Chapter 7

An Introduction to Risk and Return: History of Financial Market Returns

Chapter 7 Contents

• Learning Objectives
  1. Calculate Realized and Expected Rates of Return and Risk. (Computationally intensive)
  2. Describe the Historical Pattern of Financial Market Returns.
  3. Compute Geometric and Arithmetic Average Rates of Return. (Technical Issue)
  4. Explain Efficient Market Hypothesis and Why it is Important to Stock Prices. (View of the Market)
Principles Used in This Chapter

- **Principle 2**: There is a Risk-Return Tradeoff.
  - We will expect to receive higher returns for assuming more risk.

- **Principle 4**: Market Prices Reflect Information.
  - Depending on the degree of efficiency of the market, security prices may or may not fully reflect all information.

Calculating the Realized Return

\[
\text{Cash Return} = \frac{\text{Ending Price}}{\text{Beginning Price}} + \frac{\text{Cash Distribution}}{\text{Beginning Price}} - 1
\]

- Realized return or cash return measures the gain or loss on an investment.
  - Cash Return measures gain in total wealth for the period
  - Poor means of comparison across different wealth sizes or investment amounts.

- **Example 1**: You invested in 1 share of Apple (AAPL) for $95 and sold a year later for $200. The company did not pay any dividend during that period. What will be the cash return on this investment?
  
  \[
  \text{Cash Return} = \frac{200}{95} + \frac{0}{95} - 1 = \frac{105}{95} = 1.1053
  \]
  
  \[\text{Realized Return} = 105\text{ }\text{realized return}\]
Relative Realized Returns

Rate of Return = \frac{\text{Cash Return}}{\text{Beginning Price}} = \frac{\text{Ending Price} + \text{Cash Distribution (Dividend)}}{\text{Beginning Price}}

- Calculate the rate of return as a percentage.
  - It is simply the cash return divided by the beginning stock price.
  - Measures relative increase in wealth for an investment.
  - Allows comparison of different sized investments.

- Continuing with AAPL example

  \text{Rate of Return} = \frac{($200 + 0 - $95)}{95} = 110.53\%

<table>
<thead>
<tr>
<th>Table 7.1</th>
<th>Measuring an Investor’s Realized Rate of Return from Investing in Common Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Prices</td>
<td>Beginning (Oct. 8, 2009)</td>
</tr>
<tr>
<td>Company</td>
<td>A</td>
</tr>
<tr>
<td>Dick’s Sporting Goods (DKS)</td>
<td>51.52</td>
</tr>
<tr>
<td>Duke Energy (DUK)</td>
<td>16.38</td>
</tr>
<tr>
<td>Emerson Electric (EMR)</td>
<td>32.73</td>
</tr>
<tr>
<td>Sears Holdings (SHLD)</td>
<td>57.74</td>
</tr>
<tr>
<td>Walmart (WMT)</td>
<td>55.81</td>
</tr>
</tbody>
</table>

Legend:

Column D (Cash or Dollar Return):

\text{Cash Return} \quad \text{Ending Price} \quad \text{Cash Distribution} \quad \text{Beginning Price} = \frac{\text{Beginning Price \_ Div} - \text{Beginning Price}}{\text{Beginning Price}}

\text{Column E (Rate of Return)}:

\text{Rate of Return} = \frac{\text{Beginning Price \_ Div} - \text{Beginning Price}}{\text{Beginning Price}}

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Calculating the Expected Return

- **Expected return** is what you expect to earn from an investment in the future.
  - It is estimated as the average of the possible returns, where each possible return is weighted by the probability that it occurs.

\[
\text{Expected Rate of Return} \ [E(r)] = \left( \frac{\text{Rate of Return 1} \times \text{Probability of Return 1}}{(P_{R_1})} \right) + \left( \frac{\text{Rate of Return 2} \times \text{Probability of Return 2}}{(P_{R_2})} \right) + \cdots + \left( \frac{\text{Rate of Return n} \times \text{Probability of Return n}}{(P_{R_n})} \right)
\]

