CHAPTER 15 INTERNATIONAL PORTFOLIO INVESTMENT
SUGGESTED ANSWERS AND SOLUTIONS TO END-OF-CHAPTER
QUESTIONS AND PROBLEMS

QUESTIONS

1. What factors are responsible for the recent surge in international portfolio investment (IPI)?

Answer: The recent surge in international portfolio investments reflects the globalization of financial markets. Specifically, many countries have liberalized and deregulated their capital and foreign exchange markets in recent years. In addition, commercial and investment banks have facilitated international investments by introducing such products as American Depository Receipts (ADRs) and country funds. Also, recent advancements in computer and telecommunication technologies led to a major reduction in transaction and information costs associated with international investments. In addition, investors might have become more aware of the potential gains from international investments.

2. Security returns are found to be less correlated across countries than within a country. Why can this be?

Answer: Security returns are less correlated probably because countries are different from each other in terms of industry structure, resource endowments, macroeconomic policies, and have non-synchronous business cycles. Securities from a same country are subject to the same business cycle and macroeconomic policies, thus causing high correlations among their returns.

3. Explain the concept of the world beta of a security.

Answer: The world beta measures the sensitivity of returns to a security to returns to the world market portfolio. It is a measure of the systematic risk of the security in a global setting. Statistically, the world beta can be defined as:

\[ \text{Cov}(R_i, R_M)/\text{Var}(R_M), \]

where \( R_i \) and \( R_M \) are returns to the i-th security and the world market portfolio, respectively.
4. Explain the concept of the Sharpe performance measure.

Answer: The Sharpe performance measure (SHP) is a risk-adjusted performance measure. It is defined as the mean excess return to a portfolio above the risk-free rate divided by the portfolio’s standard deviation.

5. Explain how exchange rate fluctuations affect the return from a foreign market measured in dollar terms. Discuss the empirical evidence on the effect of exchange rate uncertainty on the risk of foreign investment.

Answer: It is useful to refer to Equations 11.4 and 11.5 of the text. Exchange rate fluctuations mostly contribute to the risk of foreign investment through its own volatility as well as its covariance with the local market returns. The covariance tends to be positive in most of the cases, implying that exchange rate changes tend to add to exchange risk, rather than offset it. Exchange risk is found to be much more significant in bond investments than in stock investments.

6. Would exchange rate changes always increase the risk of foreign investment? Discuss the condition under which exchange rate changes may actually reduce the risk of foreign investment.

Answer: Exchange rate changes need not always increase the risk of foreign investment. When the covariance between exchange rate changes and the local market returns is sufficiently negative to offset the positive variance of exchange rate changes, exchange rate volatility can actually reduce the risk of foreign investment.

7. Evaluate a home country’s multinational corporations as a tool for international diversification.

Answer: Despite the fact that MNCs have operations worldwide, their stock prices behave very much like purely domestic firms. This is puzzling yet undeniable. As a result, MNCs are a poor substitute for direct foreign portfolio investments.

8. Discuss the advantages and disadvantages of closed-end country funds (CECFs) relative to the American Depository Receipts (ADRs) as a means of international diversification.
Answer: CECFs can be used to diversify into exotic markets that are otherwise difficult to access such as India and Turkey. Being a portfolio, CECFs also provide instant diversification. ADRs do not provide instant diversification; investors should form portfolios themselves. In addition, there are relatively few ADRs from emerging markets. The main disadvantage of CECFs is that their share prices behave somewhat like the host country’s share prices, reducing the potential diversification benefits.

9. Why do you think closed-end country funds often trade at a premium or discount?

Answer: CECFs trade at a premium or discount because capital markets of the home and host countries are segmented, preventing cross-border arbitrage. If cross-border arbitrage is possible, CECFs should be trading near their net asset values.

