Understanding Financial Management: A Practical Guide
Guideline Answers to the Concept Check Questions

Chapter 9

Risk Analysis

Concept Check 9.1

1. **What are the three general perspectives from which to evaluate risk in capital budgeting?**

   Three general perspectives for evaluating risk in capital budgeting are a single-project, a company, and a shareholders' perspective. The *single-project perspective* assesses an investment's total risk as a stand-alone unit. The *company perspective* considers each project according to its contribution to the firm's total risk. This perspective focuses on diversification and portfolio effects. The *shareholders' perspective* views each project according to its contribution to the riskiness of a diversified shareholder's portfolio. This perspective focuses on market risk.

2. **What is the justification for viewing risk from each of the three risk perspectives?**

   Justification exists for using each of the three risk perspectives. According to one view, managers should focus on single-project risk and leave diversification up to the shareholders. The justification for using single-project risk centers on its ease in estimation, high correlation with other types of risk, and relevance for undiversified stockholders. The rationale for viewing risk from a company perspective focuses on diversification and portfolio effects. That is, a project may appear risky on a stand-alone basis but may actually reduce total company risk. Managers should consider company risk because others hold them accountable for the success or failure of major projects introduced while they are in charge. If shareholders are highly diversified, then market risk is the most relevant type of risk. Viewing risk from this perspective should help managers achieve the goal of maximizing shareholder wealth.

3. **How can analysts measure single-project risk, corporate risk, and market risk?**

   Single-project risk is measured by the variability of a project's expected returns (cash flows). This measure is commonly the standard deviation or the coefficient of variation. Company risk is measured by the project's effect on uncertainty about the firm's future cash flows. Analysts often use the standard deviation of the expected returns from a firm's existing portfolio of investments. Adding an investment with a correlation coefficient that is less than perfectly positively correlated with the firm's existing investment portfolio reduces the portfolio standard deviation. Market risk is measured by

the project's effect on the firm's beta coefficient. The market risk of a project is typically the most difficult of the three types of risk to estimate.

4. **What are the two components of total project risk? How do they differ?**

Total project risk consists of systematic risk and unsystematic risk. In terms of capital budgeting projects, *systematic risk*, also called market risk, is the part of a project's risk that is common to all projects of the same general class. A firm cannot eliminate systematic risk by diversification because it tends to affect all investments. The beta coefficient is the measure of systematic risk. *Unsystematic risk*, also call non-market or diversifiable risk, is risk unique to a particular firm or investment and can be reduced or eliminated by combining various investments in a portfolio. Investors can diversify away the unsystematic portion of total risk. Thus, only systematic risk should concern a firm's shareholders who hold fully diversified portfolios.

5. **What are examples of diversifiable and undiversifiable risk?**

Causes of diversifiable risk involve such random events as lawsuits, strikes, successful and unsuccessful marketing programs, winning or losing a major contract, and other events that are unique to a particular firm. Because these events are random, a firm can eliminate their effects on a portfolio by diversification. Undiversifiable risk, on the other hand, stems from factors that systematically affect most firms such as war, inflation, recessions, and high interest rates. Since these factors have a negative effect on most stocks, a firm cannot eliminate market risk through diversification.

6. **Under what circumstances is beta an appropriate risk measure of a new project?**

Market risk, as measured by beta, may be an appropriate risk measure for capital investments for well-diversified stockholders. If stockholders have highly diversified portfolios, they have already diversified away unsystematic risk. Therefore, the only relevant risk should be market risk.

Concept Check 9.2

1. **What are the steps required in conducting sensitivity analysis?**

Conducting sensitivity analysis involves the following steps.

- Calculate a project's NPV using the most likely value estimated for each variable.
- Identify key variables that are likely to affect the NPV of the project.
- Change one of the selected input variables by some amount, say plus and minus 10 or 20 percent, of the most likely value while holding the other variables constant, and recalculate the NPV based on the revision.
- Repeat the process described in Step 3 by revising the estimate of each of the other selected variables one at a time.
- Identify the sensitive variables by plotting the NPVs for each variable against the fixed percentage change.

2. **How does sensitivity analysis differ from scenario analysis?**

Sensitivity analysis and scenario analysis are similar in many respects, but some differences exist. *Sensitivity analysis* is a "what if" technique that measures change in one variable, such as NPV, resulting from a change in another variable. For example, sensitivity analysis could show how NPV would change if one variable such as sales or cost of goods sold differed from its predicted value. Thus, a use of sensitivity analysis is to determine which variables have a pronounced effect on a project's NPV.

