Answers to Concepts Review and Critical Thinking Questions

1. They all wish they had! Since they didn’t, it must have been the case that the stellar performance was not foreseeable, at least not by most.

2. As in the previous question, it’s easy to see after the fact that the investment was terrible, but it probably wasn’t so easy ahead of time.

3. No, stocks are riskier. Some investors are highly risk averse, and the extra possible return doesn’t attract them relative to the extra risk.

4. On average, the only return that is earned is the required return—investors buy assets with returns in excess of the required return (positive NPV), bidding up the price and thus causing the return to fall to the required return (zero NPV); investors sell assets with returns less than the required return (negative NPV), driving the price lower and thus causing the return to rise to the required return (zero NPV).

5. The market is not weak form efficient.

6. Yes, historical information is also public information; weak form efficiency is a subset of semi-strong form efficiency.

7. Ignoring trading costs, on average, such investors merely earn what the market offers; stock investments all have a zero NPV. If trading costs exist, then these investors lose by the amount of the costs.

8. Unlike gambling, the stock market is a positive sum game; everybody can win. Also, speculators provide liquidity to markets and thus help to promote efficiency.

9. The EMH only says, within the bounds of increasingly strong assumptions about the information processing of investors, that assets are fairly priced. An implication of this is that, on average, the typical market participant cannot earn excessive profits from a particular trading strategy. However, that does not mean that a few particular investors cannot outperform the market over a particular investment horizon. Certain investors who do well for a period of time get a lot of attention from the financial press, but the scores of investors who do not do well over the same period of time generally get considerably less attention from the financial press.

10. a. If the market is not weak form efficient, then this information could be acted on and a profit earned from following the price trend. Under (2), (3), and (4), this information is fully impounded in the current price and no abnormal profit opportunity exists.
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b. Under (2), if the market is not semi-strong form efficient, then this information could be used to buy the stock “cheap” before the rest of the market discovers the financial statement anomaly. Since (2) is stronger than (1), both imply that a profit opportunity exists; under (3) and (4), this information is fully impounded in the current price and no profit opportunity exists.

c. Under (3), if the market is not strong form efficient, then this information could be used as a profitable trading strategy, by noting the buying activity of the insiders as a signal that the stock is underpriced or that good news is imminent. Since (1) and (2) are weaker than (3), all three imply that a profit opportunity exists. Note that this assumes the individual who sees the insider trading is the only one who sees the trading. If the information about the trades made by company management is public information, it will be discounted in the stock price and no profit opportunity exists. Under (4), this information does not signal any profit opportunity for traders; any pertinent information the manager-insiders may have is fully reflected in the current share price.

Solutions to Questions and Problems

NOTE: All end of chapter problems were solved using a spreadsheet. Many problems require multiple steps. Due to space and readability constraints, when these intermediate steps are included in this solutions manual, rounding may appear to have occurred. However, the final answer for each problem is found without rounding during any step in the problem.

Basic

1. The return of any asset is the increase in price, plus any dividends or cash flows, all divided by the initial price. The return of this stock is:

   \[ R = \frac{($79 - 72) + 1.20}{72} = .1139, \text{ or } 11.39\% \]

2. The dividend yield is the dividend divided by price at the beginning of the period price, so:

   \[
   \text{Dividend yield} = \frac{1.20}{72} = .0167, \text{ or } 1.67\%
   \]

   And the capital gains yield is the increase in price divided by the initial price, so:

   \[
   \text{Capital gains yield} = \frac{($79 - 72)}{72} = .0972, \text{ or } 9.72\%
   \]

3. Using the equation for total return, we find:

   \[ R = \frac{($61 - 72) + 1.20}{72} = -.1361, \text{ or } -13.61\% \]

   And the dividend yield and capital gains yield are:

   \[
   \text{Dividend yield} = \frac{1.20}{72} = .0167, \text{ or } 1.67\%
   \]

   \[
   \text{Capital gains yield} = \frac{($61 - 72)}{72} = -.1528, \text{ or } -15.28\%
   \]

   Here’s a question for you: Can the dividend yield ever be negative? No, that would mean you were paying the company for the privilege of owning the stock. It has happened on bonds.
4. The total dollar return is the increase in price plus the coupon payment, so:

Total dollar return = $940 – 920 + 60 = $80

The total percentage return of the bond is:

\[ R = \frac{[(940 - 920) + 60]}{920} = .0870, \text{ or } 8.70\% \]

Notice here that we could have simply used the total dollar return of $80 in the numerator of this equation.