10. Why do investors invest the lion’s share of their funds in domestic securities?

Answer: Investors invest heavily in their domestic securities because there are significant barriers to investing overseas. The barriers may include excessive transaction costs, information costs for foreign securities, legal and institutional restrictions, extra taxes, exchange risk and political risk associated with overseas investments, etc.

11. What are the advantages of investing via international mutual funds?

Answer: The advantages of investing via international mutual funds include: (1) save transaction/information costs, (2) circumvent legal/institutional barriers, and (3) benefit from the expertise of professional fund managers.

12. Discuss how the advent of the euro would affect international diversification strategies.

Answer: As the euro-zone will have the same monetary and exchange-rate policies, the correlations among euro-zone markets are likely to go up. This will reduce diversification benefits. However, to the extent that the adoption of euro strengthens the European economy, investors may benefit from enhanced returns.
PROBLEMS

1. Suppose you are a euro-based investor who just sold Microsoft shares that you had bought six months ago. You had invested 10,000 euros to buy Microsoft shares for $120 per share; the exchange rate was $1.15 per euro. You sold the stock for $135 per share and converted the dollar proceeds into euro at the exchange rate of $1.06 per euro. First, determine the profit from this investment in euro terms. Second, compute the rate of return on your investment in euro terms. How much of the return is due to the exchange rate movement?

Solution: It is useful first to compute the rate of return in euro terms:

\[ r_e = r_k + e \]

\[ = \left( \frac{135 - 120}{120} \right) + \left( \frac{1}{1.06} - \frac{1}{1.15} \right) \]

\[ = 0.125 + 0.085 \]

\[ = 0.210 \]

This indicates that this euro-based investor benefited from an appreciation of dollar against the euro, as well as from an appreciation of the dollar value of Microsoft shares. The profit in euro terms is about €2,100, and the rate of return is about 21% in euro terms, of which 8.5% is due to the exchange rate movement.

2. Mr. James K. Silber, an avid international investor, just sold a share of Nestlé, a Swiss firm, for SF5,080. The share was bought for SF4,600 a year ago. The exchange rate is SF1.60 per U.S. dollar now and was SF1.78 per dollar a year ago. Mr. Silber received SF120 as a cash dividend immediately before the share was sold. Compute the rate of return on this investment in terms of U.S. dollars.
Solution: Mr. Silber must have paid $2,584.27 (=4,600/1.78) for a share of Nestlé a year ago. When the share was liquidated, he must have received $3,250 [=(5,080 + 120)/1.60]. Therefore, the rate of return in dollar terms is:

\[
R($) = \left(\frac{3,250 - 2,584.27}{2,584.27}\right) \times 100 = 25.76%.
\]

3. In the above problem, suppose that Mr. Silber sold SF4,600, his principal investment amount, forward at the forward exchange rate of SF1.62 per dollar. How would this affect the dollar rate of return on this Swiss stock investment? In hindsight, should Mr. Silber have sold the Swiss franc amount forward or not? Why or why not?

Solution: The dollar profit from selling SF4,600 forward is equal to:

\[
\text{Profit} ($) = 4,600 \left(\frac{1}{1.62} - \frac{1}{1.60}\right) \\
= 4,600 \left(0.6173 - 0.625\right) \\
= -$35.42.
\]

Thus, the total return of investment is:

\[
R($) = \left(\frac{3,250 - 2,584.27 - 35.42}{2,584.27}\right) \times 100 = 24.39%.
\]

By ‘hindsight’, Mr. Silber should not have sold the SF amount forward as it reduced the return in dollar terms.

4. Japan Life Insurance Company invested $10,000,000 in pure-discount U.S. bonds in May 1995 when the exchange rate was 80 yen per dollar. The company liquidated the investment one year later for $10,650,000. The exchange rate turned out to be 110 yen per dollar at the time of liquidation. What rate of return did Japan Life realize on this investment in yen terms?

