

A Return Formula That Doesn't Always Work



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Return formulas tend to be pretty simple



You're no doubt familiar with:

$$R^{ModifiedDietz} = \frac{V_E - V_0 - \sum C_i}{V_0 + \sum W_i \times C_i}$$

$$R^{Exact} = \frac{V_E}{V_0} - 1$$

You've probably seen this one, too

$$R = \frac{\sum_{i=1}^n v_{0,i} \times r_i}{V_0}$$

Sum product of the
sub-portfolio
returns

Divided by the
portfolio's starting
value

Jose Menchero has often used this form

E.g., from Menchero, Jose G. 2000/2001. “A Fully Geometric Approach to Performance Attribution.” *The Journal of Performance Measurement*. Winter.

“The portfolio return R_t for a single period t can be written as the weighted average return of N sectors

$$R_t = \sum_{i=1}^N w_{it} r_{it}$$

“where w_{it} and r_{it} are the portfolio weights and returns for sector i .”

Problem w/this formula: it doesn't account for cash flows. So, we expand it a bit:

$$R = \frac{\sum_{i=1}^n \left(v_{0,i} + \sum_{j=0}^m w_{i,j} \times c_{i,j} \right) \times r_i}{\sum_{i=1}^n \left(v_{0,i} + \sum_{j=0}^m w_{i,j} \times c_{i,j} \right)}$$

If used daily, it *should* yield an exact return
BUT, it won't in some cases

Thus, this talk

I'll discuss three scenarios where it fails

#1: Mixed Weighted Model Problem

- Some use start-of-day (SOD) for all flows
- Some use end-of-day (EOD) for all flows
- But an increasing number use:
 - SOD for inflows
 - EOD for outflows
- Thus, the “mixed weighting method”

Non-Mixed; using EOD for all flows

| Case #1: A case where both inflows and outflows use the same cash flow weighting method (EOD) | | | | | | | |
|---|------------|------------|-------------|--------------|----------|--------|---------|
| Security | V_0 | V_e | C | W (for flow) | Wtd Flow | Weight | R |
| A | 100,000.00 | 130,000.00 | 25,000.00 | 0.00 | 0.00 | 0.20 | 5.0000% |
| B | 400,000.00 | 377,000.00 | (25,000.00) | 0.00 | 0.00 | 0.80 | 0.5000% |
| Portfolio (asset-wt) | 500,000.00 | 507,000.00 | 0.00 | n/a | | | 1.4000% |
| Portfolio (exact) | 500,000.00 | 507,000.00 | 0.00 | n/a | | | 1.4000% |

$$r_i = \frac{V_{E,i} + V_{0,i} + C_i}{V_{0,i}}$$

Using Mixed-Weighting

| Case #2: A case where inflows are treated as SOD and outflows as EOD | | | | | | | |
|--|------------|------------|-------------|--------------|-----------|--------|---------|
| Security | V_0 | V_e | C | W (for flow) | Wtd Flow | Weight | R |
| A | 100,000.00 | 130,000.00 | 25,000.00 | 1.0000 | 25,000.00 | 0.24 | 4.0000% |
| B | 400,000.00 | 377,000.00 | (25,000.00) | 0.00 | 0.00 | 0.76 | 0.5000% |
| Portfolio (asset-wt) | 500,000.00 | 507,000.00 | 0.00 | n/a | 25,000.00 | 1.00 | 1.3333% |
| Portfolio (exact) | 500,000.00 | 507,000.00 | 0.00 | n/a | | | 1.4000% |

$$r_i^{EOD} = \frac{V_{E,i} + V_{0,i} + C_i}{V_{0,i}}$$

$$r_i^{SOD} = \frac{V_{E,i} + V_{0,i} + C_i}{V_{0,i} + C_i}$$

#2: Not everything is included

- What if our portfolio includes securities that are not at the discretion of the manager: perhaps their legacy holdings that the client wants included in the portfolio. If these securities are excluded from the portfolio's return, we might have a different sort of problem.

