

The Financial Facts of Life

(Welch, Chapter 07-A)

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Maintained Assumptions

Perfect Markets

1. No differences in opinion.
2. No taxes.
3. No transaction costs.
4. No big sellers/buyers
 - ▶ infinitely many clones that can buy or sell.
 - ▶ plus unequal RoRs and uncertainty.
 - ▶ Now we add **risk aversion**.

A “Tour” of Investments for CorpFin

We need to cover:

1. Basic historical return patterns.
2. What risk aversion does.
3. How to measure risk and reward.
4. Benchmarks
5. The CAPM formula and its inputs.
6. How to use the CAPM.

Important Corp Fin Questions

- ▶ Where does the discount rate $E(r)$ in the NPV formula come from?
- ▶ What makes investors want to give us money?
- ▶ Advice: A full investments course can help you understand the reasoning of your counterpart.

Asset Classes

We often use convenient large diversified portfolios to represent a swath of investment types — though inaccurately so, such as:

- ▶ Stocks: Large-firm stocks, Small-firm stocks, Foreign stocks, Value stocks, ...
- ▶ Bonds: Long-term bonds, Risky bonds, Foreign bonds, Mortgage bonds, ...

- ▶ Short-Term: Cash, Foreign currencies, Short-term bonds, ...
- ▶ Real Estate: Commercial, Retail, West-Coast, Foreign, ...
- ▶ Art: Paintings, Renaissance sculptures, Rare Books, NFTs, ...
- ▶ Commodities: Eggs, Bacon, Crude, ... Precious Metals: Gold, Silver, Platinum, ... Agricultural: Land, Grain, ...

The S&P500 (with Dividends), Annual

Decade | 0 | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 |

|-----+-----+-----+-----+-----+-----+-----+-----+-----+-----| | 1970 | 3.5% |
14.1% | 18.7% | -14.5% | -26.0% | | 1975 | 36.9% | 23.6% |
-7.2% | 6.4% | 18.2% | | 1980 | 31.5% | -4.8% | 20.4% | 22.3%
| 6.9% | | 1985 | 31.1% | 18.5% | 5.7% | 16.3% | 31.2% | | 1990
| -3.1% | 30.0% | 7.4% | 9.9% | 1.3% | | 1995 | 37.1% | 22.7% |
33.1% | 28.3% | 20.9% |

Decade | 0 | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 |

|-----+-----+-----+-----+-----+-----+-----+-----+-----+-----| | 2000 | -9.0% |
-11.9% | -22.0% | 28.4% | 10.7% | | 2005 | 4.8% | 15.6% |
5.5% | -36.6% | 25.9% | | 2010 | 14.8% | 2.1% | 16.0% | 32.5%
| 13.5% | | 2015 | 1.5% | 9.5% | 19.2% | -6.0% | 28.4% | | 2020
| 18.4% | 28.7% | -16%? | | |

Source, e.g., <https://www.slickcharts.com/sp500/returns>
(-16% was by May 2022)

Graph: Time-Series

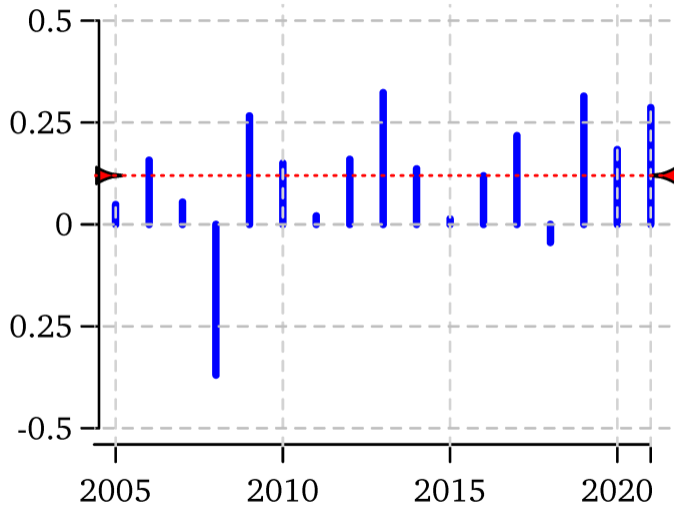


Figure 1: stock returns

Graph: Histogram (Density Plot)