**Table 7.2**

<table>
<thead>
<tr>
<th>State of the Economy</th>
<th>Probability of the State of the Economy$^a$ (PB)</th>
<th>End of Year Selling Price for the Stock</th>
<th>Beginning Price of the Stock</th>
<th>Cash Return from Your Investment</th>
<th>Percentage Rate of Return = Cash Return/Beginning Price of the Stock</th>
<th>Product = Rate of Return × Probability of State of the Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column A</td>
<td>Column B</td>
<td>Column C</td>
<td>Column D</td>
<td>Column E – C</td>
<td>D</td>
<td>Column F = E × D</td>
</tr>
<tr>
<td>Recession</td>
<td>20%</td>
<td>$9,000</td>
<td>$10,000</td>
<td>$(1,000)</td>
<td>–10%</td>
<td>$1,000 = $10,000</td>
</tr>
<tr>
<td>Moderate growth</td>
<td>30%</td>
<td>$11,200</td>
<td>$10,000</td>
<td>$1,200</td>
<td>12%</td>
<td>$1,200 = $10,000</td>
</tr>
<tr>
<td>Strong growth</td>
<td>50%</td>
<td>$12,200</td>
<td>$10,000</td>
<td>$2,200</td>
<td>22%</td>
<td>$2,200 = $10,000</td>
</tr>
<tr>
<td>Sum</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$The probabilities assigned to the three possible economic conditions have to be determined subjectively, which requires management to have a thorough understanding of both the investment cash flows and the general economy.
Measuring Risk

- In the example on Table 7-2, the expected return is 12.6%; however, the return could range from -10% to +22%.

- This variability in returns can be quantified by computing the Variance or Standard Deviation in investment returns.
  - Standard deviation is given by square root of the variance and is more commonly used.

- Finance looks at both the mean and std. deviation of returns for the risk/return trade-off (1 st two moments of the statistical distribution)

Calculating the Variance and Standard Deviation of the Rate of Return on an Investment

- Compare two possible investment alternatives:
     - Assume this particular Treasury bill matures in one year and promises to pay an annual return of 5%.
     - U.S. Treasury bill is considered risk-free as there is no risk of default on the promised payments.

  2. Common stock of the Ace Publishing Company – investment in common stock will be risky.

- Probability distribution of investment’s return contains all possible rates of return from the investment along with associated probabilities for each outcome.
Example: Calculating the Variance and Standard Deviation of the Rate of Return

• Using equation 7-3, calculate the expected return on the stock to be 15% while the expected return on Treasury bill is always 5%.

• Does the higher return of stock make it a better investment? Not necessarily. Need to know the risk in both the investments.

• We can measure the risk of an investment by computing the variance as follows:

\[
\sigma^2 = \sum \left( \frac{\text{Rate of Return for State } n}{(r_n)} \right)^2 \times \text{ Probability of State } n (P_{b_n})
\]

\[
\sigma = \sqrt{\sigma^2}
\]
Tabulating the results for decision time

<table>
<thead>
<tr>
<th>Investment</th>
<th>Expected Return</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasury Bill</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Common Stock</td>
<td>15%</td>
<td>12.85%</td>
</tr>
</tbody>
</table>

- Observe that the publishing company stock offers a higher expected return but also entails more risk as measured by standard deviation.

- An investor’s choice of a specific investment will be determined by their attitude toward risk.
Checkpoint 7.1 - Example

Evaluating an Investment’s Return and Risk

Clarion Investment Advisors is evaluating the distribution of returns for a new stock investment and has come up with five possible rates of return for the coming year. Their associated probabilities are as follows:

<table>
<thead>
<tr>
<th>Chance (Probability of Occurrence)</th>
<th>Rate of Return on Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 chance in 10 (10%)</td>
<td>-30%</td>
</tr>
<tr>
<td>2 chances in 10 (20%)</td>
<td>0%</td>
</tr>
<tr>
<td>4 chances in 10 (40%)</td>
<td>15%</td>
</tr>
<tr>
<td>2 chances in 10 (20%)</td>
<td>30%</td>
</tr>
<tr>
<td>1 chance in 10 (10%)</td>
<td>50%</td>
</tr>
</tbody>
</table>

1. What expected rate of return might they expect to realize from the investment?
2. What is the risk of the investment as measured using the standard deviation of possible future rates of return?

Checkpoint 7.1 – Solution Approach

STEP 2: Decide on a solution strategy

We use the expected value of the rate of return to measure Clarion’s expected return from the investment and the standard deviation to evaluate its risk. We can use Equations (7–3) and (7–6) for these tasks.

STEP 3: Solve

Calculating the Expected Return.

We use Equation (7–3) to calculate the expected rate of return for the investment as follows:

\[ E(r) = r_1P_1 + r_2P_2 + \cdots + r_nP_n \]  

\[ E(r) = (-20\% \times .10) + (0\% \times .20) + (15\% \times .40) + (30\% \times .20) + (50\% \times .10) = 15\% \]  

Calculating the Standard Deviation.

