Making Sense of PMEs: A Practical Comparison of Approaches

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Properties of benchmarks

- Unambiguous
- Investable
- Measurable
- Appropriate
- Reflective of current investment opinions
- Specified in advance
- Owned / Accountable

Bailey, Jeffery V. and David E. Tierney. 1998. *Controlling Misfit Risk in Multiple-Manager Investment Programs*. Charlottesville, VA: Research Foundation of CFA Institute.

What these properties mean

- Unambiguous: The identities and weights of securities constituting the benchmark are clearly defined
- Investable: It is possible to forgo active management and simply hold the benchmark
- Measurable: The benchmark's return is readily calculable on a reasonably frequent basis
- Appropriate: The benchmark is consistent with the manager's investment style or area of expertise and the needs / situation of the client
- Reflective of current investment opinions: The manager has current investment knowledge (be it positive, negative, or neutral) of the securities or factor exposures within the benchmark

What these properties mean

- Specified in advance: The benchmark is specified prior to the start of an evaluation period and known to all interested parties

- Owned/accountable: The investment manager should be aware of and accept accountability for the constituents and performance of the benchmark. It is encouraged that the benchmark be embedded in and integral to the investment process and procedures of the investment manager.

Public Market Equivalents - PMEs

- Let’s speak briefly about MWRR and public market indexes
- Public market indexes are time-weighted
- If we report a money-weighted return to a client, will a time-weighted index present any issues?
- Many think it will, as it gives us an “apples-to-oranges” comparison

Public Market Equivalents - PMEs

- While the index has no cash flows, the portfolio does
- We want a way to use a time-weighted public index as a benchmark for our private assets, but in a meaningful way
- We will consider a few approaches to converting our public market index into one that takes cash flows into consideration

Public Market Equivalents – First Steps

- The “Index Comparison Method” was introduced by Long-Nickels in 1996

- David Spaulding independently developed an identical method

Long, Austin M. III and Craig J. Nickels. *A Private Investment Benchmark*. Working Paper, 1996. Introduced the Index Comparison Method (ICM), later known as the Long-Nickels PME

Spaulding, David. TSG’s May 2006 Newsletter https://tinyurl.com/3t4t7hun

Calculating our Starting Value

- To start, we need to figure out the *equivalent number of shares* or units the investor would hold in the index.
- This is based on the portfolio's market value and index value.
- We simply divide the market value by the index value:

$$StartingNumberOfIndexShares = \frac{StartingPortfolioValue}{StartingIndexValue}$$

Calculating our Starting Value

- Start Date = 3/15/2024
- Starting Value = $100,000
- Index value on trade date before start date = 1101.20
- Equivalent number of shares in the index = 90.81.

$$StartingNumberOfIndexShares = \frac{StartingPortfolioValue}{StartingIndexValue} = \frac{100{,}000}{1101.20} = 90.81$$

Starting Values			
Start Date	**V_0**	**Starting Index Value**	**Equivalent # Shares in Index**
3/15/2024	100,000	1,101.20	90.81

Dealing With Cash Flows

- Whenever there's a cash flow, we need to determine the equivalent number of index shares/units the cash flow amount represents.
- Once this is done, we either add this number to the starting number (in the case of inflows) or reduce it (in the case of outflows).
- The formula is identical to what we do to determine the starting value.

Incorporating Cash Flows into our Index

- Flow Date = 12/1/2024; Contribution = $40,000
- Index value on trade date before flow date = 1210.10
- Equivalent number of shares/units of the index bought (because it's an inflow) = 33.06.

$$NumberOfSharesBought = \frac{CashFlowAmount}{IndexValue} = \frac{40{,}000}{1210.10} = 33.06$$

Cash Flow			
Flow Date	**Flow Amount**	**Index Value Prior Day**	**Equivalent # Shares Purchased**
12/1/2024	40,000	1,210.10	33.06

Ending Value

- At the end, we want to know the dollar value equivalent of the index, given the accumulated shares/units and the current index value.