Using the Fisher equation, the real return was:

\[ (1 + R) = (1 + r)(1 + h) \]
\[ r = \frac{(1.0870)}{1.03} - 1 = .0553, \text{ or } 5.53\% \]

5. The nominal return is the stated return, which is 11.90 percent. Using the Fisher equation, the real return was:

\[ (1 + R) = (1 + r)(1 + h) \]
\[ r = \frac{(1.190)}{(1.031)} - 1 = .0854, \text{ or } 8.54\% \]

6. Using the Fisher equation, the real returns for long-term government and corporate bonds were:

\[ r_G = \frac{1.059}{1.031} - 1 = .0272, \text{ or } 2.72\% \]
\[ r_C = \frac{1.062}{1.031} - 1 = .0301, \text{ or } 3.01\% \]

7. The average return is the sum of the returns, divided by the number of returns. The average return for each stock was:

\[ \bar{x} = \frac{1}{N} \sum_{i=1}^{N} x_i = \frac{.17 + .22 + .08 - .15 + .10}{5} = .0840, \text{ or } 8.40\% \]
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\[ \overline{y} = \left[ \sum_{i=1}^{N} y_i \right] / N = \left[ \frac{.23 + .24 + .11 - .32 + .21}{5} \right] = .1140, \text{ or } 11.40\% \]

Remembering back to “sadistics,” we calculate the variance of each stock as:

\[ \sigma^2_x = \frac{1}{N-1} \left\{ (x_{1} - \overline{x})^2 + (x_{2} - \overline{x})^2 + \ldots + (x_{N} - \overline{x})^2 \right\} \]

\[ \sigma^2_x = \frac{1}{5-1} \left\{ (.17 - .084)^2 + (.22 - .084)^2 + (.08 - .084)^2 + (-.15 - .084)^2 + (.10 - .084)^2 \right\} = .02023 \]

\[ \sigma^2_y = \frac{1}{5-1} \left\{ (.23 - .114)^2 + (.24 - .114)^2 + (.11 - .114)^2 + (.32 - .114)^2 + (.21 - .114)^2 \right\} = .06553 \]

The standard deviation is the square root of the variance, so the standard deviation of each stock is:

\[ \sigma_x = (.02023)^{1/2} = .1422, \text{ or } 14.22\% \]

\[ \sigma_y = (.06553)^{1/2} = .2560, \text{ or } 25.60\% \]

8. We will calculate the sum of the returns for each asset and the observed risk premium first. Doing so, we get:

<table>
<thead>
<tr>
<th>Year</th>
<th>Large Co. Stock Return</th>
<th>T-Bill Return</th>
<th>Risk Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>3.94%</td>
<td>6.50%</td>
<td>-2.56%</td>
</tr>
<tr>
<td>1971</td>
<td>14.30</td>
<td>4.36</td>
<td>9.94</td>
</tr>
<tr>
<td>1972</td>
<td>18.99</td>
<td>4.23</td>
<td>14.76</td>
</tr>
<tr>
<td>1973</td>
<td>-14.69</td>
<td>7.29</td>
<td>-21.98</td>
</tr>
<tr>
<td>1974</td>
<td>-26.47</td>
<td>7.99</td>
<td>-34.46</td>
</tr>
<tr>
<td>1975</td>
<td>37.23</td>
<td>5.87</td>
<td>31.36</td>
</tr>
<tr>
<td></td>
<td>33.30</td>
<td>36.24</td>
<td>-2.94</td>
</tr>
</tbody>
</table>

a. The average return for large company stocks over this period was:

Large company stocks average return = 33.30% / 6 = 5.55%

And the average return for T-bills over this period was:

T-bills average return = 36.24% / 6 = 6.04%
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b. Using the equation for variance, we find the variance for large company stocks over this period was:

\[
\text{Variance} = \frac{1}{5}[(.0394 - .0555)^2 + (.1430 - .0555)^2 + (.1899 - .0555)^2 + (-.1469 - .0555)^2 + (-.2647 - .0555)^2 + (.3723 - .0555)^2]
\]

\[
\text{Variance} = 0.053967
\]