Next, we calculate the standard deviation using Equation (7–5) as follows:

\[ \sigma = \sqrt{[(r_1 - E(r))^2P_1] + [(r_2 - E(r))^2P_2] + \cdots + [(r_n - E(r))^2P_n]} \]  

\[ \sigma = \sqrt{[(-20\% - 15\%)^2\times.10] + [(0\% - 15\%)^2\times.20] + [(15\% - 15\%)^2\times.40] + [(30\% - 15\%)^2\times.20] + [(50\% - 15\%)^2\times.10]} \]  

\[ \sigma = \sqrt{0.03365} = .183 \text{ or } 18.3\% \]
A Brief History of the Financial Markets

- We can use the tools that we have learned to determine the risk-return tradeoff in the financial markets.
- Investors have historically earned higher rates of return on riskier investments.
- However, having a higher expected rate of return simply means that investors “expect” to realize a higher return. Higher return is not guaranteed.

U.S. Financial Markets—Domestic Returns

![Graph showing historical rates of return for U.S. Financial Securities: 1926–2009.](image)
U.S. Markets — Domestic Returns (table)

- We observe a clear relationship between risk and return. Small stocks have the highest annual return but higher returns are associated with much greater risk.

<table>
<thead>
<tr>
<th>Annual</th>
<th>Small Stocks</th>
<th>Large Stocks</th>
<th>Government Bonds</th>
<th>Treasury Bills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>11.7%</td>
<td>9.6%</td>
<td>5.7%</td>
<td>3.7%</td>
</tr>
<tr>
<td>S.D.</td>
<td>34.1%</td>
<td>21.4%</td>
<td>8.5%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

Lessons Learned from Historical Returns

**Lesson #1**: The riskier investments have historically realized higher returns.
- The difference between the return on riskier stock investments and government securities is called the **equity risk premium**.
- For example, the equity risk premium is 6% for small stocks over government bonds.

**Lesson #2**: Historical returns of higher-risk class investments have higher standard deviations.
- Small stocks had a standard deviation of 34.1% while the standard deviation of treasury bill was only 0.9%.
U.S. Stocks vs. Other Investment Classes

- Figure 7-3 illustrates the growth in the value of $1 invested in 1980 until the end of 2008 for five different asset classes:
  - U.S. stocks
  - Real estate
  - International stocks
  - Commodities
  - Gold
Global Financial Markets—International Investing

**Figure 7.4**

**Historical Rates of Return in Global Markets: 1970–2009**

This figure reports the ranges of annual returns for domestic and international composites, as well as the Europe and Pacific regional composites, over the period 1970 through 2009.

![Graph showing annual ranges of returns for different regions.](image)

**Legend:**
- U.S. stocks in this example are represented by the Standard & Poor’s 500®, which is an unmanaged group of securities and considered to be representative of the stock market in general. International stocks are represented by the Morgan Stanley Capital International Europe, Australasia, and Far East (EMPII) Index, European stocks by the Morgan Stanley Capital International Europe Index, Pacific stocks by the Morgan Stanley Capital International Pacific Index. An investment cannot be made directly in an index. The data assumes reinvestment of income and does not account for taxes or transaction costs.
- Source: © 2010 Morningstar. All rights reserved. Used with permission.

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**Figure 7.5**


The following graph illustrates the range of returns as well as the compound annual return of selected developed and emerging countries. Although both sets experienced growth, emerging markets experienced a much greater upside and often deeper drawdowns.

![Bar graph showing returns for developed and emerging markets.](image)

**Legend:**
- Equities for Austria, Germany, Japan, and U.K. are represented by the Morgan Stanley Capital International country indexes. Equities for Taiwan, Philippines, Mexico, Korea, and Jordan are represented by the Morgan Stanley Capital International Emerging market country indexes. U.S. stocks are represented by the Standard & Poor’s 500®, which is an unmanaged group of securities and considered to be representative of the stock market in general. An investment cannot be made directly in an index. Keep in mind that the countries illustrated do not represent investment choices. The developed countries illustrated are a common range of investment options. Emerging market country indexes were chosen based on availability of historical data, those with the longest stream of data were selected.
- Source: © 2010 Morningstar. All rights reserved. Used with permission.
Geometric vs. Arithmetic Mean Returns

- Arithmetic average may not always capture the true rate of return realized on an investment.
- In some cases, geometric or compound average may be a more appropriate measure of return.