- Once we have done this, we will have the data to calculate the MWR:

  - Beginning value and date
  - Cash flows (contributions and withdrawals) and corresponding dates
  - Ending value and date

Ending Value

- Accumulated number of shares = 90.81 + 33.06 = 123.87
- Ending index value = 1305.19
- Ending value of index position = $161,667.55

$$IndexDollarValue = SharesHeld \times IndexValue =$$

$$123.87 \times 1305.19 = 161{,}667.55$$

Ending Values				
End Date	**Portfolio V_E**	**Ending Index Value**	**Equivalent $ Value Index V_E**	**# Index Shares Held**
5/1/2025	155,000	1,305.19	161,667.55	123.87

Calculating the Return

- We calculate the cash flow weighting factor:

$$W = \frac{CD - D}{CD} = \frac{412 - 261}{412} = 36.65\%$$

- We use Modified Dietz as the IRR's 1st order approximation

$$R_{IndexMoneyWeighted} = \frac{V_E - V_0 - C}{V_0 + W \times C} =$$

$$\frac{161{,}667.55 - 100{,}000 - 40{,}000}{100{,}000 + 0.3665 \times 40{,}000} = 18.90\%$$

Calculating the Index's Return

- We use Excel's XIRR to calculate the index's IRR
- Our index's market equivalent is 19.03%

	Flows
3/15/2024	$ (100,000.00)
12/1/2024	$ (40,000.00)
5/1/2025	$ 161,667.55

CD	412
D	261
Weight	36.65%
Modified Dietz	18.90%
XIRR (Annualized)	16.69%
XIRR (Cumulative)	19.03%

Calculating the Portfolio's Return

- Use the same approach to calculate the portfolio's return
- Our portfolio's IRR is 13.15%,

	Flows
3/15/2024	$ (100,000.00)
12/1/2024	$ (40,000.00)
5/1/2025	$ 155,000.00

CD	412
D	261
Weight	36.65%
Modified Dietz	13.08%
XIRR (Annualized)	11.56%
XIRR (Cumulative)	13.15%

- Underperforming the PME's 19.03%

The Tables We Used

Index

	Flows		CD	412
3/15/2024	$ (100,000.00)		D	261
12/1/2024	$ (40,000.00)		Weight	36.65%
5/1/2025	$ 161,667.55		Modified Dietz	18.90%
			XIRR (Annualized)	16.69%
			XIRR (Cumulative)	19.03%

Portfolio

	Flows		CD	412
3/15/2024	$ (100,000.00)		D	261
12/1/2024	$ (40,000.00)		Weight	36.65%
5/1/2025	$ 155,000.00		Modified Dietz	13.08%
			XIRR (Annualized)	11.56%
			XIRR (Cumulative)	13.15%

Starting Values

Start Date	V_0	Starting Index Value	Equivalent # Shares in Index
3/15/2024	100,000	1,101.20	90.81

Cash Flow

Flow Date	Flow Amount	Index Value Prior Day	Equivalent # Shares Purchased
12/1/2024	40,000	1,210.10	33.06

Ending Values

End Date	Portfolio V_E	Ending Index Value	Equivalent $ Value Index V_E	# Index Shares Held
5/1/2025	155,000	1,305.19	161,667.55	123.87

Another example:

- Assume the following dates and cash flows:

Date	Flow
12/31/2020	-$1,000,000.00
12/31/2021	-$250,000.00
12/31/2022	$1,400,000.00
12/31/2023	$7,128.00

- Note:
  - Our convention is to show contributions as negative numbers and distributions as positive
  - The distribution shaded in grey is the ending valuation
  - The fund's IRR is 6.76% (annualized), 21.68% (unannualized)

Calculating the PME using Long-Nickels

	Long-Nichols PME						
Date	Index Return	Index Value	Flow	Units Bought/Sold	Cum Units Held	Notional Value before flow	Notional Value after flow
12/31/2020		2000	-$1,000,000.00	500.0000	500.0000	$0.00	$1,000,000.00
12/31/2021	4.50%	2090	-$250,000.00	119.6172	619.6172	$1,045,000.00	$1,295,000.00
12/31/2022	6.50%	2225.85	$1,400,000.00	-628.9732	-9.3560	$1,379,175.00	-$20,825.00
12/31/2023	7.70%	2397.24	-$22,428.53	0.0000	-9.3560	-$22,428.53	-$22,428.53

- Notional investments:
  - On 12/31/20: buy 500 units (1,000,000 / 2000)
  - On 12/31/21: buy 119.6172 units (250,000 / 2090)
  - On 12/31/22: sell 628.9732 units (1,400,000 / 2225.85)

Problems:

	Long-Nichols PME						
Date	Index Return	Index Value	Flow	Units Bought/Sold	Cum Units Held	Notional Value before flow	Notional Value after flow
12/31/2020		2000	-$1,000,000.00	500.0000	500.0000	$0.00	$1,000,000.00
12/31/2021	4.50%	2090	-$250,000.00	119.6172	619.6172	$1,045,000.00	$1,295,000.00
12/31/2022	6.50%	2225.85	$1,400,000.00	-628.9732	-9.3560	$1,379,175.00	-$20,825.00
12/31/2023	7.70%	2397.24	-$22,428.53	0.0000	-9.3560	-$22,428.53	-$22,428.53

- We see two problems have occurred:
  - The notional holding has changed from a long position to a short position, after the sale on 12/31/22
  - The notional value has, as a result, “crossed zero,” moving from positive to negative
  - Potential third issue: IRR may not yield a result (in this case we get 5.88% annualized)

In summary:

- The Long-Nickels approach assumes the PME has the same contributions and distributions as the fund
- A problem occurs if the performance of the public index is not sufficiently large to allow the PME to sustain the same distributions as the fund
- Various approaches have been developed to address this

Alternate PME approaches

- Long-Nickels (1996): aka Index Comparison Method
- PME+ (2003, Rouvinez)
- Modified PME (2013, Cambridge Associates)

- **Rouvinez, Christophe (2003). *Private Equity Benchmarking with PME+*. Venture Capital Journal, August 2003. Introduced the PME+ methodology, an enhancement to the Long-Nickels Public Market Equivalent (PME) approach.**

Cambridge Associates. (2013). *Modified Public Market Equivalent (mPME).* Cambridge Associates LLC. Introduced a PME methodology that addresses the negative-NAV issue through dynamic distribution scaling based on interim NAVs.

The PME+ approach

- This approach:
  - Uses the initial value of the fund to start the PME's notional investment
  - Assumes the PME will have the same contributions as the fund, with corresponding notional investments
  - Discounts the fund's distributions so that they can be taken from the PME
    - A constant factor (lambda) is used to discount all distributions
    - Goal is to discount distributions so that the PME ending value matches the fund's ending value

PME+ step 1: separate contributions and distributions

Date	Flow	contributions(t	distributions(t)
12/31/2020	-$1,000,000.00	$1,000,000.00	$0.00
12/31/2021	-$250,000.00	$250,000.00	$0.00
12/31/2022	$1,400,000.00	$0.00	$1,400,000.00
12/31/2023	$7,128.00		

- Recall our convention: contributions (-) and distributions (+)
- Treat both as positive numbers after separating

- Note: ending value is not a distribution for these purposes

PME+ step 2: adjust contributions and distributions for index performance

Date	Index Value	contributions(t	distributions(t)	S_c	S_d
12/31/2020	2000	$1,000,000.00	$0.00	$1,198,620.23	$0.00
12/31/2021	2090	$250,000.00	$0.00	$286,751.25	$0.00
12/31/2022	2225.85	$0.00	$1,400,000.00	$0.00	$1,507,800.00
12/31/2023	2397.24045				

- On 12/30/20: 1,000,000 x (2397.24045 / 2000) = 1,198,620.23
- On 12/31/21: 250,000 x (2397.24045 / 2090) = 286,751.25
- On 12/31/22: 1,400,000 x (2397.24045 / 2225.85) = 1,507,800.00

PME+ step 3: sum the index-adjusted contributions and distributions

Date	Index Value	contributions(t	distributions(t)	S_c	S_d
12/31/2020	2000	$1,000,000.00	$0.00	$1,198,620.23	$0.00
12/31/2021	2090	$250,000.00	$0.00	$286,751.25	$0.00
12/31/2022	2225.85	$0.00	$1,400,000.00	$0.00	$1,507,800.00
12/31/2023	2397.24045				

- Sum of S_c: 1,198,620.23 + 286,751.25 = 1,485,371.475
- Sum of S_d: 1,507,800.00

PME+ step 4: calculate the scaling constant lambda

- Lambda = (Sum of S_c – Fund ending value) / (Sum of S_d)
- Thus, lambda = (1,485,371.475 – 7,128) / (1,507,800) = 0.9804

PME+ step 5: scale (discount) each of the distributions

- On 12/31/22: 1,400,000 x 0.9804 = 1,372,556.6156

PME+ step 6: gather the dates, contributions, and discounted distributions, and calculate the IRR

