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Sustainable Returns, and other Measures of Long-Run Investor Outcomes

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How Can we Measure Outcomes to Long-Term Investors?

- We will discuss a series of measures that apply to those investors who do not consume from their investments; some more familiar and some less so.
  - Monthly returns.
  - “Holding period” returns across months.

- We will introduce a new return measure focused specifically on rates of withdrawal for consumption that I call the “sustainable return.”
  - The rate of periodic withdrawal for consumption that is consistent with the final value of capital equal to the initial value.

- We will illustrate outcomes for a sample of 71,000 global stocks, 1990 to 2022.

- Based on a working paper downloadable at https://ssrn.com/abstract=4528681

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Start with a series of Monthly Returns

- For the examples here, 396 monthly returns, January 1990 to December 2022, for the value-weighted portfolio of global sample stocks.
- Each return is computed in the usual way based on price change and dividend for the month.
- Now what?

Study the Arithmetic Mean of the monthly portfolio returns?

Monthly Measure	Monthly Outcome, VW Global Portfolio	Potential Holding Period Measure	Gross Outcome for 396 months.	Trading Strategy Interpretation
Arithmetic Mean	0.65%	Compound the Arithmetic Mean	12.70x	None
Arithmetic Mean	0.65%	Multiply the Arithmetic Mean by the Number of Months	3.55x	Each period, add or withdraw capital to maintain constant amount invested.

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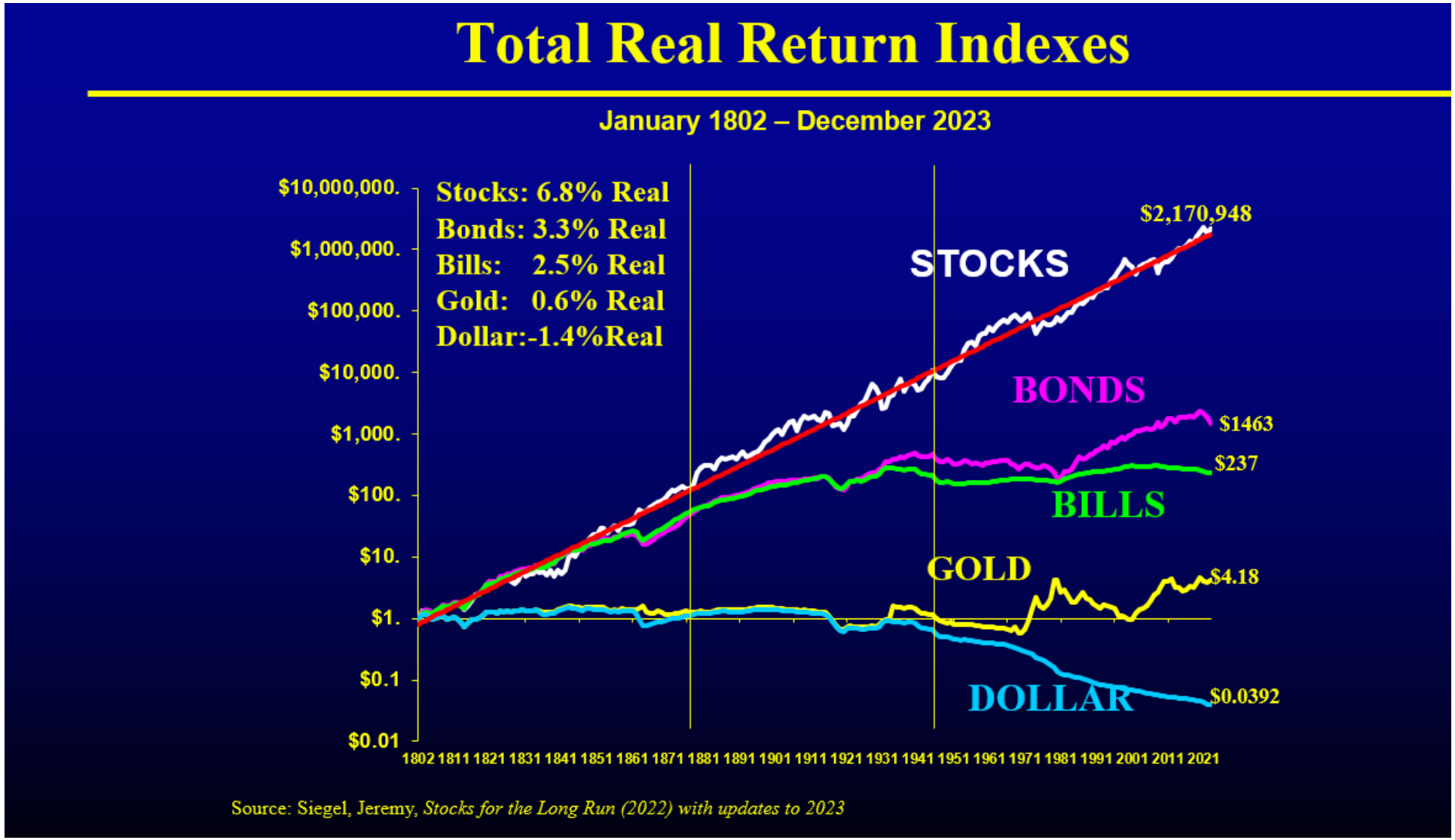
Study the Arithmetic Mean of the monthly portfolio returns?

