodology and Investor's CalcStation (mhj3.com) Modified Dietz, Large Cash Flows Geometric Linking, and Daily Valuation investment portfolio performance calculator compliance with them:

- Use a consistent return calculation (time-weighted rate of return) when calculating investment portfolio returns. **Complies.**
- Take investor contributions and withdrawals during the analysis period into consideration when calculating ROI for investment portfolios. **Complies.**
- Time-weight the cash flows. **Complies.**
- Total Return required ROI includes both income and appreciation. **Complies.**
- Non-annualized returns should be presented for periods less than a year. **Complies.**
- Investment returns may be presented after deduction of management fees or before deduction of management fees; provided the fee schedule is disclosed separately. **Complies.**
- Portfolios should be valued at least quarterly and on dates of large deposits or withdrawals. **Complies.**
- Portfolio ROI includes cash as well as security holdings. **Complies.**

TWROI Calculation Simplified

If you started an analysis period of one year with \$1,000.00, contributed \$1,000.00 during the analysis period, and ended the analysis period with \$3,000.00, the answer of how to determine the return on investment during the analysis period depends on when the contribution of \$1,000.00 was made.

The profit during this period was \$1,000.00; \$1,000.00 start, plus \$1,000.00 contribution, minus the end value of \$3,000.00.

Therefore, it would seem that the return on investment for the period would be \$1,000.00 gain divided by an investment of \$2,000.00.

There is more.

You need to know how long you had the use of the contribution of \$1,000.00 during the analysis period to generate the profit of \$1,000.00 to calculate the most accurate Return on Investment; a time-weighted return on investment which takes into consideration the amount of time you had use of invested capital by taking into consideration when contributions were made and withdrawals and fees were deducted from the working capital available during the analysis period.

In other words, you need to know the Average Time-Weighted Capital Invested during the analysis period to generate a much more accurate approximation of the Return on Investment.

We will take an extreme case to make the issue and the solution clear:

- If you started with \$1,000.00 on day one of the analysis period and contributed \$1,000.00 on day two of the analysis period, you would have had almost full use (one day short) of \$2,000.00 during the analysis period to generate a profit of \$1,000.00.

- In this case, the time-weighted calculation of ROI would be closer to a \$1,000.00 gain divided by an average time-weighted investment of \$2,000.00 (\$1,995.00, per the modified Dietz method below because you had all but one day's use of the \$1,000.00 contribution during the analysis period).
- If you started with \$1,000.00 on day one of the analysis period and contributed \$1,000.00 one day prior to the end of the analysis period, you would have had almost no use of the \$1,000.00 contribution (one day short of the end of the analysis period) to generate the profit.
 - In this case, the time-weighted calculation of ROI would be closer to a \$1,000.00 gain divided by an average time-weighted investment of about \$1,000.00 (\$1,003.00, per the modified Dietz method below because you had only one day's use of the contribution of \$1,000.00 during the analysis period to generate the profit).

The Portfolio Performance Calculator does all of the calculations for you after you have entered the cash flows (date, amount, and type) by applying the Modified Dietz Method for calculating TWROI (Time Weighted Return on Investment).

Modified Dietz Method

Technically, the most accurate approximation for calculating TWROI (Time Weighted Return on Investment) during an analysis period would be to calculate the return on investment from each time a significant/large contribution or withdrawal is made up to the day prior to another significant/large contribution/withdrawal using the starting and ending portfolios values during each of these significant/large contribution or withdrawal analysis periods to calculate profit and ROI for each significant/large contribution or withdrawal analysis period. Then generate an average return of each of the contribution or withdrawal periods to calculate TWROI for the entire analysis period.

This process would result in a time-wasting, administrative nightmare.

For this reason, the Modified Dietz Method is the most practical and accurate way to calculate TWROI.

The differences between the two calculations, if any, would be measured in fractions of a percent; 10.00% Modified Dietz verses most often 10.01% to occasionally 10.10%.

TWROI Modified Dietz Calculations

The best formula for calculating time-weighted returns is the modified Dietz method:

$$R_{MDietz} = \frac{(EMV - BMV - CF)}{BMV + \sum_{i=1}^n (CF_i \times W_i)}$$

...where EMV is the market value of the portfolio at the end of the period, including all income accrued up to the end of the period, and BMV is the portfolio's market value at the beginning of the period, including all income accrued up to the end of the previous period. CF is the net cash

flows within the period (contributions to the portfolio are positive flows, and withdrawals or distributions are negative flows), and...

$$\sum_{i=1}^n (CF_i \times W_i)$$

...is the sum of each cash flow CF_i , multiplied by its weight, W_i . The weight (W_i) is the proportion of the total number of days in the period that cash flow CF_i has been held in (or out of) the portfolio. The formula for W_i is...

$$W_i = \frac{CD - D_i}{CD}$$

...where CD is the total number of calendar days in the period and D_i is the number of calendar days since the beginning of the period in which cash flow CF_i occurred. (The numerator is based on the assumption that the cash flows occur at the end of the day.) For example, if a cash flow occurred on January 20th, W_i is then calculated as $(31-20)/31 = 0.35483871$.

Phyllis invests \$100 in Safeco, a mutual fund, on August 1. On August 10, she adds \$25 to her investment. On August 31, the market value of her shares is \$150. Her time-weighted return is 21.4%, calculated as follows:

$$\frac{(\$150 - \$100 - \$25)}{(\$100 + \$25 \times 21/31)} = 21.4\%$$

The modified Dietz method assumes an investment earns a constant rate of return over a selected period, eliminating the need to know the exact valuation on the date of each cash flow.

Intuitively, this return might be thought of as a weighted average of achieving a 25% return (earning \$25 on \$100 invested) for one-third of the period under analysis and a 20% return (earning \$25 on \$125 invested) for two-thirds of the period.

Annualizing Returns

Investors often need to see returns for multi-year periods reflected on an annualized basis.

Annualized returns for such periods show the equivalent yearly return for each of the years within the multi-year period that would have been needed to achieve the overall period return.

$$R_{\text{annualized}} = \sqrt[n]{(1 + R_{\text{multiyear}})} - 1$$

...where $R_{\text{multiyear}}$ is the overall period return for the multi-year period expressed as a decimal and "n" is the number of years in the multi-year period.

Example: Annualized Returns for Whole Year Periods

Assume a 5-year period return of 31.54%.

What equivalent return (i.e., "annualized return") would be required to achieve a 31.55% return for the overall 5-year period? Using the formula above, the "Rannualized" = 5.6359%. So, it can be said that the 31.55% return for the 5-year period could also have been achieved had we had annual returns of 5.63% for each of the 5 years.

Example: Annualized Returns for Fractional years

Investors may want to see an annualized return for an analysis period which includes a fractional year.

Assume an investor wants to know the annualized return since account inception, which in this case is assumed to be 18 months (1½ years). If the period return since inception is 21.39%, then the annualized return is computed as 13.74%.

While this example was done for illustration, mhj3.com uses days instead of months when calculating the nth root. This is more accurate since not all months have the same number of days.

The same analysis and calculations apply to analysis periods for less than a year. However, one should be cautioned that a large gain for a short period, a month for example, will show extraordinary annualized returns that probably are not sustainable.

These annualized return calculations are standard industry practice.