Date	Flow	contributions(t	distributions(t)	Discounted Distributions	Revised Flows
12/31/2020	-$1,000,000.00	$1,000,000.00	$0.00	$0.0000	-$1,000,000.00
12/31/2021	-$250,000.00	$250,000.00	$0.00	$0.0000	-$250,000.00
12/31/2022	$1,400,000.00	$0.00	$1,400,000.00	$1,372,556.6156	$1,372,556.62
12/31/2023	$7,128.00			$0.0000	$7,128.00

- Using the dates and the revised flows, we obtain an IRR of 5.61% (annualized) and 17.785 (unannualized)

PME+ step 7: we can check the ending value of the PME equals that of the fund

Date	Index Return	Revised Flows	Notional Value before flow	Notional Value after flow	
12/31/2020		-$1,000,000.00	0	$1,000,000.00	
12/31/2021	4.50%	-$250,000.00	$1,045,000.00	$1,295,000.00	
12/31/2022	6.50%	$1,372,556.62	$1,379,175.00	$6,618.38	
12/31/2023	7.70%	$7,128.00	$7,128.00	$0.00	

The Modified PME approach (Cambridge)

- This approach:
  - Uses the initial value of the fund to start the PME's notional investment
  - Assumes the PME will have the same contributions as the fund, with corresponding notional investments
  - Each distribution from the fund is a percentage of the fund's NAV at the time. The same weight will be taken as a distribution from the PME on the given date.
  - Note (additional data requirement): this approach requires knowing the fund's NAV on each distribution date

Modified PME step 1: fund data

Fund				
Date	Flow	Return	NAV before flow	NAV after flow
12/31/2020	-$1,000,000.00		$0.00	$1,000,000.00
12/31/2021	-$250,000.00	5.00%	$1,050,000.00	$1,300,000.00
12/31/2022	$1,400,000.00	8.20%	$1,406,600.00	$6,600.00
12/31/2023	$7,128.00	8.00%	$7,128.00	$0.00

- Fund flows, returns and/or NAVs can be gathered so that weights corresponding to distributions can be obtained

Modified PME step 2: calculate distribution weights

Date	Flow	Return	NAV before flow	NAV after flow	Distribution Weight
12/31/2020	-$1,000,000.00		$0.00	$1,000,000.00	0.0000%
12/31/2021	-$250,000.00	5.00%	$1,050,000.00	$1,300,000.00	0.0000%
12/31/2022	$1,400,000.00	8.20%	$1,406,600.00	$6,600.00	99.5308%
12/31/2023	$7,128.00	8.00%	$7,128.00	$0.00	100.0000%

- The fund only has one distribution: 1,400,000 on 12/31/22
- 1,400,000 / 1,406,600 = 99.5308% of the fund value

Modified PME step 3: calculate PME NAVs using contributions and adjusted distributions

Date	Flow	Index Return	Flow	Theoretical Contributions	Distribution Weight	Theoretical NAV pre-flow	Theoretical NAV post-flow	Weighted Distribution
12/31/2020	-$1,000,000.00		-$1,000,000.00	$1,000,000.00	0.0000%	$0.00	$1,000,000.00	0
12/31/2021	-$250,000.00	4.50%	-$250,000.00	$250,000.00	0.0000%	$1,045,000.00	$1,295,000.00	0
12/31/2022	$1,400,000.00	6.50%	$1,400,000.00	$0.00	99.5308%	$1,379,175.00	$6,471.32	1372703.683
12/31/2023	$7,128.00	7.70%	$7,128.00		100.0000%	$6,969.61	$0.00	6969.608798

- Theoretical contributions = original contributions
- On dates of distributions, the distribution weight is distributed from the pre-flow NAV
  - On 12/31/22: 99.5308% of 1,379,175 is distributed (1,372,03.663)