- The compound arithmetic mean can be computed, but does not have economic interpretation.
- The sum of returns (arithmetic mean times number of observations) does have economic interpretation, as the outcome to a “always rebalance to initial investment” strategy.
  - This can be less than -100% (it is, for 12% of individual stocks in study).
  - There is no compounding.
- Why do we so often focus on arithmetic means?
- By far the most common approach in academic papers.
  - Mean/Variance Analysis, Comparison across portfolios formed from characteristics such as size or market/book, Sharpe Ratios, Alphas.

Study the Geometric Mean Return? Here are geometric means from Jeremy Siegel, "Stocks for the Long Run"



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Study the Geometric Mean?

Monthly Measure	Monthly Outcome, VW Global Portfolio	Potential Holding Period Measure	Gross Outcome for 396 months.	Trading Strategy Interpretation
Geometric Mean	0.54%	Compound the Geometric Mean	8.54x	Buy-and-hold, with dividends reinvested.

- All good, for a hypothetical buy-and-hold, reinvest dividends, investor.
- But not for all investors in a stock, or for the overall stock market.
  - Collectively, ***we do not reinvest dividends***.
  - We do ***receive share repurchase proceeds***.
  - We do ***fund new equity issuances***.

- Dividends and net share issuances are very important in aggregate.