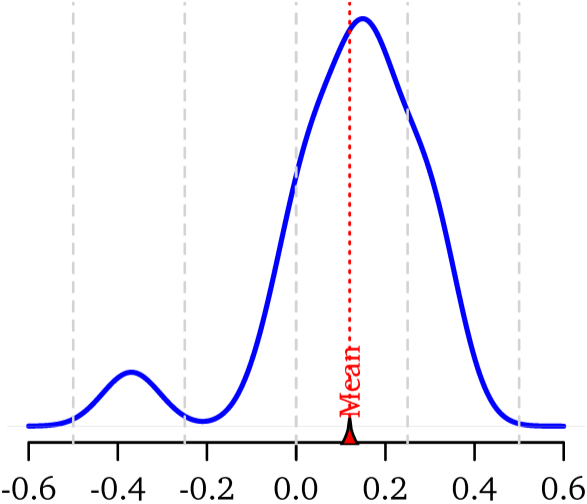


Figure 2: stock returns

Long-Run Market Rate of Return

- ▶ Depends on Measurement Period
- ▶ Here, 2005-2021 (probably too short).
- ▶ Average Rate of Return = 12% per year.
- ▶ Annualized RoR = 10.6% per year.
- ▶ Standard Deviation = 16.7% per year.
 - ▶ remember: $SD_{1,T} \approx \sqrt{T} \cdot SD_{1,1}$.
- ▶ Stock market was “really” great in this sample!
 - ▶ Will it continue at this average RoR?? ($E(r)$)?

Buy-and-Hold vs Average RoR?

Is the *average* RoR on an investment a good representation of the long-run RoR that a buy-and-hold investor receives?

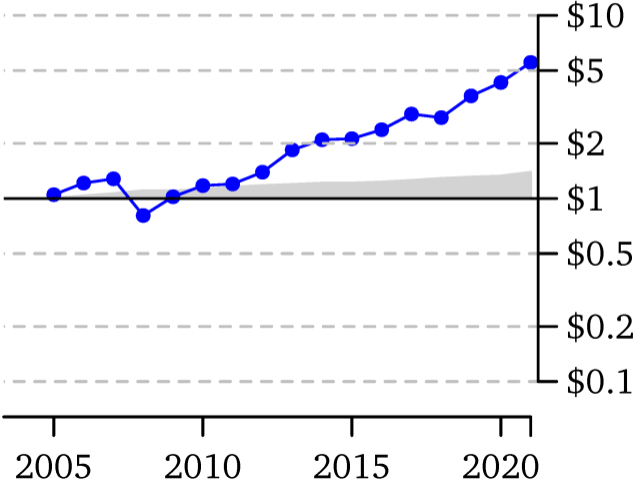
Average Rates of Return

- ▶ Compare two assets, A and B with equal average RoRs. However, A had a higher standard deviation than B.
- ▶ You are *not* risk-averse but risk-neutral.
- ▶ Would both investment have earned you the same?

Buy-and-Hold vs Average RoR

Is it possible to lose all your money on a buy-and-hold portfolio that had a positive average RoR?