And the standard deviation for large company stocks over this period was:

\[
\text{Standard deviation} = (0.053967)^{1/2} = 0.2323, \text{ or } 23.23\%
\]

Using the equation for variance, we find the variance for T-bills over this period was:

\[
\text{Variance} = \frac{1}{5}[(.0650 - .0604)^2 + (.0436 - .0604)^2 + (.0423 - .0604)^2 + (.0729 - .0604)^2 + (.0799 - .0604)^2 + (.0587 - .0604)^2]
\]

\[
\text{Variance} = 0.000234
\]

And the standard deviation for T-bills over this period was:

\[
\text{Standard deviation} = (0.000234)^{1/2} = 0.0153, \text{ or } 1.53\%
\]

c. The average observed risk premium over this period was:

\[
\text{Average observed risk premium} = \frac{-2.94}{6} = -0.49\%
\]

The variance of the observed risk premium was:

\[
\text{Variance} = \frac{1}{5}[(-.0256 - (-.0049))^2 + (.0994 - (-.0049))^2 + (.1476 - (-.0049))^2 + (-.2198 - (-.0049))^2 + (-.3446 - (-.0049))^2 + (.3136 - (-.0049))^2]
\]

\[
\text{Variance} = 0.059517
\]

And the standard deviation of the observed risk premium was:

\[
\text{Standard deviation} = (0.059517)^{1/2} = 0.2440, \text{ or } 24.40\%
\]

d. Before the fact, for most assets the risk premium will be positive; investors demand compensation over and above the risk-free return to invest their money in the risky asset. After the fact, the observed risk premium can be negative if the asset’s nominal return is unexpectedly low, the risk-free return is unexpectedly high, or if some combination of these two events occurs.

9. a. To find the average return, we sum all the returns and divide by the number of returns, so:

\[
\text{Average return} = \frac{(.14 + .09 + .16 + .21 + .03)\times 5}{5} = .0900, \text{ or } 9.00\%
\]
b. Using the equation to calculate variance, we find:

\[
\text{Variance} = \frac{1}{4}[(.14 - .090)^2 + (.09 - .090)^2 + (.16 - .090)^2 + (.21 - .090)^2 + (.03 - .090)^2]
\]

\[
\text{Variance} = 0.01445
\]

So, the standard deviation is:

\[
\text{Standard deviation} = (0.01445)^{1/2} = 0.1202, \text{ or } 12.02\%
\]

10. a. To calculate the average real return, we can use the average return of the asset, and the average inflation in the Fisher equation. Doing so, we find:

\[
(1 + R) = (1 + r)(1 + h)
\]

\[
\bar{r} = (1.090/1.035) - 1 = 0.0531, \text{ or } 5.31\%
\]

b. The average risk premium is simply the average return of the asset, minus the average risk-free rate, so, the average risk premium for this asset would be:

\[
\overline{RP} = \bar{R} - \bar{r}_f = 0.090 - 0.042 = 0.0480, \text{ or } 4.80\%
\]

11. We can find the average real risk-free rate using the Fisher equation. The average real risk-free rate was:

\[
(1 + R) = (1 + r)(1 + h)
\]

\[
\bar{r}_f = (1.042/1.035) - 1 = 0.0068, \text{ or } 0.68\%
\]

And to calculate the average real risk premium, we can subtract the average risk-free rate from the average real return. So, the average real risk premium was:

\[
\overline{rp} = \bar{r} - \bar{r}_f = 5.31\% - 0.68\% = 4.64\%
\]

12. T-bill rates were highest in the early 1980s. This was during a period of high inflation and is consistent with the Fisher effect.
To find the real return, we first need to find the nominal return, which means we need the current price of the bond. Going back to the chapter on pricing bonds, we find the current price is:

\[ P_1 = $80(PVIFA_{7\%,14}) + $1,000(PVIF_{7\%,14}) = $1,087.45 \]

So the nominal return is:

\[ R = \left(\frac{$1,087.45 - 1,030}{1,030}\right) + 80/1,030 = .1335, \text{ or } 13.35\% \]