Solution: Japan Life Insurance Company spent ¥800,000,000 to buy $10,000,000 that was invested in U.S. bonds. The liquidation value of this investment is ¥1,171,500,000, which is obtained from multiplying $10,650,000 by ¥110/$. The rate of return in terms of yen is:

\[
\left(\frac{¥1,171,500,000 - ¥800,000,000}{¥800,000,000}\right) \times 100 = 46.44%.
\]
5. At the start of 1996, the annual interest rate was 6 percent in the United States and 2.8 percent in Japan. The exchange rate was 95 yen per dollar at the time. Mr. Jorus, who is the manager of a Bermuda-based hedge fund, thought that the substantial interest advantage associated with investing in the United States relative to investing in Japan was not likely to be offset by the decline of the dollar against the yen. He thus concluded that it might be a good idea to borrow in Japan and invest in the United States. At the start of 1996, in fact, he borrowed ¥1,000 million for one year and invested in the United States. At the end of 1996, the exchange rate became 105 yen per dollar. How much profit did Mr. Jorus make in dollar terms?

Solution: Let us first compute the maturity value of U.S. investment:

\[
\frac{¥1,000,000,000}{95}(1.06) = $11,157,895.
\]

The dollar amount necessary to pay off yen loan is:

\[
\frac{¥1,000,000,000}{105} = $9,790,476.
\]

The dollar profit = $11,157,895 - $9,790,476 = $1,367,419.

Mr. Jorus was able to realize a large dollar profit because the interest rate was higher in the U.S. than in Japan and the dollar actually appreciated against yen. This is an example of uncovered interest arbitrage.

6. From Exhibit 11.4 we obtain the following data in dollar terms:

<table>
<thead>
<tr>
<th>Stock market</th>
<th>Return (mean)</th>
<th>Risk (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>1.26% per month</td>
<td>4.43%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.23% per month</td>
<td>5.55%</td>
</tr>
</tbody>
</table>
The correlation coefficient between the two markets is 0.58. Suppose that you invest equally, i.e., 50% each, in the two markets. Determine the expected return and standard deviation risk of the resulting international portfolio.

Solution: The expected return of the equally weighted portfolio is:

\[ E(R_p) = (0.5)(1.26\%) + (0.5)(1.23\%) = 1.25\% \]

The variance of the portfolio is:

\[ \text{Var}(R_p) = (0.5)^2(4.43)^2 + (0.5)^2(5.55)^2 + 2(0.5)^2(4.43)(5.55)(0.58) \]
\[ = 4.91 + 7.70 + 7.13 = 19.74 \]

The standard deviation of the portfolio is thus 4.44%.

7. Suppose you are interested in investing in the stock markets of 7 countries--i.e., Canada, France, Germany, Japan, Switzerland, the United Kingdom, and the United States--the same 7 countries that appear in Exhibit 15.9. Specifically, you would like to solve for the optimal (tangency) portfolio comprising the above seven stock markets. In solving the optimal portfolio, use the input data (i.e. correlation coefficients, means, and standard deviations) provided in Exhibit 15.4. The risk-free interest rate is assumed to be 0.5% per month and you can take a short position in any stock market. What are the optimal weights for each of the seven stock markets? This problem can be solved using MPTSolver.xls spreadsheet.
Solution: Using the data in Exhibit 15.4, the covariance matrix is computed and is given below.

<table>
<thead>
<tr>
<th>Asset</th>
<th>Return</th>
<th>Std Dev</th>
<th>Weight</th>
<th>R(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>0.880</td>
<td>5.780</td>
<td>-65.236%</td>
<td>1.489</td>
</tr>
<tr>
<td>France</td>
<td>1.190</td>
<td>6.290</td>
<td>7.023%</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>1.090</td>
<td>6.260</td>
<td>-2.111%</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>0.910</td>
<td>6.990</td>
<td>-1.760%</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>1.130</td>
<td>5.400</td>
<td>11.647%</td>
<td></td>
</tr>
<tr>
<td>U.K.</td>
<td>1.230</td>
<td>5.550</td>
<td>27.872%</td>
<td></td>
</tr>
<tr>
<td>U.S.</td>
<td>1.260</td>
<td>4.430</td>
<td>122.565%</td>
<td></td>
</tr>
</tbody>
</table>