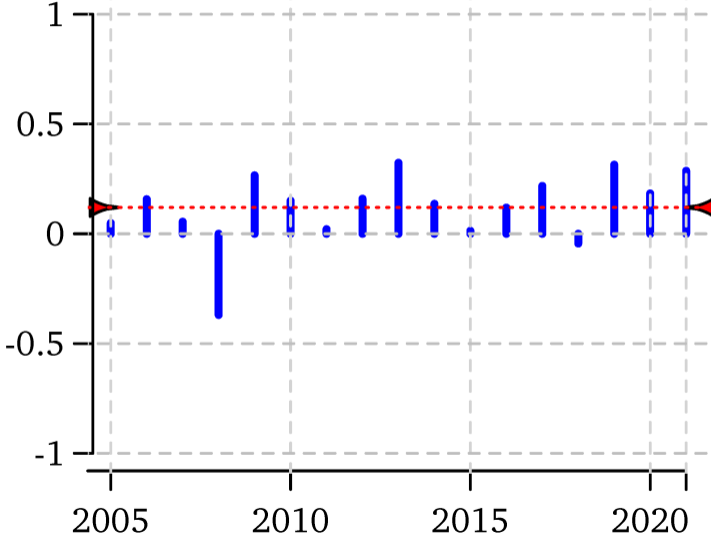
Graph: Compound, 1990-2015



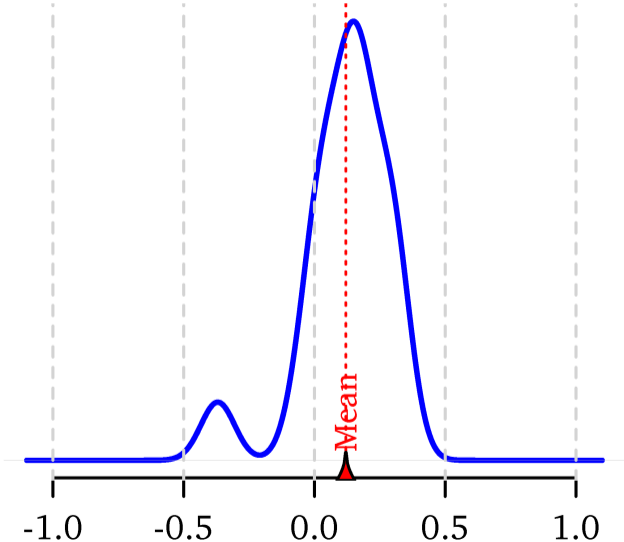
Stocks End Result

- ▶ \$1 on Jan 2005 became \approx \$5.53 in Dec 2021.
 - ▶ (Accuracy is useless, because different market portfolios [and sample periods] have different RoRs.)
- ▶ \$1 \rightarrow \$5.53.
- ▶ Geometric Avg RoR: $\sqrt[17]{\$5.53/\$1} - 1 = 10.6\%/yr.$
- ▶ Arithmetic Avg RoR: 12%/yr.
- ▶ SD(RoR) : 17%/yr.