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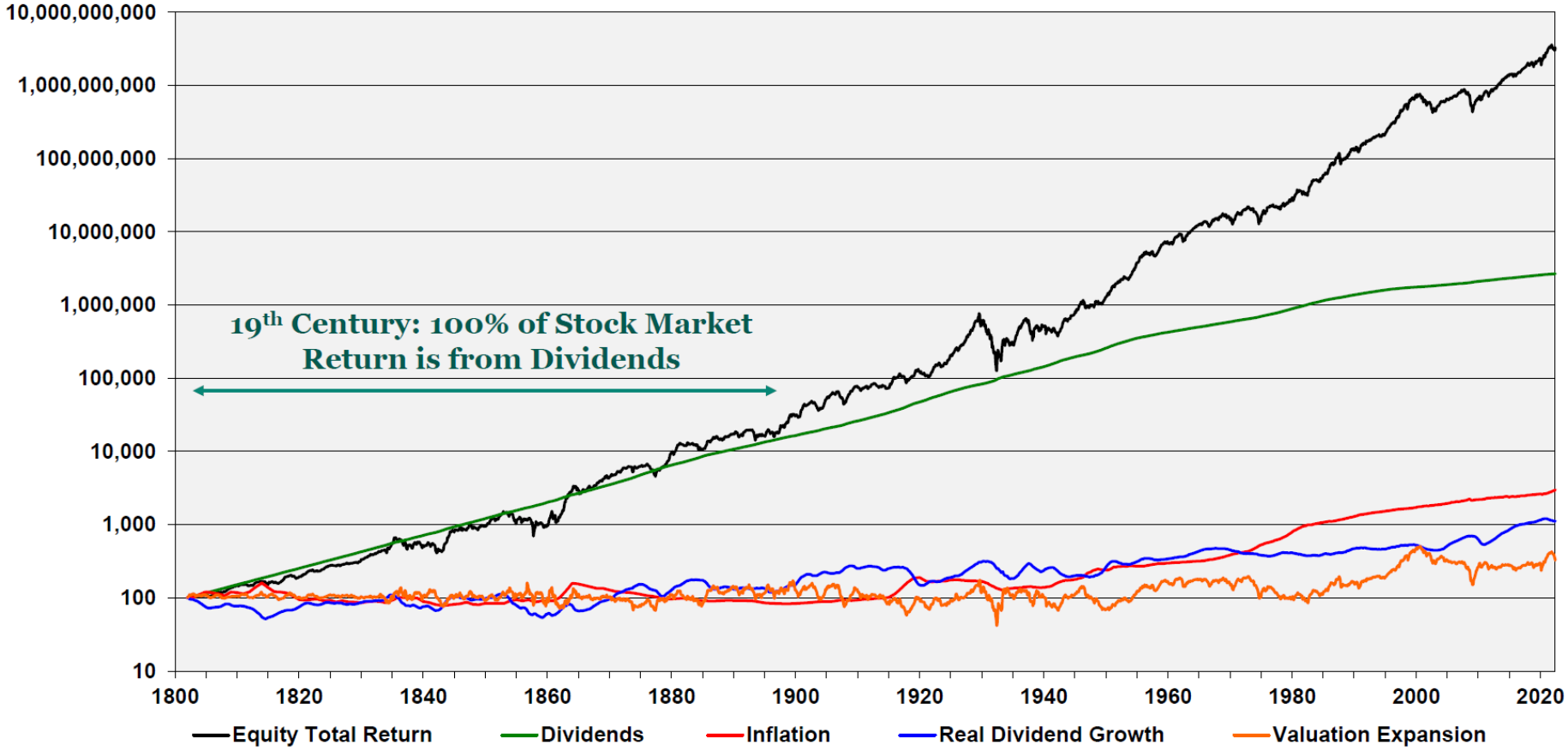
The Importance of Dividends

Dividends and the Three Dwarfs

Volatility is almost entirely due to changing P/D (or CAPE) ratio. Real returns are almost entirely due to dividends.



Study the Dollar-Weighted Monthly Return?

- Computed as the Internal Rate of Return (IRR) that equates the initial market value to the discounted value of all interim cash flows and the final market capitalization.

Monthly Measure	Monthly Outcome, VW Global Portfolio	Potential Holding Period Measure	Gross Outcome for 396 months.	Trading Strategy Interpretation
Dollar-Weighted Return (IRR)	0.53%	Compound the Dollar Weighted Return	7.20x	None

- Compounding the IRR makes the counterfactual assumption that interim cash flows can be reinvested to earn the IRR.

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Study Modified Versions of the IRR (MIRRs)

- The only method with ***potential*** to accurately measure holding period outcomes to active investors (including investors in aggregate).
- Outcomes depend on reinvestment rates/opportunity costs.
- One such method:
  - Discount negative interim cash flows to start of sample, add to the initial investment.
  - Compound positive interim cash flows to end of sample, add to the final investment value.
  - Solve for discount rate that equates these.
  - These discount rates can be meaningfully compounded to obtain holding period returns.

Study Modified Versions of the IRR (MIRRs)?