And, using the Fisher equation, we find the real return is:

\[ 1 + R = (1 + r)(1 + h) \]

\[ r = \frac{1.1335/1.042}{1} - 1 = .0878, \text{ or } 8.78\% \]

Here we know the average stock return, and four of the five returns used to compute the average return. We can work the average return equation backward to find the missing return. The average return is calculated as:

\[ 5(.113) = .09 - .16 + .21 + .17 + R \]

\[ R = .255, \text{ or } 25.5\% \]

The missing return has to be 25.5 percent. Now we can use the equation for the variance to find:

\[ \text{Variance} = \frac{1}{4}[ (.09 - .113)^2 + (-.16 - .113)^2 + (.21 - .113)^2 + (.17 - .113)^2 + (.255 - .113)^2] \]

\[ \text{Variance} = 0.026970 \]

And the standard deviation is:

\[ \text{Standard deviation} = (0.026970)^{\frac{1}{2}} = 0.1642, \text{ or } 16.42\% \]

The arithmetic average return is the sum of the known returns divided by the number of returns, so:

\[ \text{Arithmetic average return} = (.14 + .18 + .26 - .19 + .34 - .09) / 6 \]

\[ \text{Arithmetic average return} = .1067, \text{ or } 10.67\% \]

Using the equation for the geometric return, we find:

\[ \text{Geometric average return} = \left[\left(1 + R_1\right) \times \left(1 + R_2\right) \times \ldots \times \left(1 + R_T\right)\right]^{1/T} - 1 \]

\[ \text{Geometric average return} = [\left(1 + .14\right)(1 + .18)(1 + .22)(1 - .19)(1 + .34)(1 - .09)]^{\frac{1}{6}} - 1 \]

\[ \text{Geometric average return} = .0897, \text{ or } 8.97\% \]

Remember, the geometric average return will always be less than the arithmetic average return if the returns have any variation.
16. To calculate the arithmetic and geometric average returns, we must first calculate the return for each year. The return for each year is:

\[
R_1 = \frac{($48.13 - 43.15 + 0.45)}{43.15} = 0.1258, \text{ or } 12.58\%
\]

\[
R_2 = \frac{($57.05 - 48.13 + 0.49)}{48.13} = 0.1955, \text{ or } 19.55\%
\]

\[
R_3 = \frac{($45.13 - 57.05 + 0.55)}{57.05} = -0.1993, \text{ or } -19.93\%
\]

\[
R_4 = \frac{($52.05 - 45.13 + 0.62)}{45.13} = 0.1671, \text{ or } 16.71\%
\]

\[
R_5 = \frac{($61.13 - 52.05 + 1.68)}{52.05} = 0.1875, \text{ or } 18.75\%
\]

The arithmetic average return was:

\[
R_A = \frac{(0.1258 + 0.1955 - 0.1993 - 0.1671 + 0.1875)}{5} = 0.0953, \text{ or } 9.53\%
\]

And the geometric average return was:

\[
R_G = \left[\left(1 + 0.1258\right)\left(1 + 0.1955\right)\left(1 - 0.1993\right)\left(1 - 0.1671\right)\left(1 + 0.1875\right)\right]^{1/5} - 1 = 0.0835, \text{ or } 8.35\%
\]

17. Looking at the long-term corporate bond return history in Figure 12.10, we see that the mean return was 6.2 percent, with a standard deviation of 8.3 percent. In the normal probability distribution, approximately 2/3 of the observations are within one standard deviation of the mean. This means that 1/3 of the observations are outside one standard deviation away from the mean. Or:

\[
\Pr(R < -2.1 \text{ or } R > 14.5) \approx \frac{1}{3}
\]

But we are only interested in one tail here, that is, returns less than –2.1 percent, so:

\[
\Pr(R < -2.1) \approx \frac{1}{6}
\]

You can use the \( z \)-statistic and the cumulative normal distribution table to find the answer as well. Doing so, we find:

\[
z = \frac{(X - \mu)}{\sigma}
\]

\[
z = (\frac{-2.1% - 6.2}{8.3}) = -1.00
\]