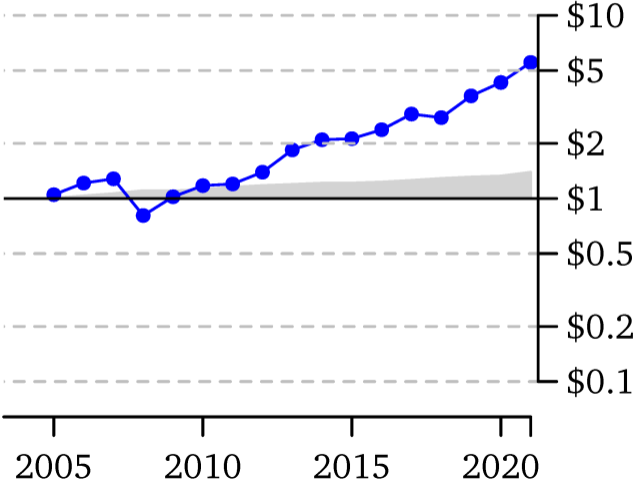
Graph: Stocks Time-Series



Graph: Stocks Histogram



Graph: Stocks Compound



Long-Term Bonds

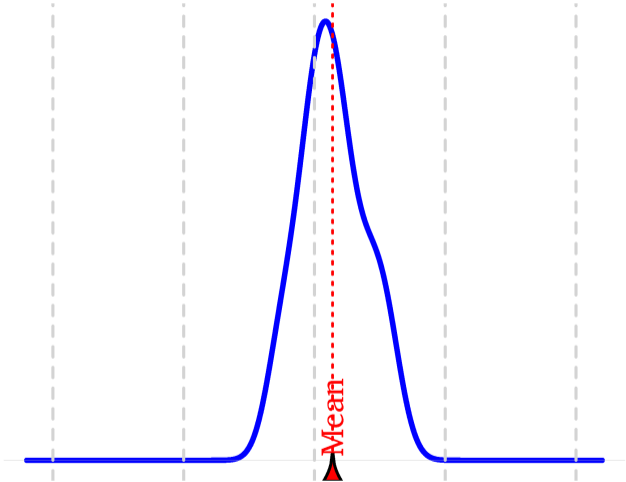
- ▶ U.S. Long-Term Treasury-Bonds from 2005 to 2021
- ▶ (Still have a term premium, though no default risk.)

Graph: Time-Series

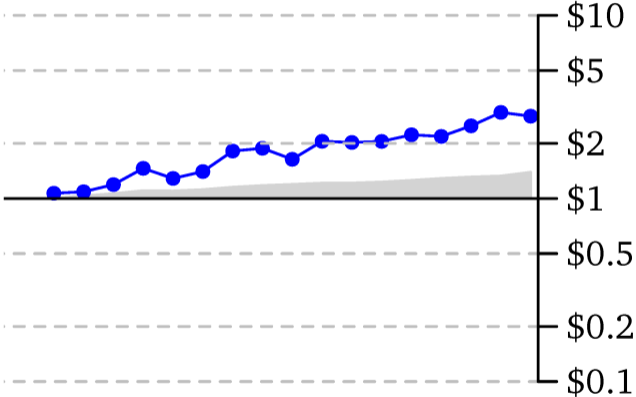


- ▶ \$1 → \$2.82
- ▶ $\sqrt[17]{\$2.82/\$1} - 1 = 6.3\%/yr.$
- ▶ Arithmetic Avg RoR: 6.9%/yr.
- ▶ SD(RoR) : 12%/yr.

Graph: T-Bonds Histogram



Graph: T-Bonds Compound



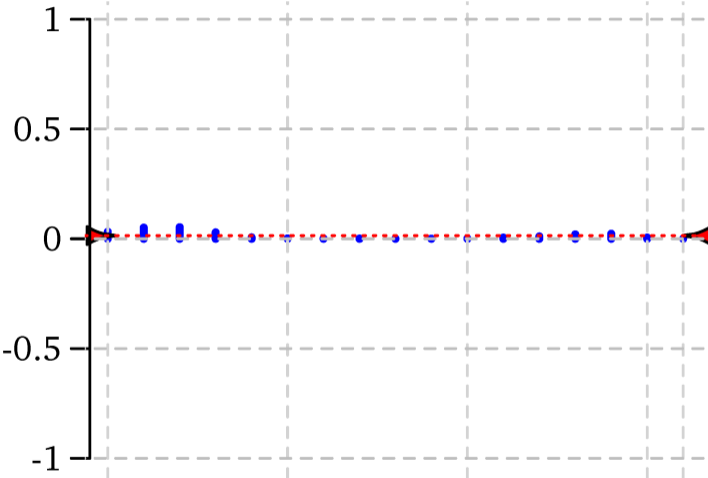
Cash

- ▶ U.S. Short-Term Treasury-Bonds from 2005 to 2021
- ▶ (Pretty risk- and term-free all around.)

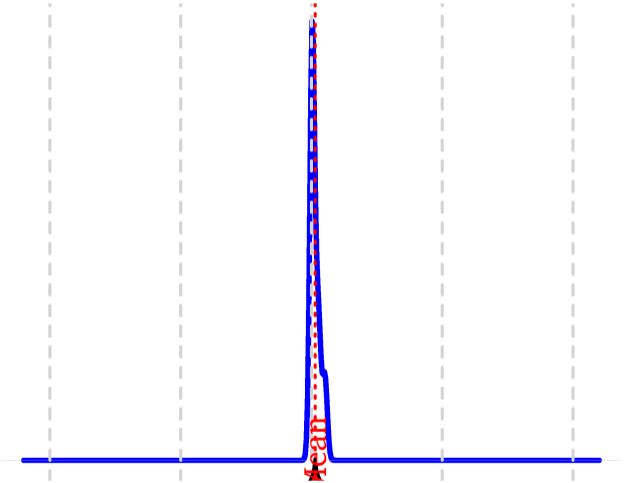
Graph: Cash (Money-Market)