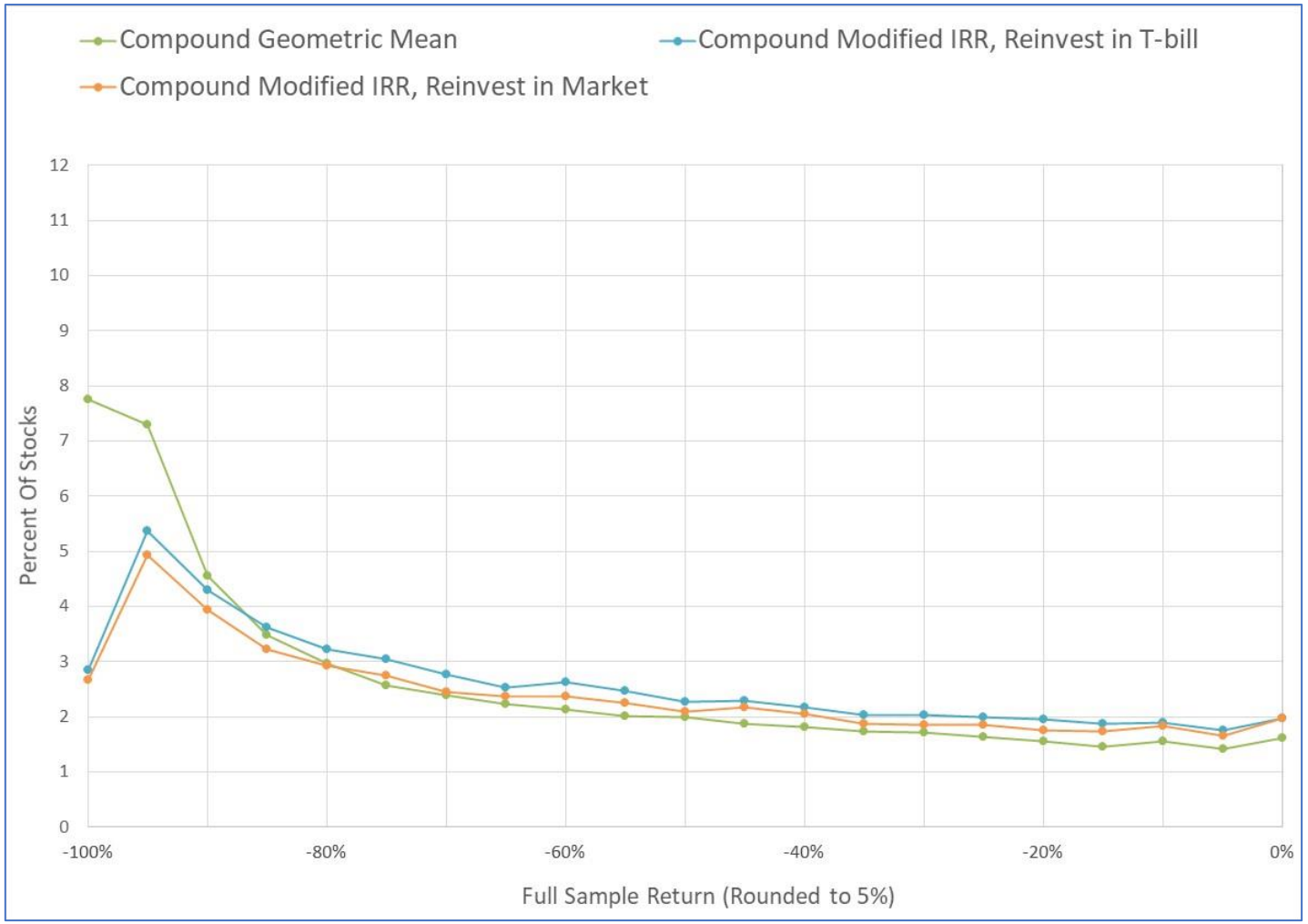
Monthly Measure	Monthly Outcome, VW Global Portfolio	Potential Holding Period Measure	Gross Outcome for 396 months.	Trading Strategy Interpretation
MIRR-Tbill	0.46%	Compound the MIRR-Tbill	6.07x	Reinvest positive interim cash flows until end, initially invest the PV of negative cash flows.
MIRR-SP500	0.62%	Compound the MIRR-SP500	11.37x	

These holding period measures do have economic interpretation, but require specific information/assumptions on reinvestment rates.

Outcomes for Selected Individual Stocks

			Return Measure				
Company Name (Most Recent)	First Date	Last Date	Arithmetic Mean	Geometric Mean	Dollar-Weighted Return (IRR)	MIRR Using T-bill	MIRR UsingVW Market
Netflix, Inc.	Jun. 2002	Dec. 2022	3.63%	2.30%	2.17%	1.18%	1.52%
Nvidia Corp.	Feb. 1999	Dec. 2022	3.62%	2.11%	1.89%	1.04%	1.27%
Apple Inc.	Jan. 1990	Dec. 2022	2.38%	1.60%	1.70%	1.22%	1.34%
GameStop Corp. (New)	Mar. 2002	Dec. 2022	7.70%	0.99%	0.42%	0.26%	0.60%
General Motors Corp.	Jan. 1990	May 2009	-0.63%	-1.40%	0.34%	0.30%	0.32%