Scenario analysis is a technique that examines a firm's circumstances if a certain set of events called *scenarios* occur. Unlike sensitivity analysis, scenario analysis measures the impact on a project's NPV if a number of variables differ from their expected values. For example, scenario analysis could show how NPV would change if simultaneous changes in sale volume, price, and the tax rate arise. Thus, sensitivity analysis does not allow for interactions among different variables upon NPV, whereas scenario analysis can consider such interactions on NPV. In addition, sensitivity analysis does not involve probabilities, but scenario analysis may involve attaching a probability to each scenario.

3. **What is the difference between the optimistic scenario and the best-case scenario and between the pessimistic scenario and the worst-case scenario?**

In the optimistic scenario, the analyst assumes that the outcomes of some variables are better than the most likely values. In the best-case scenario, the analysts would use all the optimistic values for each variable. In the pessimistic scenario, the analyst assumes that the outcomes of some variables are worse than the most likely values. In the worst-case scenario, the analyst would use all the pessimistic values for each variable.

4. **What are two methods for developing optimistic and pessimistic scenarios? Explain each.**

Two major ways to develop optimistic (or best-case) and pessimistic (or worst-case) scenarios are the ad hoc approach and the forecasting approach. The *ad hoc approach* is a mechanical approach used to determine the level of each variable of interest. For example, an analyst could take a fixed percentage above or below the most likely (or base) case, such as plus or minus 20 percent. The ad hoc approach is simple to apply, time efficient, and easily applicable to all variables but may result in extreme values that lack logical justification. The *forecasting approach* is a less mechanical approach in which analysts try to develop values that represent probable events. This method emphasizes the process of forecasting and emulates expected real-world behavior but is time consuming to implement.

5. **What are the advantages and disadvantages of sensitivity analysis and scenario analysis?**

The advantages of sensitivity analysis are that it: (1) helps to identify the key input variables affecting a project's NPV, (2) is easy to conduct and the results are easy to interpret, and (3) can provide useful insights about project risk when comparing two projects. Its drawbacks are that it: (1) provides only a limited amount of information, (2) does not show the impact on NPV of simultaneous changes in variables, and (3) does not provide a decision rule for accepting or rejecting projects.

The advantages of scenario analysis are that it: (1) provides a range of outcomes and (2) produces outputs that managers can use to determine the expected NPV, standard deviation of NPV, and coefficient of variation of NPV. Its limitations are that it: (1) is generally limited to a few discrete outcomes, (2) is difficult to estimate scenario probabilities, (2) assumes a perfect correlation between the inputs used in the best-case and worst-case variants, and (4) does not provide a decision rule for making accept-reject decisions.

Concept Check 9.3

1. **How can financial managers estimate the risk-free rate, the expected return on the market, and a project's beta using CAPM?**

   Estimating the risk-free rate typically involves using yields on government securities as suitable proxies for the risk-free rate. A question arises involving whether to use the 90-day Treasury bill rate or a long-term government bond as a proxy for the risk-free rate. Practical problems of using the Treasury bill rate are that actions of the Federal Reserve Board affect yields and short-term Treasury securities show significant variability over time. For capital budgeting projects, the yield on a long-term government bond matching the length of the project may be a better choice.

   Several ways are available to estimate the expected market return. One method is to use historical average stock returns over a long period. The assumption is that the past is an adequate mirror of the expected market returns. Various problems exist in calculating this return including whether to use arithmetic or geometric averages and value or equally weighted returns. In addition, the period and the market proxy used affect the estimate of the expected market return. Another approach to obtaining the expected market return is to use published data provided by investment advisory services.

   There are several ways to estimate a project's beta. One approach is by regressing its historical holding-period returns against the returns on a market portfolio. A second method of estimating a project's beta, especially for a new project, is to use comparable companies. This approach, often called the *pure-play method*, begins by identifying several publicly traded companies in the same or similar line of business as the proposed project and determining their betas. After making appropriate adjustments, the financial manager can average the betas and use this average beta as a proxy for the estimated project beta.

2. **What are the problems of using the pure-play method to estimate a project's beta?**

   Using the pure-play method to estimate a project’s beta involves several problems. First, finding pure play proxy firms is difficult if not impossible in some cases. Second, the pure-play firms reflect leveraged betas. Pure project risk identifies risk without considering the financial risk associated with how the firm anticipates financing it. Thus, the analyst must adjust downward the observed betas of the levered pure-play firm into an unlevered beta using the pure-play firm’s debt/equity ratio.

