Discounted Cash Flow

Historical Equity Risk Premium

The common approach to estimate the equity risk premium is to base it on historical data. This method assumes that past performance is indicative of future results. Assuming “mean reversion,” where returns will revert to historic norms over time.

Historical ERP’s can be calculated in two different ways:

(1) Arithmetic Average

Simple average of the returns over a given period:

$$A = \frac{1}{n}\sum_{i=1}^{n} a_i = \frac{a_1 + a_2 + \cdots + a_n}{n}$$

where:

- A = arithmetic average
- n = number of values in the dataset
- a_i = represents each individual value in the dataset
- Σ = sum of all values from i=1 to *n*

(2) Geometric Average

Compound average of the returns over a given period:

$$\left(\prod_{i=1}^{n} x_i\right)^{\frac{1}{n}} = \sqrt[n]{x_1 x_2 \cdots x_n}$$

where:

- Π = represents the product of all values from i=1 to *n*
- n = number of values in the dataset
- x_i = represents each individual value in the dataset

Example: Suppose the S&P 500 has the following annual returns over three years: 10%, -5%, and 15%...

Arithmetic average calculation:

$$A = \frac{1}{3}\sum_{i=1}^{3} a_i = \frac{0.10 + (-0.05) + 0.15}{3} \rightarrow 6.67\%$$

Geometric average calculation:

$$\left(\prod_{i=1}^{3} x_i\right)^{\frac{1}{3}} = \sqrt[3]{1.10 \times 0.95 \times 1.15} \rightarrow 6.42\%$$

StableBread

Discounted Cash Flow

How to Decide on Arithmetic vs. Geometric Averages

Here's how to decide on whether to calculate arithmetic or geometric averages for expected market returns:

- **Arithmetic Average**: Suitable if you're using the Treasury bill rate as the risk-free rate and have a short time horizon.
- **Geometric Average**: Suitable if you're using the Treasury bond rate as the risk-free rate and have a long time horizon.

Therefore, for DCF valuations, which are almost always focused on longer time horizons, it's far better to use the geometric average calculation to calculate the expected market return because it accounts for compounding effects, thereby accurately reflecting long-term investment performance.

Arithmetic Average Historical Returns

Period	S&P 500 (With Dividends)	U.S. Treasury Bond (10-Year)	Equity Risk Premium
1928 - 2023 (95 Years)	11.66%	4.86%	**6.80%**
1974 - 2023 (49 Years)	12.54%	6.59%	**5.95%**
2014 - 2023 (9 Years)	12.98%	1.81%	**11.17%**

Geometric Average Historical Returns

Period	S&P 500 (With Dividends)	U.S. Treasury Bond (10-Year)	Equity Risk Premium
1928 - 2023 (95 Years)	9.80%	4.57%	**5.23%**
1974 - 2023 (49 Years)	11.10%	6.12%	**4.97%**
2014 - 2023 (9 Years)	11.91%	1.46%	**10.44%**

ERP of **5.95% to 11.17%** (arithmetic averages) vs. **4.97% to 10.44%** (geometric averages)

StableBread

Discounted Cash Flow

Flaws of Relying on Historical Data

Relying on historical data to estimate the equity risk premium (ERP) in the CAPM is generally a flawed approach. Here's why:

- **Noisy Estimates**: Returns can vary greatly depending on the chosen time period (e.g., last 10, 20, 50, 100 years). Moreover, including or excluding significant recessions (e.g., 2001 and 2008) will significantly impact your estimate.
  - Even over long periods, the derived risk premium will have substantial standard error (variability in a sample mean estimate). Between 1928 and 2023 (95 years), for instance, the ERP would fall somewhere between **2.53%** and **11.07%**, with 95% confidence (**6.80%** ± 2 × **2.15%**).
  - Differences in arithmetic and geometric average returns will also impact your equity risk premium estimate.
- **Survivorship Bias and Limited Data**: Historical data often comes from successful markets like the U.S., potentially overestimating future returns. For other markets, reliable historical data can be limited or even non-existent (e.g., some emerging markets). European markets are often dominated by a few large companies with thin trading.
- **Changing Market Dynamics**: Past performance doesn't account for structural changes in the economy or markets. Factors like globalization and the rise of technology companies have significantly altered market compositions.
- **Black Swan Events**: Rare, high-impact events like the COVID-19 pandemic can skew historical data and may not be representative of future patterns.

Despite its flaws, historical data remains the standard for estimating the ERP due to its simplicity and widespread acceptance. It provides an easily understandable, data-driven starting point. Investors can also average returns across different time periods to provide a more balanced view and reduce the impact of any single period's performance.

StableBread