Distribution of Holding Period Returns, Individual Sample Stocks (-100% to 0)



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Sustainable Returns

- All measures to here focus on the initial investment vs. the accumulated future value, while assuming reinvestment of interim cash flows.
- Let's now focus on sustainable rates of withdrawal for consumption or real investment instead.
- A series of withdrawals leading to a zero balance at a target date has been widely studied, particularly for retirement planning (often by simulation).
- Here, the focus will be on withdrawal rates consistent with the preservation of capital (nominal or real).
  - Individual with bequest motive, pension funds, endowments.
- Like any other return measure, the sustainable return can be measured ex-post, or considered ex-ante.

A bit of math
(The closed form solutions may be where the value lies)

- I_t is account balance at time t, R_t is gross return, inclusive of any dividend, and A is the annual withdrawal for consumption.

$$I_t = I_{t-1}R_t - A$$

$$GBHR_{t,T} = \prod_{j=t+1}^{T} R_j$$

$$I_T = I_0 GBHR_{0,T} - \left[\sum_{t=1}^{T} A * GBHR_{t,T}\right]$$

$$SR \stackrel{\text{def}}{=} \frac{A}{I_0} = \frac{GBHR_{0,T} - 1}{\sum_{t=1}^{T} GBHR_{t,T}}$$

Properties of the Ex-Post Sustainable Return

- Same sign as geometric mean return.
- Depends on the time ordering of returns.
- To define in real terms, simply divide each nominal gross return by 1+inflation

Outcomes on the Sustainable Return, 1990 to 2022.

- VW international portfolio, nominal: 0.52% per month.
- VW international portfolio, real: 0.31% per month.

- S&P 500, nominal: 0.93% per month.
- S&P 500, real: 0.66% per month.

- US outcomes considerably higher than the often-recommended 4% per year.

Ex-ante Sustainable Returns

- Useful for planning purposes.
- We show that, assuming iid returns, the expected sustainable return is *approximately* equal to the expected geometric mean return.
  - which is less than the expected arithmetic mean return, i.e., the “expected return”.

- In a large sample, with mean log return, μ = .06, and volatility σ = .25:

  - E(GM) ≈ E(SR) = $exp^{(.06)} - 1 = 6.18\%$.

  - E(AM) = $exp^{\left(.06 + \frac{.25^2}{2}\right)} - 1 = 9.55\%$.