Looking at the \( z \)-table, this gives a probability of 15.87%, or:

\[
\Pr(R < -2.1) \approx 0.1587, \text{ or } 15.87\%
\]

The range of returns you would expect to see 95 percent of the time is the mean plus or minus 2 standard deviations, or:

95% level: \( R \in \mu \pm 2\sigma = 6.2\% \pm 2(8.3\%) = -10.40\% \text{ to } 22.80\% \)
The range of returns you would expect to see 99 percent of the time is the mean plus or minus 3 standard deviations, or:

99% level: $R \in \mu \pm 3\sigma = 6.2\% \pm 3(8.3\%) = -18.70\% \text{ to } 31.10\%$

18. The mean return for small company stocks was 16.7 percent, with a standard deviation of 32.6 percent. Doubling your money is a 100% return, so if the return distribution is normal, we can use the $z$-statistic. So:

$$z = \frac{X - \mu}{\sigma}$$

$$z = \frac{(100\% - 16.7)/32.6\%}{2.555 \text{ standard deviations above the mean}}$$

This corresponds to a probability of $\approx 0.53\%$, or once every 200 years. Tripling your money would be:

$$z = \frac{(200\% - 16.7)/32.6\%}{5.623 \text{ standard deviations above the mean}}$$

This corresponds to a probability of about $0.00001\%$, or about once every 1 million years.

19. It is impossible to lose more than 100 percent of your investment. Therefore, return distributions are truncated on the lower tail at –100 percent.

20. To find the best forecast, we apply Blume’s formula as follows:

$$R(5) = \frac{5-1}{39} \times 9.6\% + \frac{40-5}{39} \times 11.7\% = 11.48\%$$

$$R(10) = \frac{10-1}{39} \times 9.6\% + \frac{40-10}{39} \times 11.7\% = 11.22\%$$

$$R(20) = \frac{20-1}{39} \times 9.6\% + \frac{40-20}{39} \times 11.7\% = 10.68\%$$

21. The best forecast for a one year return is the arithmetic average, which is 12.3 percent. The geometric average, found in Table 12.4 is 10.4 percent. To find the best forecast for other periods, we apply Blume’s formula as follows:

$$R(5) = \frac{5-1}{85-1} \times 9.9\% + \frac{85-5}{85-1} \times 11.9\% = 11.80\%$$

$$R(20) = \frac{20-1}{85-1} \times 9.9\% + \frac{85-20}{85-1} \times 11.9\% = 11.45\%$$

$$R(30) = \frac{30-1}{85-1} \times 9.9\% + \frac{85-30}{85-1} \times 11.9\% = 11.21\%$$
22. To find the real return we need to use the Fisher equation. Rewriting the Fisher equation to solve for the real return, we get:

\[ r = \frac{(1 + R)}{(1 + h)} - 1 \]

So, the real return each year was:

<table>
<thead>
<tr>
<th>Year</th>
<th>T-Bill Return</th>
<th>Inflation</th>
<th>Real Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>0.0729</td>
<td>0.0871</td>
<td>–0.0131</td>
</tr>
<tr>
<td>1974</td>
<td>0.0799</td>
<td>0.1234</td>
<td>–0.0387</td>
</tr>
<tr>
<td>1975</td>
<td>0.0587</td>
<td>0.0694</td>
<td>–0.0100</td>
</tr>
<tr>
<td>1976</td>
<td>0.0507</td>
<td>0.0486</td>
<td>0.0020</td>
</tr>
<tr>
<td>1977</td>
<td>0.0545</td>
<td>0.0670</td>
<td>–0.0117</td>
</tr>
<tr>
<td>1978</td>
<td>0.0764</td>
<td>0.0902</td>
<td>–0.0127</td>
</tr>
<tr>
<td>1979</td>
<td>0.1056</td>
<td>0.1329</td>
<td>–0.0241</td>
</tr>
<tr>
<td>1980</td>
<td>0.1210</td>
<td>0.1252</td>
<td>–0.0037</td>
</tr>
</tbody>
</table>

\[ \text{Average return } = \frac{0.619}{8} \]
\[ \text{Average return } = .0775, \text{ or 7.75\%} \]