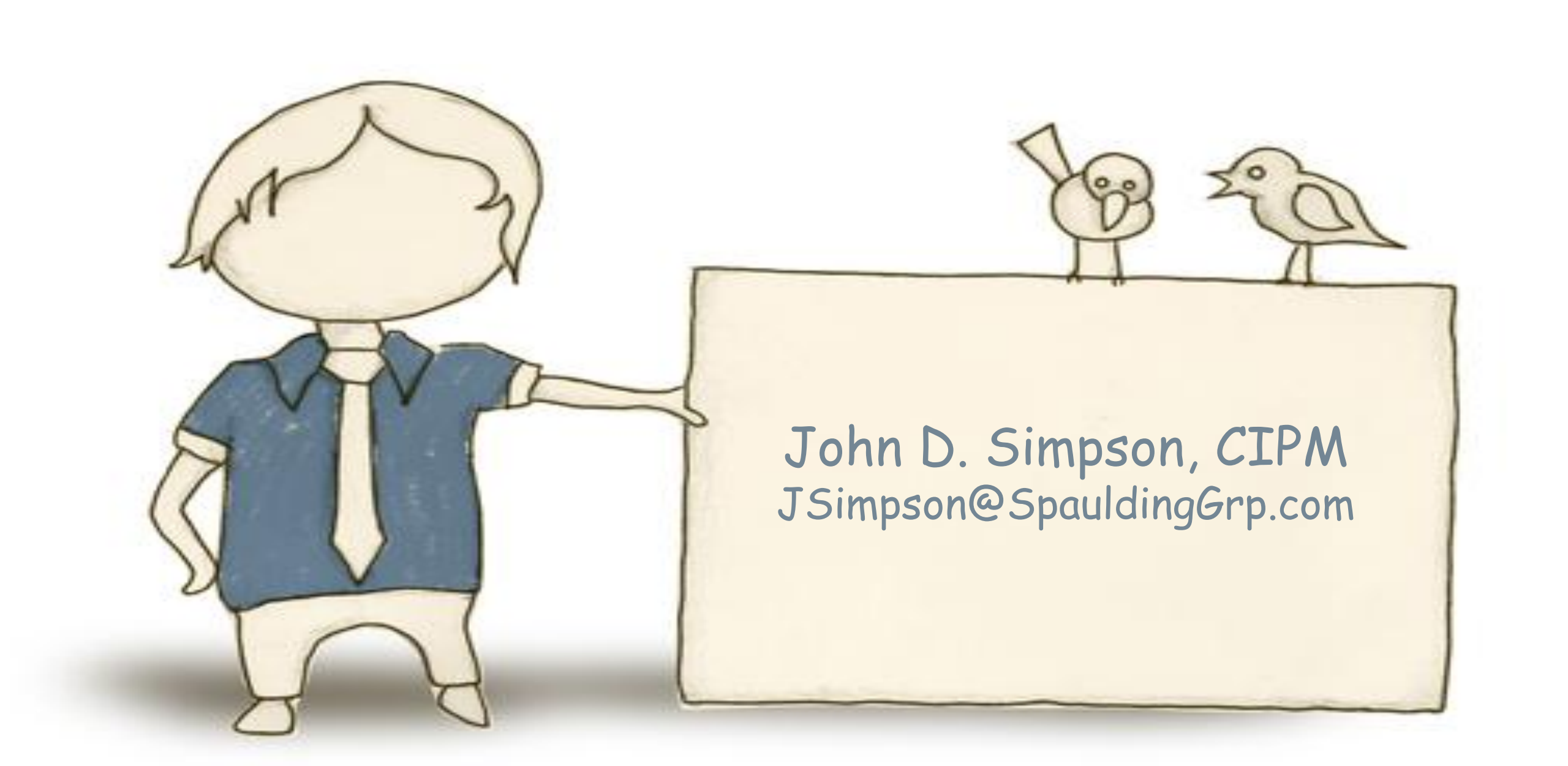
Modified PME step 4: use dates and revised cash flows to calculate IRR

Date	Flow	Revised Flows
12/31/2020	-$1,000,000.00	-$1,000,000.00
12/31/2021	-$250,000.00	-$250,000.00
12/31/2022	$1,400,000.00	$1,372,703.68
12/31/2023	$7,128.00	$6,969.61

- Using the dates and revised cash flows, we get an IRR of 5.61% (annualized) and 17.78% (unannualized)

Comparing the methods

Method	Introduced By	Year	Key Innovation
Long-Nickels PME (ICM)	Austin Long & Craig Nickels	1996	Creates a synthetic public portfolio with ***cash flows that match the PE fund cash flows***
PME+	Christophe Rouvinez / Capital Dynamics	2003	Makes the distributions possible by ***scaling using a single λ factor***
Modified PME (mPME)	Cambridge Associates	2013	Makes the distributions possible by ***dynamically using interim NAVs***



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