- ▶ \$1 → \$1.27
- ▶ Geometric RoR : 1.4%/yr.
- ▶ Arithmetic RoR: 1.4%/yr.
- ▶ SD(RoR) : 1.8%/yr.
 - ▶ SD is so low that geo and ari avg RoR are similar

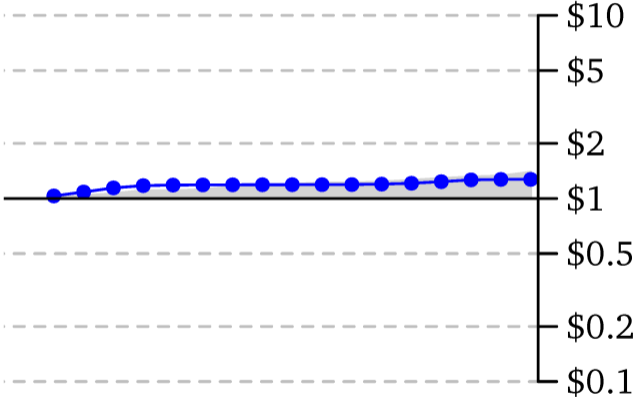
Graph: Cash Time-Series



Graph: Cash Histogram



Graph: Cash Compound



Individual Stocks Now

- ▶ Plots are in the book.

TSLA

- ▶ \$3.84 (2010-) → \$1,057
- ▶ \$1.00 (2010-) → \$275
- ▶ Geometric RoR: 60%/yr.

INTC

- ▶ \$1 → \$7.72
- ▶ Geometric RoR : 7.7%/yr.
- ▶ Arithmetic RoR : 10.5%/yr.

GM

- ▶ \$1 → \$0
 - ▶ really!
 - ▶ GM went bankrupt. Existing shareholders got nothing. Today's shareholders are different.
- ▶ Geometric RoR : $-100\%/yr.$
- ▶ Arithmetic RoR : $-4.5\%/yr.$

Asset Classes

Which of these asset classes (and stocks) generally offer higher average RoRs?

Asset Class Risk

Which of these asset classes (and stocks) were riskier?

Asset Class Risk

Could you have lost your shirt?

Asset Class Risk-Return

Is there a risk-return relationship?

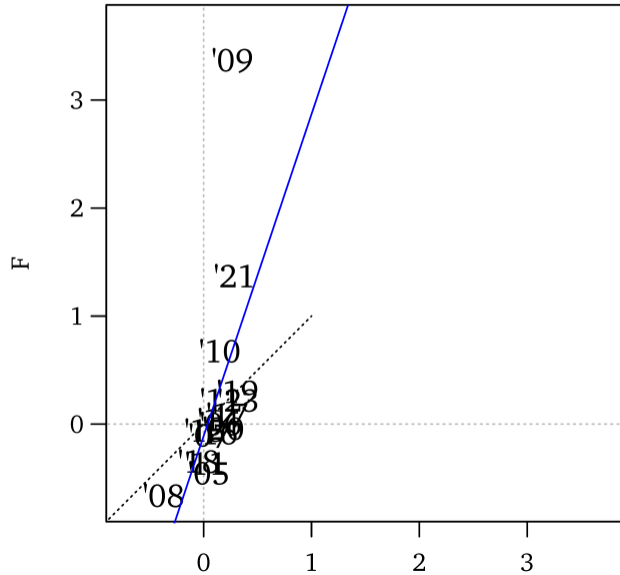
Positive Avg RoR

Do assets with a positive average RoR always make you money?