Sum W(i) 100.000%

<table>
<thead>
<tr>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Japan</th>
<th>Switzerland</th>
<th>U.K.</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1.000</td>
<td>0.460</td>
<td>0.420</td>
<td>0.330</td>
<td>0.460</td>
<td>0.570</td>
</tr>
<tr>
<td>France</td>
<td>0.460</td>
<td>1.000</td>
<td>0.690</td>
<td>0.410</td>
<td>0.610</td>
<td>0.570</td>
</tr>
<tr>
<td>Germany</td>
<td>0.420</td>
<td>0.690</td>
<td>1.000</td>
<td>0.330</td>
<td>0.670</td>
<td>0.500</td>
</tr>
<tr>
<td>Japan</td>
<td>0.330</td>
<td>0.410</td>
<td>0.330</td>
<td>1.000</td>
<td>0.410</td>
<td>0.420</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.460</td>
<td>0.610</td>
<td>0.670</td>
<td>0.410</td>
<td>1.000</td>
<td>0.590</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.570</td>
<td>0.570</td>
<td>0.500</td>
<td>0.420</td>
<td>0.590</td>
<td>1.000</td>
</tr>
<tr>
<td>U.S.</td>
<td>0.740</td>
<td>0.500</td>
<td>0.450</td>
<td>0.310</td>
<td>0.510</td>
<td>0.580</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Japan</th>
<th>Switzerland</th>
<th>U.K.</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>-65.236%</td>
<td>7.023%</td>
<td>-2.111%</td>
<td>-1.760%</td>
<td>11.647%</td>
<td>27.872%</td>
</tr>
</tbody>
</table>

8. The HFS Trustees have solicited input from three consultants concerning the risks and rewards of an allocation to international equities. Two of them strongly favor such action, while the third consultant
commented as follows: “The risk reduction benefits of international investing have been significantly overstated. Recent studies relating to the cross-country correlation structure of equity returns during different market phases cast serious doubt on the ability of international investing to reduce risk, especially in situations when risk reduction is needed the most.”

a. Describe the behavior of cross-country equity return correlations to which the consultants is referring.
   Explain how that behavior may diminish the ability of international investing to reduce risk in the short run. Assume that the consultant’s assertion is correct.

b. Explain why it might still be more efficient on a risk/reward basis to invest internationally rather than only domestically in the long run.

The HFS Trustees have decided to invest in non-U.S. equity markets and have hired Jacob Hind, a specialist manager, to implement this decision. He has recommended that an unhedged equities position be taken in Japan, providing the following comments and the table data to support his view: “Appreciation of a foreign currency increases the returns to a U.S. dollar investor. Since appreciation of the Yen from ¥100/$U.S. to ¥98/$U.S. is expected, the Japanese stock position should not be hedged.”

<table>
<thead>
<tr>
<th>Market Rates and Hind’s Expectations</th>
<th>U.S.</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot rate (yen per $U.S.)</td>
<td>n/a</td>
<td>100</td>
</tr>
<tr>
<td>Hind’s 12-month currency forecast (yen per $U.S.)</td>
<td>n/a</td>
<td>98</td>
</tr>
<tr>
<td>1-year Eurocurrency rate (% per annum)</td>
<td>6.00</td>
<td>0.80</td>
</tr>
<tr>
<td>Hind’s 1-year inflation forecast (% per annum)</td>
<td>3.00</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Assume that the investment horizon is one year and that there are no costs associated with currency hedging.

c. State and justify whether Hind’s recommendation (not to hedge) should be followed. Show any calculations.