Suppose you bought a stock for $25. After one year, the stock rises to $30 and in the second year, it falls to $15. What was the average return on this investment?
  - The stock earned +20% in the first year and -50% in the second year.
  - Simple average = (20%-50%) ÷ 2 = -15%

Geometric Mean Logic and Method

- During 2 years, the $25 stock lost the compounded annual equivalent of 22.54% \( (\{(\frac{15}{25})^{1/2}\} - 1 = 22.54\%) \).

\[
\begin{align*}
FV &= 15; \ PV = -25; \ N = 2; \ PMT = 0; \\
\text{Solve } I/Y &= -22.54\%
\end{align*}
\]

- The simple arithmetic average is -15% while the geometric or compound average rate is -22.54%.

- Which one is the correct indicator of return? It depends on the question being asked.
**Geometric vs. Arithmetic Mean Logic**

- The geometric average rate of return answers the question, "What was growth rate of investment?"

- The arithmetic average rate of return answers the question, "what was the average of the yearly rates of return?"

- Formula for Geometric Mean Return (below) is “ugly”. Financial calculator approach is easier.

\[
\text{Geometric Average Return} = \left( \prod_{i=1}^{n} \left(1 + \text{Rate of Return for Year } i, r_{\text{year } i} \right) \right)^{1/n} - 1
\]

**Example-Compute Geometric Mean Return**

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Rate of Return</th>
<th>Value of the stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>$25</td>
</tr>
<tr>
<td>1</td>
<td>40%</td>
<td>$35</td>
</tr>
<tr>
<td>2</td>
<td>-50%</td>
<td>$17.50</td>
</tr>
</tbody>
</table>

- Compute the arithmetic and geometric average for the above stock.

- **Arithmetic Mean** = \((40-50) \div 2 = -5\%\)

- **Geometric Mean**: 
  
  \[n=2; PV = -$25; FV = $17.50; \]
  
  **Solve** \(I/Y = -16.33\%\)
Choosing the Right “Average”

- Both arithmetic average geometric average are important and correct. The following grid provides some guidance as to which average is appropriate and when:

<table>
<thead>
<tr>
<th>Question being addressed:</th>
<th>Appropriate Average Calculation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What annual rate of return can we expect for next year?</td>
<td>The arithmetic average calculated using annual rates of return.</td>
</tr>
<tr>
<td>What annual rate of return can we expect over a multi-year horizon?</td>
<td>The geometric average calculated over a similar past period.</td>
</tr>
</tbody>
</table>

Checkpoint 7.2

Computing the Arithmetic and Geometric Average Rates of Return

Five years ago Mary’s grandmother gave her $10,000 worth of stock in the shares of a publicly traded company founded by Mary’s grandfather. Mary is now considering whether she should continue to hold the shares, or perhaps sell some of them. Her first step in analyzing the investment is to evaluate the rate of return she has earned over the past five years. The following table contains the beginning value of Mary’s stock five years ago as well as the values at the end of each year up until today (the end of year 5):

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Rate of Return</th>
<th>Value of the Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>$10,000.00</td>
</tr>
<tr>
<td>1</td>
<td>10.0%</td>
<td>11,000.00</td>
</tr>
<tr>
<td>2</td>
<td>15.0%</td>
<td>12,650.00</td>
</tr>
<tr>
<td>3</td>
<td>-15.0%</td>
<td>10,752.50</td>
</tr>
<tr>
<td>4</td>
<td>20.0%</td>
<td>12,903.00</td>
</tr>
<tr>
<td>5</td>
<td>10.0%</td>
<td>14,193.30</td>
</tr>
</tbody>
</table>

What rate of return did Mary earn on her investment in the stock given to her by her grandmother?
What Determines Stock Prices?

- In short, stock prices tend to go up when there is good news about future profits, and they go down when there is bad news about future profits.

- Since US businesses have generally done well over the past 80 years, the stock returns have also been favorable.

- Another view of stock price: Price today is the present value of future “stuff” (where “stuff” is input determined by particular valuation model).
  - Consider what makes present value larger
    - More “stuff” (good news about profits, cash flow, dividends)
    - Lower discount rates (Less inflation or loose monetary policy)
The Efficient Market Hypothesis

- The efficient market hypothesis (EMH) states that securities prices accurately reflect future expected cash flows and are based on information available to investors.

- An efficient market is a market in which all the available information is fully incorporated into the prices of the securities and the returns the investors earn on their investments cannot be predicted.

- Relative efficiency of market determines pricing perspective.