And the average inflation rate was:

\[ \text{Average inflation } = \frac{0.7438}{8} \]
\[ \text{Average inflation } = .0930, \text{ or 9.30\%} \]

b. Using the equation for variance, we find the variance for T-bills over this period was:

\[ \text{Variance } = \frac{1}{7}[(.0729 - .0775)^2 + (.0799 - .0775)^2 + (.0587 - .0775)^2 + (.0507 - .0775)^2 + (.0545 - .0775)^2 + (.0764 - .0775)^2 + (.1056 - .0775)^2 + (.1210 - .0775)^2] \]
\[ \text{Variance } = 0.000616 \]

And the standard deviation for T-bills was:

\[ \text{Standard deviation } = (0.000616)^{1/2} \]
\[ \text{Standard deviation } = 0.0248, \text{ or 2.48\%} \]

The variance of inflation over this period was:

\[ \text{Variance } = \frac{1}{7}[(.0871 - .0930)^2 + (.1234 - .0930)^2 + (.0694 - .0930)^2 + (.0486 - .0930)^2 + (.0670 - .0930)^2 + (.0902 - .0930)^2 + (.1329 - .0930)^2 + (.1252 - .0930)^2] \]
\[ \text{Variance } = 0.000971 \]

And the standard deviation of inflation was:

\[ \text{Standard deviation } = (0.000971)^{1/2} \]
\[ \text{Standard deviation } = 0.0312, \text{ or 3.12\%} \]
c. The average observed real return over this period was:

\[ \text{Average observed real return} = -0.0140 \text{, or } -1.40\% \]

\[ \text{Average observed real return} = \frac{-0.1122}{8} \]

\[ \text{Average observed real return} = -0.0140, \text{ or } -1.40\% \]

d. The statement that T-bills have no risk refers to the fact that there is only an extremely small chance of the government defaulting, so there is little default risk. Since T-bills are short term, there is also very limited interest rate risk. However, as this example shows, there is inflation risk, i.e., the purchasing power of the investment can actually decline over time even if the investor is earning a positive return.

**Challenge**

23. Using the z-statistic, we find:

\[ z = \frac{(X - \mu)}{\sigma} \]

\[ z = \frac{(0\% - 11.9)}{20.4\%} = -0.583 \]

\[ \Pr(R=0) \approx 27.98\% \]

24. For each of the questions asked here, we need to use the z-statistic, which is:

\[ z = \frac{(X - \mu)}{\sigma} \]

a. \[ z_1 = \frac{(10\% - 6.2)}{8.3\%} = 0.4578 \]

This z-statistic gives us the probability that the return is less than 10 percent, but we are looking for the probability the return is greater than 10 percent. Given that the total probability is 100 percent (or 1), the probability of a return greater than 10 percent is 1 minus the probability of a return less than 10 percent. Using the cumulative normal distribution table, we get:

\[ \Pr(R=10\%) = 1 - \Pr(R=10\%) = 1 - 0.4578 \approx 32.35\% \]

For a return greater than 0 percent:

\[ z_2 = \frac{(0\% - 6.2)}{8.3\%} = -0.7470 \]

\[ \Pr(R=10\%) = 1 - \Pr(R=10\%) = 1 - 0.7725 \approx 22.75\% \]

b. The probability that T-bill returns will be greater than 10 percent is:

\[ z_3 = \frac{(10\% - 3.7)}{3.1\%} = 2.032 \]

\[ \Pr(R=10\%) = 1 - \Pr(R=10\%) = 1 - 0.9789 \approx 2.11\% \]
And the probability that T-bill returns will be less than 0 percent is:
\[ z_4 = (0\% - 3.7)/3.1\% = -1.1935 \]
\[ \Pr(R=0) \approx 11.63\% \]

(c.) The probability that the return on long-term corporate bonds will be less than \(-4.18\) percent is:
\[ z_5 = (-4.18\% - 6.2)/8.3\% = -1.2506 \]
\[ \Pr(R=-4.18\%) \approx 10.55\% \]

And the probability that T-bill returns will be greater than 10.56 percent is:
\[ z_6 = (10.56\% - 3.7)/3.1\% = 2.2129 \]
\[ \Pr(R=10.56\%) = 1 - \Pr(R=10.56\%) = 1 - .9865 \approx 1.35\% \]