Legacy asset included

Case # 3: A legacy security included; same cash flow method (EOD)

| Security | V_0 | V_e | C | W (for flow) | Wtd Flow | Weight | R |
|-----------------------------|-------------------|-------------------|-------------|--------------|----------|--------|----------------|
| A | 100,000.00 | 100,100.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.1000% |
| B | 400,000.00 | 400,100.00 | 0.00 | 0.00 | 0.00 | 0.73 | 0.0250% |
| Legacy security | 50,000.00 | 50,100.00 | (1,000.00) | 0.00 | 0.00 | 0.09 | 2.2000% |
| Cash | 0.00 | 1,000.00 | 1,000.00 | 0.00 | 0.00 | 0.00 | 0.0000% |
| Portfolio (asset-wt) | 550,000.00 | 551,300.00 | 0.00 | n/a | | | 0.2364% |
| Portfolio (exact) | 550,000.00 | 551,300.00 | 0.00 | n/a | | | 0.2364% |

Legacy asset excluded

Case # 4: A legacy security excluded; same cash flow method (EOD)

| Security | V_0 | V_e | C | W (for flow) | Wtd Flow | Weight | R |
|-----------------------------|-------------------|-------------------|-------------|--------------|----------|--------|----------------|
| A | 100,000.00 | 100,100.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.1000% |
| B | 400,000.00 | 400,100.00 | 0.00 | 0.00 | 0.00 | 0.80 | 0.0250% |
| Cash | 0.00 | 1,000.00 | 1,000.00 | 0.00 | 0.00 | 0.00 | 0.0000% |
| Portfolio (asset-wt) | 500,000.00 | 501,200.00 | 0.00 | n/a | | | 0.0400% |
| Portfolio (exact) | 500,000.00 | 501,200.00 | 0.00 | n/a | | | 0.2400% |

#3: Sub-portfolio transactions don't pair-off

- If the firm isn't diligent about ensuring *both sides* of a trade are done on the same day.
- E.g., the buy of a security and the sale of cash (perhaps from a money market)
 - With daily, transactions are missing
 - With monthly, the cash flow weighing formulas are different
- In both cases, we get errors

This formula

$$R = \frac{\sum_{i=1}^n \left(v_{0,i} + \sum_{j=0}^m w_{i,j} \times c_{i,j} \right) \times r_i}{\sum_{i=1}^n \left(v_{0,i} + \sum_{j=0}^m w_{i,j} \times c_{i,j} \right)}$$

- Expects sub-portfolio transactions to pair-off
- If they don't the returns will be inaccurate.

Monthly: likely more challenging than daily

- In the above examples, returns were calculated on a single day, thus the asset-weighted approach was compared with an exact time-weighted return.
- If we use it to derive returns on a monthly basis, thus as an approximation method, the situation gets even worse, as the likelihood of internal cash flows occurring increases.

My experience

- First, I always question the use of the method to derive the overall portfolio return from the sumproduct of the portfolio's sub-portfolio transactions
- It is unnecessary, and often results in errors

Have I found problems? Yes!

- First time, a UK client, who wanted me to verify their portfolio returns for a year.
- No external flows; so, should have been easy; but:
 - The sub-portfolio transactions didn't pair-off properly
 - And the results were skewed positively
- Second (recent), a long-standing GIPS[®] verification client, who switched to a system that uses this approach.
 - The client is unable to pair-off the transactions
 - It's been months, and they're still not verified

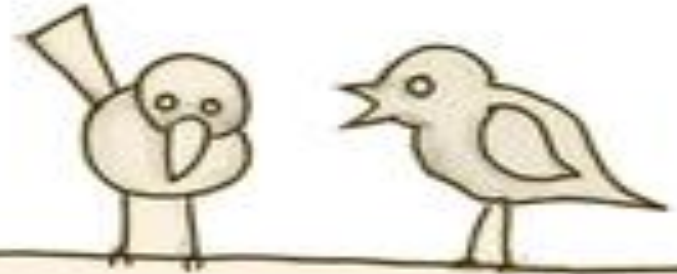
Summary

*Nothing to be gained
from this approach,
so why use it?
You'll run the risk of
errors.*



YOUR THOUGHTS?





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