Forms of the Efficient Market Hypothesis

- Can distinguish among three types of efficient market, depending on the degree of efficiency:

  1. The Weak-Form Efficient Market Hypothesis
  2. The Semi-Strong Form Efficient Market Hypothesis
  3. The Strong Form Efficient Market Hypothesis
Weak Form Efficiency

- The **Weak-Form Efficient Market Hypothesis** asserts that all *past* security market information is fully reflected in security prices.
  - This means that all price and volume information is already reflected in a security’s price.
  - Not compatible with the existence of Futures and Options markets where you contract today for a delivered price and quantity to be received or delivered in the future.

Strong-Form Market Efficiency

- The **Strong-Form Efficient Market Hypothesis** asserts that all information, regardless of whether this information is public or private, is fully reflected in securities prices.
  - It asserts that there isn’t any information that isn’t already embedded into the prices of all securities.
  - Incompatible with the need for Insider-Trading Laws
  - Incompatible with the existence of the Financial Analyst profession
  - Implies that investors should not pick individual stocks. Instead people should invest in the market portfolio.
Semi-Strong-Form Market Efficiency

- The **Semi-Strong-Form Efficient Market Hypothesis** asserts that all publicly available information is fully reflected in security prices.
  - This is a stronger statement as it includes all public information (such as firm’s financial statements, analysts’ estimates, announcements about the economy, industry, or company.)
  - Implications are consistent with the existence of all asset markets (including futures and options).
  - Asset prices are, on average, correct and reflect all public information.
  - Implies new information is impounded in prices but allows for different “speeds” in different markets.

Do We Expect Financial Markets To Be Perfectly Efficient?

- In general, markets are expected to be at least weak form and semi-strong form efficient.
- If there did exist simple profitable strategies, then the strategies would attract the attention of investors, who by implementing their strategies would compete away the profits (no arbitrage).
- We would not expect financial markets to be strong-form efficient. We expect the markets to partially, but not perfectly, reflect information that is privately collected.
- The markets will be inefficient enough to provide some investors with an opportunity to recoup their costs of obtaining information, but not so inefficient that there is easy money to be made in the stock market.
The Behavioral View

- Efficient market hypothesis is based on the assumption that investors, as a group, are pretty rational. This view has been challenged.

- What if investors are not rational?

- If investors do not rationally process information, then markets may not accurately reflect even public information.

The Behavioral View (cont.)

- For example, overconfident investors may underreact when management announces earnings as they have too much confidence in their own views of the company’s true value and tend to place too little weight on new information provided by management.

- As a result, this new information, even though it is publicly and freely available, is not completely reflected in stock prices.
Market Efficiency—What the Evidence Shows

• The degree of efficiency of financial markets is an important question and has generated extensive research.

• Historically, there has been some evidence of inefficiencies in the financial markets. This is summarized by three observations in Table 7-4.

<table>
<thead>
<tr>
<th>Anomaly</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1. Value stocks outperform</td>
<td>Value stocks, which are stocks with tangible assets that generate current earnings, have tended to outperform growth stocks, which are stocks with low current earnings that are expected to grow in the future. More specifically, stocks with low price-earnings ratios, low price-to-cash flow, and low price-to-book value ratios tend to outperform the market.</td>
</tr>
<tr>
<td>growth stocks</td>
<td></td>
</tr>
<tr>
<td>#2. Momentum in stock returns</td>
<td>Stocks that have performed well in the past six to twelve months tend to continue to outperform other stocks.</td>
</tr>
<tr>
<td>#3. Over- and under-reaction to corporate announcements</td>
<td>The market has tended to under-react to many corporate events. For example, stock prices react favorably on dates when firms announce favorable earnings news, which is exactly what we would expect in an efficient market. However, on the days after favorable earnings news, stock returns continue to be positive on average. This is known as post-earnings announcement drift. Similarly, there is evidence of some degree of predictability in stock returns following other major announcements, such as the issuance of stock or bonds.</td>
</tr>
</tbody>
</table>
Market Efficiency – The Evidence

- If equity markets are inefficient it means that investors can earn returns that are greater than the risk of their investment by taking advantage of mispricing in the market.

- More recent evidence suggests that these patterns (as noted in Table 7-4) have largely disappeared after 2000.

- Why is the more recent time period different?

- Following the publication of academic research on market inefficiencies, institutional investors set up quantitative hedge funds to exploit these return patterns. By trading aggressively on these patterns, the hedge funds have largely eliminated the inefficiencies.