Solution:

a. Cross-country correlations tend to increase during the turbulent market phase, reducing the benefits from international diversification in the short run.

b. Unless the investor has to liquidate investments during the turbulent phase, he/she can ride out the turbulence and realize the benefits from international investments in the long run.
c. The interest rate parity implies that the forward exchange rate would be ¥95.09/$:

\[ F = \frac{1.06}{1.008}(1/100) = \frac{0.010516}{¥} = ¥95.09/$, \]

which is compared with Hind’s expected future spot rate of ¥98/$. Clearly, the HFS Trustees can receive more dollar amount from selling yen forward than from the unhedged position. Relative to the forward rate, Hind underestimates the yen’s future strength.

9. Rebecca Taylor, an international equity portfolio manager, recognizes that optimal country allocation strategy combined with an optimal currency strategy should produce optimal portfolio performance. To develop her strategy, Taylor produced the table below, which provides expected return data for the three countries and three currencies in which she may invest. The table contains the information she needs to make market strategy (country allocation) decisions and currency strategy (currency allocation) decisions.

**Expected Returns for a U.S.-Based Investor**

<table>
<thead>
<tr>
<th>Country</th>
<th>Local Currency Equity Returns</th>
<th>Exchange Rate Returns</th>
<th>Local Currency Eurodeposit Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>7.0%</td>
<td>1.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>10.5</td>
<td>-3.0</td>
<td>11.0</td>
</tr>
<tr>
<td>United States</td>
<td>8.4</td>
<td>0.0</td>
<td>7.5</td>
</tr>
</tbody>
</table>

a. Prepare a ranking of the three countries in terms of expected equity-market return premiums. Show your calculations.

b. Prepare a ranking of the three countries in terms of expected currency return premiums from the perspective of a U.S. investor. Show your calculations.

c. Explain one advantage a portfolio manager obtains, in formulating a global investment strategy, by calculating both expected market premiums and expected currency premiums.

Solution:

a. United Kingdom = first; United States = second; Japan = third.

b. Japan = first; United States = second; United Kingdom = third.
c. Computing expected currency premium helps the portfolio manager to decide whether to hedge currency risk.

10. The Glover Scholastic Aid Foundation has received a €20 million global government bond portfolio from a Greek donor. This bond portfolio will be held in euros and managed separately from Glover’s existing U.S. dollar-denominated assets. Although the bond portfolio is currently unhedged, the portfolio manager, Raine Sofia, is investigating various alternatives to hedge the currency risk of the portfolio. The bond portfolio’s current allocation and the relevant country performance data are given in Exhibits 1 and 2. Historical correlations for the currencies being considered by Sofia are given in Exhibit 3. Sofia expects that future returns and correlations will be approximately equal to those given in Exhibits 2 and 3.

Exhibit 1. Glover Scholastic Aid Foundation Current Allocation Global Government Bond Portfolio

<table>
<thead>
<tr>
<th>Country</th>
<th>Allocation (%)</th>
<th>Maturity (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>A</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

Exhibit 2. Country Performance Data (in local currency)

<table>
<thead>
<tr>
<th>Country</th>
<th>Cash Return (%)</th>
<th>5-year Excess Bond Return (%)</th>
<th>10-year Excess Bond Return (%)</th>
<th>Unhedged Currency Return (%)</th>
<th>Liquidity of 90-day Currency Forward Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>2.0</td>
<td>1.5</td>
<td>2.0</td>
<td>---</td>
<td>Good</td>
</tr>
<tr>
<td>A</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>- 4.0</td>
<td>Good</td>
</tr>
<tr>
<td>B</td>
<td>4.0</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>Fair</td>
</tr>
<tr>
<td>C</td>
<td>3.0</td>
<td>1.0</td>
<td>2.0</td>
<td>- 2.0</td>
<td>Fair</td>
</tr>
<tr>
<td>D</td>
<td>2.6</td>
<td>1.4</td>
<td>2.4</td>
<td>- 3.0</td>
<td>Good</td>
</tr>
</tbody>
</table>
Exhibit 3. Historical Currency Correlation Table (1998-2003, weekly observations)