3. **How do business risk and financial risk differ?**

Business risk is the risk inherent in the normal operations of the firm, before the financing decision. Business risk does not change regardless of how the firm finances its operations. Various factors influence business risk including the variability of sales and operating costs. Firms with greater variability in earnings before interest and taxes (EBIT) reflect greater business risk. *Financial risk* is the additional risk that a firm faces by using debt financing. Debt financing increases the variability of earnings before taxes (EBT) but after interest. Thus, financial risk contributes to the uncertainty of a firm's net income and its earnings per share.

4. **Explain how to draw the SML.**

The *security market line* (SML) is the graphical form of the capital asset pricing model (CAPM) in which $R_i = R_f + \beta_i(R_m - R_f)$. The x-axis represents the risk of an asset as measured by its beta (β_i) and the y-axis represents the required rates of return for individual assets (R_i). To plot the SML, select several betas and plot their corresponding required rates of return. The SML results by connecting each plot. The SML intersects the y-axis at the risk-free rate (R_f). The positively sloped SML shows that projects with higher market (beta) risk require higher rates of return to compensate investors for greater risk.

5. **What is the difference between an expected rate of return and a required rate of return on a capital budgeting project? Under what condition are these two rates of return the same?**

The *expected rate of return* is the rate of return expected on an asset given its current price and expected future cash flows. The *required rate of return* is the minimum acceptable rate of return considering both its risk and the returns available on other investments. In equilibrium, the required and expected rate of return will be equal.

6. **How can financial managers use the SML to make accept-reject decisions for capital investments?**

The SML provides a clear decision rule for making accept-reject decisions by portraying a project's risk-return relationship. When a project's expected rate of return, represented by its internal rate of return (IRR), is above its required rate of return, the project plots above the SML. Such a project will produce positive NPVs and, therefore, fall within the acceptance region. Similarly, a project whose expected rate of return (IRR) is below its required rate of return plots below the SML. Investing in this project will produce a negative NPV and fall within the rejection region. Projects plotting on the SML yield an NPV of zero. Financial managers should accept projects plotting above the SML and reject those falling below the SML.

7. **Why do projects plotting above (below) the SML have positive (negative) NPVs?**

When a project plots above the security market line (SML), its IRR is above the required rate of return so the project's NPV is positive. However, when a project plots below the SML, its IRR is below the required rate of return and the NPV is negative.

8. **What are several limitations of using the CAPM to calculate a project's required rate of return?**

The standard CAPM has several limitations when used to calculate the required rate of return of a project. A major problem is the difficulty of getting accurate inputs, especially beta. In many instances, obtaining project betas is impractical. Another problem is applying the single-period CAPM to a multi-period capital budgeting project. Using a single rate to discount cash flows for all periods could be inappropriate if the inputs needed to calculate the required rate of return change over time. In practice, estimating multi-period discount rates can be a difficult process.

Concept Check 9.4

1. **Why is using a risk-adjusted discount rate, k*, superior to using the firm's cost of capital, k, in calculating the NPV of a risky project?**

In practice, projects often have different levels of riskiness associated with them. The firm's cost of capital represents the appropriate discount rate for average or normal risk projects of the firm. If a project has more (less) risk than average, using the firm's cost of capital would overstate (understate) the project's NPV. Using a risk-adjusted discount rate (RADR) compensates for the uncertainty of the timing and the amount of a project's cash flows. Thus, the financial manager should use a higher (lower) discount rate than the firm's cost of capital to reflect a project's higher (lower) riskiness.

2. **How do firms develop and use project risk classes?**

Determining the appropriate risk-adjusted discount rate (RADR) for each project can be difficult. Therefore, some firms develop project risk classes and assign a different discount rate to each risk class. Several approaches are available for achieving this task. One method is to use historical data to calculate the coefficient of variation (CV) of the NPVs for past projects. The financial manager identifies the range of CVs for most of a firm's projects. Because projects within this range represent those of average risk, the manager should assign the firm's cost of capital as the discount rate for this risk class. The manager then develops other risk classes and assigns a specific number of percentage points to the cost of capital for projects whose CVs lie outside that range to adjust for differential project risk. For example, suppose the firm's cost of capital is 10 percent, the manager may add (subtract) several percentage points for more-than (less-than) average risk project. Another method is to classify projects by type and to assign a risk-adjusted discount rate for each project type. For example, the financial manager could assign a higher than normal discount rate to new products with higher uncertain demand. Using either method, management must rely on experience and subjective judgment to develop and use project risk classes.

3. **What are two ways of estimating risk-adjusted discount rates? Explain.**

Two ways of estimating risk-adjusted discount rates are to adjust the firm's cost of capital for risk and to use the capital asset pricing model (CAPM). With the first method, the financial manager assigns a higher (lower) than normal discount rate for projects that are

more (less) risky than average. Using sensitivity analysis and scenario analysis may help the manager form judgments about the appropriate risk adjustment. A firm's cost of capital serves as the basis for evaluating average-risk projects. With the CAPM approach, the financial manager estimates the risk-free rate, the expected return on the market, and a project beta. By substituting these estimates into the CAPM equation, the manager can calculate a risk-adjusted discount rate for a specific project.

