

Appendix D
The Use of Historical Returns to Measure an Expected Risk Premium

It is quite common for analysts to estimate an equity or market risk premium as the difference between historical stock and bond returns. However, using the historical relationship between stock and bond returns to measure an ex ante equity risk premium can produce an inflated measure of the true market or equity risk premium. The equity risk premium is based on expectations of the future. When past market conditions vary significantly from the present, historic data does not provide a realistic or accurate barometer of expectations of the future. More significantly, there are a number of empirical issues that can result in historical returns being poor measures of the expected risk premium.

There are a number of issues in using historic returns over long time periods to estimate expected equity risk premiums. These issues include:

- (A) Biased historical bond returns
- (B) Use of the arithmetic versus the geometric mean return
- (C) The large error in measuring the equity risk premium using historical returns
- (D) Unattainable and biased historical stock returns
- (E) Company Survivorship bias
- (F) The “Peso Problem” - U.S. stock market survivorship bias

These issues will be addressed in order.

A. Biased Historical Bond Returns

An essential assumption of this approach is that over long periods of time,

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investors' expectations are realized. However, the experienced returns of bondholders in the past invalidate this critical assumption. Historic bond returns are biased downward as a measure of expectancy because of capital losses suffered by bondholders in the past. As such, risk premiums derived from this data are biased upwards.

B. The Arithmetic versus the Geometric Mean Return

The measure of investment return has a significant effect on the interpretation of the risk premium results. When analyzing a single security price series over time (i.e., a time series), the best measure of investment performance is the geometric mean return. Using the arithmetic mean overstates the return experienced by investors. In a study entitled "Risk and Return on Equity: The Use and Misuse of Historical Estimates," Carleton and Lakonishok make the following observation: "The geometric mean measures the changes in wealth over more than one period on a buy and hold (with dividends invested) strategy."¹ When a historic stock and bond return study covers more than one period (and he assumes that dividends are reinvested), he should be employing the geometric mean and not the arithmetic mean.

To demonstrate the upward bias of the arithmetic mean, consider the following example. Assume that you have a stock (that pays no dividend) that is

¹ Willard T. Carleton and Josef Lakonishok, "Risk and Return on Equity: The Use and Misuse of Historical Estimates," *Financial Analysts Journal*, pp. 38-47, (January-February, 1985).

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selling for \$100 today, increases to \$200 in one year, and then falls back to \$100 in two years. The table below shows the prices and returns.

Time Period	Stock Price	Annual Return
0	\$100	
1	\$200	100%
2	\$100	-50%

The arithmetic mean return is simply $(100\% + (-50\%))/2 = 25\%$ per year. The geometric mean return is $((2 * .50)^{(1/2)}) - 1 = 0\%$ per year. Therefore, the arithmetic mean return suggests that your stock has appreciated at an annual rate of 25%, while the geometric mean return indicates an annual return of 0%. Since after two years, your stock is still only worth \$100, the geometric mean return is the appropriate return measure. For this reason, when stock returns and earnings growth rates are reported in the financial press, they are generally reported using the geometric mean. This is because of the upward bias of the arithmetic mean. As further evidence of the appropriate mean return measure, the SEC requires equity mutual funds to report historic return performance using geometric mean and not arithmetic mean returns.² Therefore, the historic arithmetic mean return measures are biased and should be disregarded.

Nonetheless, in measuring historic returns to develop an expected equity risk premium, finance texts will often recommend the use of an arithmetic mean return as a measure of central tendency. A common justification for using the arithmetic mean return is that since annual stock returns are not serially correlated, the best measure of a return for next year is the arithmetic mean of past

² SEC, Form N-1A.