<table>
<thead>
<tr>
<th>Currency (Greece)</th>
<th>€</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>€ (Greece)</td>
<td>1.00</td>
<td>-0.77</td>
<td>0.45</td>
<td>-0.57</td>
<td>0.77</td>
</tr>
<tr>
<td>A</td>
<td>---</td>
<td>1.00</td>
<td>-0.61</td>
<td>0.56</td>
<td>-0.70</td>
</tr>
<tr>
<td>B</td>
<td>---</td>
<td>---</td>
<td>1.00</td>
<td>-0.79</td>
<td>0.88</td>
</tr>
<tr>
<td>C</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1.00</td>
<td>-0.59</td>
</tr>
<tr>
<td>D</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1.00</td>
</tr>
</tbody>
</table>

a. Calculate the expected total annual return (euro-based) of the current bond portfolio if Sofia decides to leave the currency risk unhedged. Show your calculations.

b. Explain, with respect to currency exposure and forward rates, the circumstance in which Sofia should use a currency forward contract to hedge the current bond portfolio’s exposure to a given currency.

c. Determine which one of the currencies being considered by Sofia would be the best proxy hedge for Country B bonds. Justify your response with two reasons.

Sofia has been disappointed with the low returns on the current bond portfolio relative to the benchmark—a diversified global bond index—and is exploring general strategies to generate excess returns on the portfolio. She has already researched two such strategies: duration management and investing in markets outside the benchmark index.

d. Identify three general strategies (other than duration management and investing in markets outside the benchmark index) that Sofia could use to generate excess returns on the current bond portfolio. Give, for each of the three strategies, a potential benefit specific to the current bond portfolio.

Solution:
a. The unhedged expected annual portfolio return in euros is calculated as follows:

\[
W_G \times (r_G + e_{H,G}) + W_A \times (r_A + e_{H,A}) + W_B \times (r_B + e_{H,B}) + W_C \times (r_C + e_{H,C}) + W_D \times (r_D + e_{H,D})
\]

\[
= 0.25 \times (2\% + 1.5\%) + 0.4 \times (1\% + 2\% - 4\%) + 0.1 \times (4\% + 1\% + 2\%)
\]

\[
+ 0.1 \times (3\% + 1\% - 2\%) + 0.15 \times (2.6\% + 2.4\% - 3\%)
\]

\[
= 0.875\% - 0.4\% + 0.7\% + 0.2\% + 0.3\%
\]

\[
= 1.675\%
\]

\[
= 1.68\%
\]
b. If Sofia expects the unhedged percentage return from exposure to a currency to be less than the forward
discount or premium, she should use a forward contract to hedge exposure to that currency. The
circumstance can also be expressed as:

\[ e_{H,i} < c_H - c_i \]

where:

unhedged expected currency return for country \( i \) = \( e_{H,i} \)
forward premium or discount = \( c_H - c_i \)

c. Country D currency would provide the best proxy hedge for Country B bonds for any of the following
reasons:

• The liquidity of 90-day currency forward contracts for country D is good.
• The relevant currencies – Country B and Country D (hedge) – are historically more highly
correlated (0.88) and therefore Country D provides a more accurate proxy hedge.
• Sofia could capitalize on a negative view of Country D currency relative to Country B currency by
establishing a short position in Country D currency.

d.

1. Bond Market Selection:
Because there are bonds from only five countries in the current portfolio, better risk-adjusted returns
could be realized by diversifying into government bonds from other countries in the index that have
low correlations with existing bonds.

2. Sector/Credit/Security Selection:
The current portfolio is invested exclusively in government bonds. Other sectors such as corporate
bonds, asset-backed securities, and mortgage-backed securities could provide further diversification
and potentially enhance portfolio risk-adjusted return.