4. **Does using a RADR method always result in a lower NPV than using the firm's cost of capital? Why or why not?**

No, using the RADR method does not always result in a lower NPV than using the firm's cost of capital. The risk-adjusted discount rate may be higher or lower than the firm's cost of capital depending on the riskiness of the project. The firm's cost of capital is appropriate only for average-risk projects. For high-risk projects, the risk-adjusted discount rate would be greater than the firm's cost of capital. Using a higher than normal discount rate would lower the project's NPV. On the other hand, low-risk projects require a risk-adjusted discount rate less than the firm's cost of capital. By using a lower than normal discount rate, an analyst would raise a project's NPV.

5. **What is the major difference between the RADR method and CE method of incorporating risk into project evaluation? Explain.**

The RADR method adjusts for project risk by changing the discount rate in the denominator of the NPV equation. This method is easier to use than the CE approach but has both theoretical and practical limitations. The CE method changes the cash flows in the numerator of the NPV equation and uses a risk-free discount rate. This approach is theoretically superior to the RADR method because it makes separate adjustments for time and risk. The CE method is difficult to implement in practice because of the problems of determining the certainty equivalent factor associated with each cash flow.

Concept Check 9.5

1. **Why is risk analysis for international capital investments more complex than for domestic capital investments?**

Risk analysis for foreign capital investments involves all the risks associated with domestic investments project plus additional risks. Various factors may cause a substantial difference between project cash flows and cash flows received by the parent firm. Two key factors affecting international capital investments are political risk and exchange rate risk.

2. **What is the meaning of political risk and exchange rate risk?**

Political risk is the uncertainty associated with various political events or occurrences initiated by host governments that might be unfavorable to a capital investment. There are various types of political risk. One type involves discriminatory practices that subject affiliates of foreign firms to certain fees or taxes, or restrictive practices that are not applicable to domestic firms. Another type of political risk involves operational

restrictions such as limiting the ability of the parent company to receive transfer of funds from its affiliates. A third type of political risk is expropriation, which refers to the seizure of foreign assets by a host country. *Exchange rate risk* refers to the uncertainty associated with fluctuations in exchange rates between currencies. Thus, a firm is unsure about the rate at which it can convert future foreign cash flows into domestic currency.

3. **What are two types of foreign exchange exposure? Explain.**

One type of foreign exchange exposure is *translation* or *accounting exposure,* which refers to the impact of changes in exchange rates on balance sheet items in the accounting period in which they occur. Firms face translation exposure when they combine financial statements of foreign subsidiaries or affiliates with the parent's data to the home currency of the parent to form consolidated financial statements. A second type of foreign exchange exposure is *economic* or *operating exposure*, which refers to the immediate and potential impact of unexpected exchange rate changes on the cash flow generated by the affiliates. Thus, economic exposure represents any impact of exchange rate fluctuations on a firm's future cash flows beyond the accounting period when these changes occurred.

Concept Check 9.6

1. **In theory, which type of risk -- single-project risk, company risk, or market risk -- is most important? Why?**

In theory, the most important type of risk is market risk. Investors should expect a return only from risk that they cannot diversify away. Investors can diversify away unsystematic risk, but they cannot diversify away systematic or market risk. Thus, if investors hold fully diversified portfolios, only market risk should be important to them. In practice, however, most investors do not hold well-diversified portfolios.

2. **Which formal method of risk assessment do firms most commonly use in practice?**

In assessing single-project risk, analysts commonly use sensitivity analysis more than they do scenario analysis or Monte Carlo simulation. Personal experience also plays an important role in risk assessment. Analysts also commonly use the capital asset pricing model (CAPM) to assess market risk.

3. **Which formal method of risk adjustment do firms use most widely in practice?**

In the risk-adjustment category, the most popular method is the risk-adjusted discount rate (RADR) method. The evidence shows that large firms tend to prefer adjusting the discount rate rather than project cash flows.

4. **What are two reasons for the increased use of risk analysis in capital budgeting? Explain.**

One reason for the increased use of risk analysis in capital budgeting is that managers and analysts are becoming increasingly aware of such techniques and how to apply

them. Thus, training and education play a key role in explaining the growing popularity of risk analysis techniques. Another reason is that economic uncertainties have made managers more aware of the need to consider risk. Failure to account for risk could lead to making value decreasing decisions.