A Brief History of Risk and Return

Our goal in this chapter is to see what financial market history can tell us about risk and return.

There are two key observations:
- First, there is a substantial reward, on average, for bearing risk.
- Second, greater risks accompany greater returns.

Dollar Returns

Total dollar return is the return on an investment measured in dollars, accounting for all interim cash flows and capital gains or losses.

Example:
Total Dollar Return on a Stock = Dividend Income + Capital Gain (or Loss)

Percent Returns

Total percent return is the return on an investment measured as a percentage of the original investment.

The total percent return is the return for each dollar invested.

Example, you buy a share of stock:

\[
\text{Percent Return on a Stock} = \frac{\text{Dividend Income} + \text{Capital Gain (or Loss)}}{\text{Beginning Stock Price}}
\]

or

\[
\text{Percent Return} = \frac{\text{Total Dollar Return on a Stock}}{\text{Beginning Stock Price (i.e., Beginning Investment)}}
\]

Annualizing Returns

Effective Annual Return (EAR): The return on an investment expressed on an “annualized” basis.

\[1 + \text{EAR} = (1 + \text{holding period percentage return})^m\]

\[m = \text{the number of holding periods in a year.}\]
A $1 Investment in Different Types of Portfolios, 1926—2006.

The Historical Record: Total Returns on Large-Company Stocks.

The Historical Record: Total Returns on Small-Company Stocks.

Historical Average Returns

- A useful number to help us summarize historical financial data is the simple, or arithmetic average.
- The formula for the historical average return is:

\[
\text{HistoricalAverageReturn} = \frac{\sum \text{yearlyreturn}}{n}
\]

Average Returns: The First Lesson

- Risk-free rate: The rate of return on a riskless, i.e., certain investment.
- Risk premium: The extra return on a risky asset over the risk-free rate; i.e., the reward for bearing risk.
- The First Lesson: There is a reward, on average, for bearing risk.
- By looking at Table 1.3, we can see the risk premium earned by large-company stocks was 8.5%!
Average Annual Risk Premiums for Five Portfolios

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Average Return</th>
<th>Risk Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large stocks</td>
<td>12.5%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Small stocks</td>
<td>17.4%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Long-term corporate bonds</td>
<td>6.2%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Long-term government bonds</td>
<td>5.8%</td>
<td>2.8%</td>
</tr>
<tr>
<td>U.S. Treasury bills</td>
<td>3.4%</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

Why Does a Risk Premium Exist?

- Modern investment theory centers on this question.
- Therefore, we will examine this question many times in the chapters ahead.
- However, we can examine part of this question by looking at the dispersion, or spread, of historical returns.
- We use two statistical concepts to study this dispersion, or variability: variance and standard deviation.
- The Second Lesson: The greater the potential reward, the greater the risk.

Return Variability: The Statistical Tools

- The formula for return variance is ("n" is the number of returns):
  \[
  \text{VAR}(R) = \sigma^2 = \frac{\sum (R_i - \mu)^2}{N-1}
  \]
- Sometimes, it is useful to use the standard deviation, which is related to variance like this:
  \[
  \text{SD}(R) = \sigma = \sqrt{\text{VAR}(R)}
  \]

Return Variability Review and Concepts

- Variance is a common measure of return dispersion. Sometimes, return dispersion is also called variability.
- Standard deviation is the square root of the variance. Sometimes the square root is called volatility.
- Standard Deviation is handy because it is in the same "units" as the average.
- Normal distribution: A symmetric, bell-shaped frequency distribution that can be described with only an average and a standard deviation.
- Does a normal distribution describe asset returns?

Frequency Distribution of Returns on Common Stocks, 1926—2006

Historical Returns, Standard Deviations, and Frequency Distributions: 1926—2006

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Average Return</th>
<th>Standard Deviation</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large stocks</td>
<td>12.2%</td>
<td>26.1%</td>
<td></td>
</tr>
<tr>
<td>Small stocks</td>
<td>17.4%</td>
<td>32.7%</td>
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</tr>
<tr>
<td>Long-term corporate bonds</td>
<td>6.2%</td>
<td>8.5%</td>
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</tr>
<tr>
<td>Long-term government bonds</td>
<td>5.8%</td>
<td>9.2%</td>
<td></td>
</tr>
<tr>
<td>U.S. Treasury bills</td>
<td>3.8%</td>
<td>3.1%</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>2.1%</td>
<td>6.3%</td>
<td></td>
</tr>
</tbody>
</table>

*The 1926 small company stocks total return was 142.9 percent.
The Normal Distribution and Large Company Stock Returns

Returns on some “Non-Normal” Days

Arithmetic Averages versus Geometric Averages

- The arithmetic average return answers the question: “What was your return in an average year over a particular period?”
- The geometric average return answers the question: “What was your average compound return per year over a particular period?”
- When should you use the arithmetic average and when should you use the geometric average?

Arithmetic Averages versus Geometric Averages

- The arithmetic average tells you what you earned in a typical year.
- The geometric average tells you what you actually earned per year on average, compounded annually.
- When we talk about average returns, we generally are talking about arithmetic average returns.
- For the purpose of forecasting future returns:
  - The arithmetic average is probably “too high” for long forecasts.
  - The geometric average is probably “too low” for short forecasts.

Geometric versus Arithmetic Averages

Risk and Return

- The risk-free rate represents compensation for just waiting.
- Therefore, this is often called the time value of money.
- First Lesson: If we are willing to bear risk, then we can expect to earn a risk premium, at least on average.
- Second Lesson: Further, the more risk we are willing to bear, the greater the expected risk premium.

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<tr>
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<th>% Change</th>
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This text focuses exclusively on financial assets: stocks, bonds, options, and futures.

You will learn how to value different assets and make informed, intelligent decisions about the associated risks.

You will also learn about different trading mechanisms, and the way that different markets function.