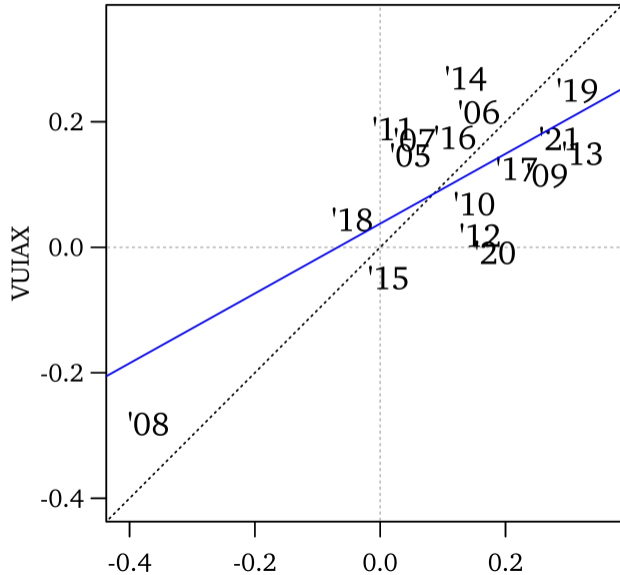
Correlation and (Market-) Beta

- ▶ Numbers in graphs are individual years.
- ▶ Blue lines are relation.
- ▶ Black dotted lines are 45 degrees.

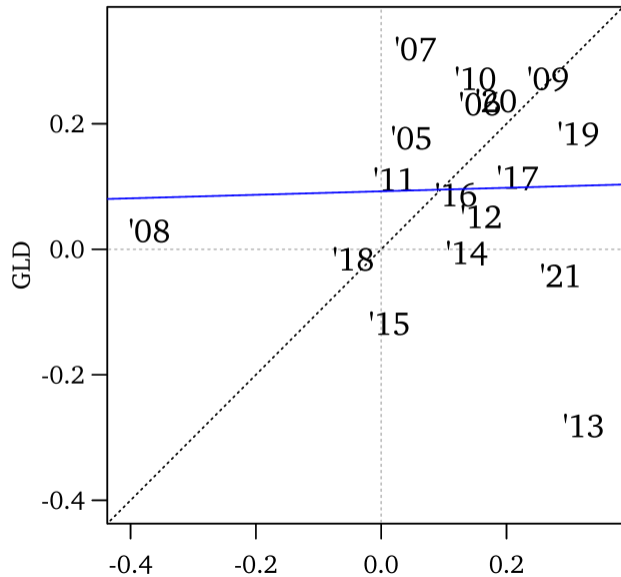
Ford



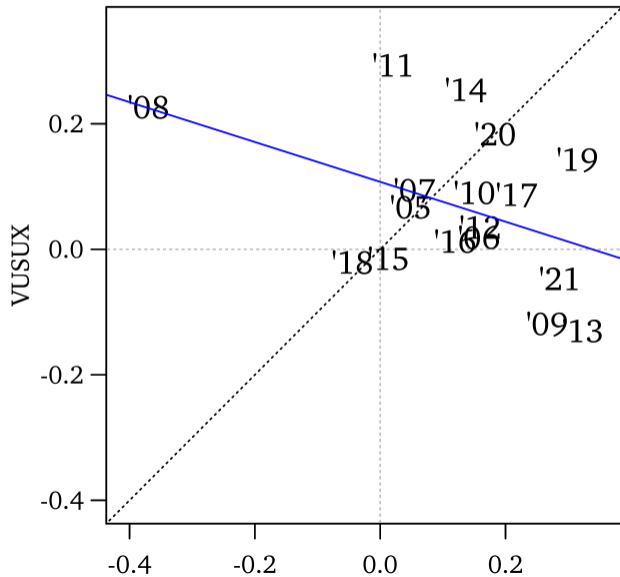
Utilities



Gold



Long Treasuries



Stock Co-Movement

- ▶ Do stocks move together?
- ▶ Do all asset classes move together?
- ▶ Intuitively, can we exploit non-synchronicity?

Why Have Many Stocks?

Is there anything special to multiple-stock investments?

History?

Can you trust history?

History vs Future — AGAIN

Finance has a lot of data

- ▶ big advantage over other economic fields,
- ▶ ...but maybe history is *not* representative!