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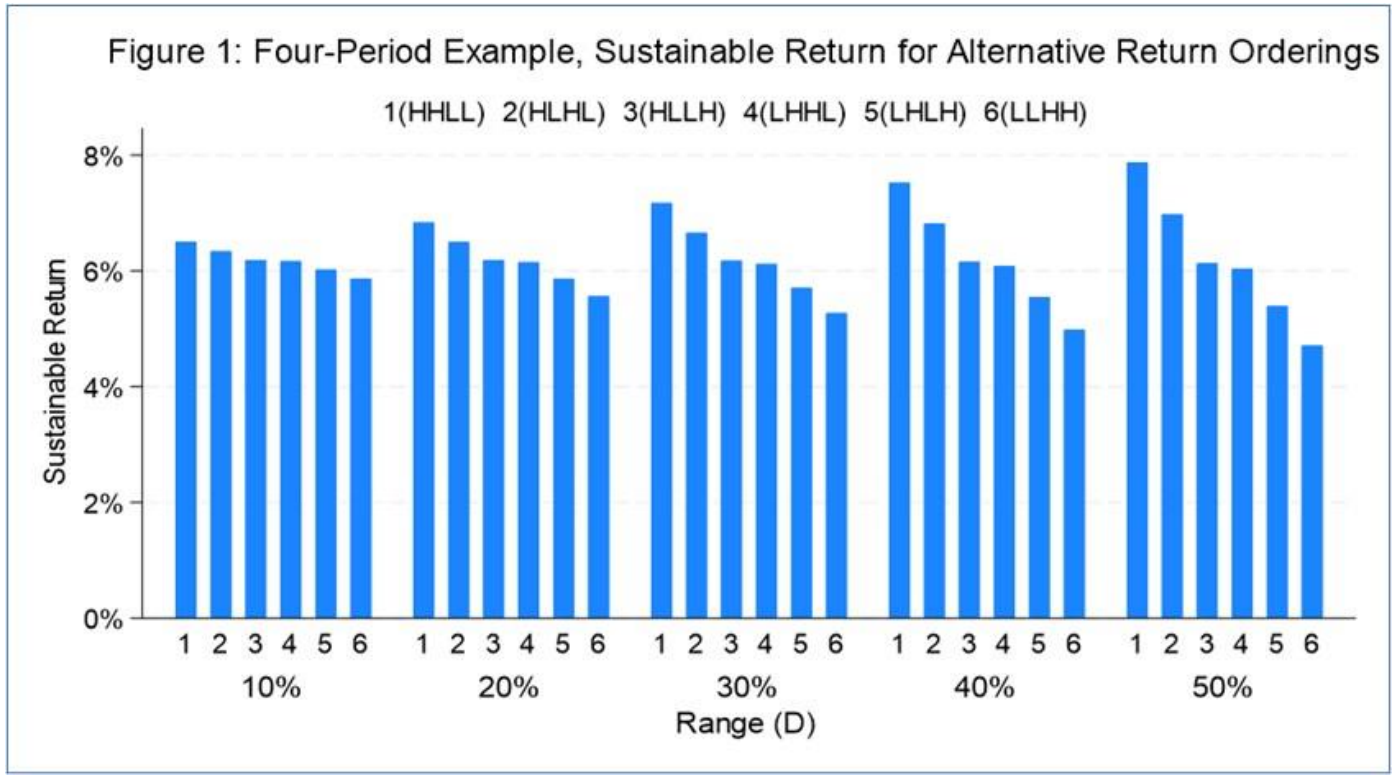
Ex-post sustainable returns depend on the sequence

- Four period example.
- Return can be H or L in a period, with D = H – L.
- Parameters selected so that ex-post geometric mean is 6.18% in each case.



The general point is already known; the innovation is the closed form solution.

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Sustainable Returns for Selected Stocks

- The ex-post Sustainable Return is of the same sign as the ex-post geometric mean.
- If the geometric mean is negative, then annual deposits rather than withdrawals would be necessary to maintain value.
- Outcomes for selected sample stocks:

Company Name (Most Recent)	First Date	Last Date	Sustainable Return (Nominal)	Sustainable Return (Real)
Netflix, Inc.	Jun. 2002	Dec. 2022	2.29%	2.08%
Nvidia Corp.	Feb. 1999	Dec. 2022	2.61%	2.23%
Apple Inc.	Jan. 1990	Dec. 2022	0.58%	0.45%
GameStop Corp. (New)	Mar. 2002	Dec. 2022	0.70%	0.54%
General Motors Corp.	Jan. 1990	May 2009	-11.02%	-13.06%

Risk of Ruin, and a Withdrawal Rule

- The GM outcome shows how risky it can be to attempt to withdraw the same dollar amount each period.
  - Particularly if the geometric mean turns out to be negative.
  - More likely for single stocks or poorly diversified portfolios.
- Which suggests a simple, time-varying, ex-ante withdrawal rule:
  - In each period, withdraw the product of the starting balance and the expected geometric return.
  - This does not guarantee that final capital will equal initial capital, but it will be true on average.
  - Neither the periodic withdrawal or the balance will turn negative, regardless of the horizon.

Further Analysis

- This paper provides a relatively simple closed form solution for both the ex-post and ex-ante Sustainable Return.
- Further analysis of the closed form solution should be useful.
- May supersede the reliance on simulations for retirement spending rules.

Conclusions

- Measuring long term investor outcomes is more complex than might be broadly realized.
  - With the exception of a hypothetical investor following a buy-and-hold with reinvested dividends approach.
- For any other investors (including investors in aggregate) the reinvestment or consumption of interim cash flows must be considered.
  - Arithmetic means (including alpha) and geometric means do not do so.
- A closed form solution for the sustainable rate of withdrawal is provided, and hopefully will prove useful.
- Questions and comments are welcome!

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