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returns. On the other hand, Damodaran suggests that such an estimate is not appropriate in estimating an equity risk premium:³

“There are, however, strong arguments that can be made for the use of geometric averages. First, empirical studies seem to indicate that returns on stocks are negatively correlated over long periods of time. Consequently, the arithmetic average return is likely to overstate the premium. Second, while asset pricing models may be single period models, the use of these models to get expected returns over long periods (such as five or ten years) suggests that the estimation period may be much longer than a year. In this context, the argument for geometric average premiums becomes stronger.”

C. The Error in Measuring Equity Risk Premiums with Historic Data

Measuring the equity risk premium using historical stock and bond returns is subject to a substantial forecasting error. For example, the arithmetic mean long-term equity risk premium of approximately 6.5% has a standard deviation of over 20.0%. This may be interpreted in the following way with respect to the historical distribution of the long-term equity risk premium using a standard normal distribution and a 95%, +/- 2 standard deviation confidence interval: We can say, with a 95% degree of confidence, that the true equity risk premium is between -34.7% and +47.7%. As such, the historical equity risk premium is measured with a substantial amount of error.

D. Unattainable and Biased Historic Stock Returns

Returns developed using Ibbotson's methodology are computed on stock indexes and therefore: (1) cannot be reflective of expectations because these returns

³Aswath. Damodaran, “A New “Risky” World Order: Unstable Risk Premiums - Implications for Practice” NYU Working Paper, 2010, p. 25.

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are unattainable to investors and (2) produce biased results. This methodology assumes: (1) monthly portfolio rebalancing and (2) reinvestment of interest and dividends. Monthly portfolio rebalancing presumes that investors rebalance their portfolios at the end of each month in order to have an equal dollar amount invested in each security at the beginning of each month. The assumption generates high transaction costs and thereby renders these returns unattainable to investors. In addition, an academic study demonstrates that the monthly portfolio rebalancing assumption produces biased estimates of stock returns.⁴

Transaction costs themselves provide another bias in historic versus expected returns. In the past, the observed stock returns were not the realized returns of investors, due to the much higher transaction costs of previous decades. These higher transaction costs are reflected through the higher commissions on stock trades and the lack of low cost mutual funds like index funds.

E. Company Survivorship Bias

Using historic data to estimate an equity risk premium suffers from company survivorship bias. Company survivorship bias results when using returns from indexes like the S&P 500. The S&P 500 includes only companies that have survived. The fact that returns of firms that did not perform well were dropped from these indexes is not reflected. Therefore, these stock returns are

⁴ See Richard Roll, "On Computing Mean Returns and the Small Firm Premium," *Journal of Financial Economics*, pp. 371-86, (1983).

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upwardly biased because they only reflect the returns from more successful companies.

F. The “Peso Problem” - U.S. Stock Market Survivorship Bias

The use of historic return data also suffers from the so-called “Peso Problem,” which is also known as U.S. stock market survivorship bias. The “peso problem” issue was first highlighted by the Nobel laureate, Milton Friedman, and gets its name from conditions related to the Mexican peso market in the early 1970s. This issue involves the fact that past stock market returns were higher than were expected at the time because despite war, depression and other social, political, and economic events, the U.S. economy survived and did not suffer hyperinflation, invasion and/or the calamities of other countries. As such, highly improbable events, which may or may not occur in the future, are factored into stock prices, leading to seemingly low valuations. Higher than expected stock returns are then earned when these events do not subsequently occur. Therefore, the “peso problem” indicates that historic stock returns are overstated as measures of expected returns because the U.S. markets have not experienced the disruptions of other major markets around the world.

F. One of the Biggest Mistakes in Teaching Finance

Jay Ritter, a Professor of Finance at the University of Florida, identified the use of historical stock and bond return data to estimate a forward-looking

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equity risk premium as one of the “Biggest Mistakes” taught by the finance profession.⁵ His argument is based on the theory behind the equity risk premium, the excessive results produced by historical returns, and the previously-discussed errors such as survivorship bias in historical data.

⁵ Jay Ritter, “The Biggest Mistakes We Teach,” *Journal of Financial Research* (Summer 2002).