Physics vs History

- ▶ Statisticians use historical distribution (means, SDs., etc.) to stand in for future distribution.
 - ▶ If we knew the physics, we would not need history.
 - ▶ We could work out the expected risk and reward from physics; maybe cross-check it w/ history.
 - ▶ We do *not* know the underlying physics of financial investments, so we try to extrapolate it from historical data.

Historical Data Problems

Historical data is helpful—but it can also mislead if it is not used carefully.

- ▶ Correlations and variances are “stable” (“reliable”), esp. with much daily data.
- ▶ Average RoRs are unstable for anything except asset classes...and even those are not very stable.
- ▶ **Tail risk** is very difficult to estimate.

Historical Data Alternative?

- ▶ **The only reason why we use historical data is because the alternative is *no data***
- ▶ ...and this would be *WAY* worse.

Geometric and Arithmetic RoRs

Can you translate geometric avg RoRs to arithmetic avg RoRs and vice-versa?

- ▶ Generally no.
- ▶ Only approximately, if movements are not too extreme.
- ▶ YMMV.

- ▶ **If** RoRs are approximately normally distributed and modest, then the arithmetic mean is higher than the geo mean by about half the variance.
- ▶ Stocks here: $12\% - (17\%^2/2) \approx 10.6\%$.
- ▶ Correct $\approx 10.6\%$.
 - ▶ Great approximation here!
 - ▶ But terrible approximation for GM.
 - ▶ claims -15%; was -100%.

Subtle But Not Obscure

- ▶ If you are interested in extrapolating your x-year RoR, you need to assess historical x-year geometric RoRs.
 - ▶ Do not extrapolate from historical *arithmetic* RoR averages into future *geometric* returns!
 - ▶ Extrapolating historic avg RoRs to longer periods without var correction is a common error.
- ▶ The historical variance is likely to continue, too!
 - ▶ ...and indeed more likely than the arithmetic avg RoR.

Digression

- ▶ **Does correlation mean causation?**

Causality vs Correlation

- ▶ One of the most important questions in finance, economic, and business.
- ▶ Everyone knows but most consulting reports get this *deliberately* wrong.
- ▶ **Regression Discontinuity** is unusually good at causality with empirical evidence—but not all questions can be addressed by it.

(Ever-changing) Market Institutions

- ▶ Brokers: Retail vs Prime Brokers
 - ▶ (Execution and Margin.)
- ▶ Market vs Limit orders.
- ▶ Various order modifications: Fill-or-kill, Good for the day, etc.
- ▶ Exchanges and non-Exchanges. Mostly computerized, batched auction or continuous, electronic crossing. OTC. (Pink sheets.)
 - ▶ no longer important.

Market Makers and Regulation

- ▶ Regulation: Congress, SEC, Exchanges(?!).
- ▶ Seeing the order book is an advantage.
- ▶ Mutual Funds (more funds than stocks today!)
- ▶ Open-end vs Closed-end funds.

SEC vs Non-SEC

- ▶ Investment companies under the 1940 Act: UITs, open-end=mutual funding the US, closed-end.
- ▶ Many other investment vehicles, e.g., hedge funds, private equity funds, venture capital funds, ADRs, trust funds, etc.
- ▶ Trust accounts (and churning).

Market Entry and Exit

- ▶ Entry of corporate securities into the financial markets: IPOs, underwriters, reverse mergers, SEOs.
- ▶ Exit of corporate funds from the financial markets: Dividends, repurchases, delisting, limited liability, financial distress.

Execution Costs

- ▶ No more commissions
- ▶ Only B-A spreads, often as low as 1c/share
 - ▶ adds up, though!

Shorting

- ▶ Ideally: You issue securities, just like the firm
- ▶ Practice: You need collateral and someone to borrow shares from. Plus, you pay to arranger and lender.
- ▶ Impossible to short BTC effectively
 - ▶ if cryptocurrencies die, whoever promised to arrange it (and give you the profit at the end) will be gone, too.

Coming Attractions

Don't miss the **egguilibrium!**