3. Currency Selection:
Active currency management can be used to produce superior risk-adjusted returns. One could either
hedge the entire portfolio from currency risk or implement expectations about specific currencies by
fully hedging, partially hedging, or not hedging.
MINI CASE: SOLVING FOR THE OPTIMAL INTERNATIONAL PORTFOLIO

Suppose you are a financial advisor and your client, who is currently investing only in the U.S. stock market, is considering diversifying into the U.K. stock market. At the moment, there are neither particular barriers nor restrictions on investing in the U.K. stock market. Your client would like to know what kind of benefits can be expected from doing so. Using the data provided in the above problem (i.e., problem 12), solve the following problems:

(a) Graphically illustrate various combinations of portfolio risk and return that can be generated by investing in the U.S. and U.K. stock markets with different proportions. Two extreme proportions are (i) investing 100% in the U.S. with no position in the U.K. market, and (ii) investing 100% in the U.K. market with no position in the U.S. market.

(b) Solve for the ‘optimal’ international portfolio comprised of the U.S. and U.K. markets. Assume that the monthly risk-free interest rate is 0.5% and that investors can take a short (negative) position in either market.

(c) What is the extra return that U.S. investors can expect to capture at the ‘U.S.-equivalent’ risk level? Also trace out the efficient set. [The Appendix 11.B provides an example.]
Suggested Solution to the Optimal International Portfolio:

Let U.S. be market 1 and U.K. be market 2. The parameter values are: $\bar{R}_1 = 1.26\%$, $\bar{R}_2 = 1.23\%$, $\sigma_1 = 4.43\%$, $\sigma_2 = 5.55\%$, $R_f = 0.5\%$.

Accordingly, $\sigma_{12} = \sigma_1 \sigma_2 \rho_{12} = (4.43)(5.55)(0.58) = 14.26$, $\sigma_1^2 = 19.62$, $\sigma_2^2 = 30.80$.

(a) $E(R_p) = 1.26w_1 + 1.23w_2$

The variance of the portfolio is:

$\text{Var}(R_p) = 19.62w_1^2 + 30.80w_2^2 + 2(14.26)w_1w_2$

Some possible portfolios are:

<table>
<thead>
<tr>
<th>$w_1$</th>
<th>$w_2$</th>
<th>$E(R_p)$</th>
<th>$\text{Var}(R_p)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>0.00</td>
<td>1.26</td>
<td>19.62</td>
</tr>
<tr>
<td>0.75</td>
<td>0.25</td>
<td>1.25</td>
<td>18.31</td>
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<tr>
<td>0.50</td>
<td>0.50</td>
<td>1.245</td>
<td>19.74</td>
</tr>
<tr>
<td>0.25</td>
<td>0.75</td>
<td>1.238</td>
<td>23.90</td>
</tr>
<tr>
<td>0.00</td>
<td>1.00</td>
<td>1.23</td>
<td>30.80</td>
</tr>
</tbody>
</table>

(b) The optimal weights are $w_1 = 0.79$ and $w_2 = 0.21$.

(c) $\bar{R}_I = R_f + \lambda \sigma_{US}$

Here, $\lambda =$ Slope of efficient set $= (\bar{R}_{OIP} - R_f) / \sigma_{OIP}$

$\bar{R}_{OIP} = (0.79)(1.26) + (0.21)(1.23) = 1.26\%$

$\sigma_{OIP}^2 = (0.79)^2(19.62) + (0.21)^2(30.8) + 2(0.79)(0.21)(14.26) = 18.55$

$\sigma_{OIP} = 4.28\%$

Therefore, $\bar{R}_I = 0.5 + [(1.26 - 0.5)/4.28](4.43) = 1.29\%$

Extra return $= 1.29 - 1.26 = 0.03\%$