Chapter 13

Risk Analysis

Introduction

In previous chapters, we have discussed how to calculate the *IRR, NPV,* and other measures of investment performance. Because of risk differences, comparing *IRR*s or *NPV*s when making choices among alternative investments is usually not possible. Indeed, such a comparison may be made only if we assume that the risk associated with the different investments being analyzed is the same. In this chapter, we provide some techniques for evaluating risk that enable us to make a more thorough comparison of alternatives. We start with a brief discussion of sources of risk and how they may differ among investment alternatives.

Comparing Investment Returns

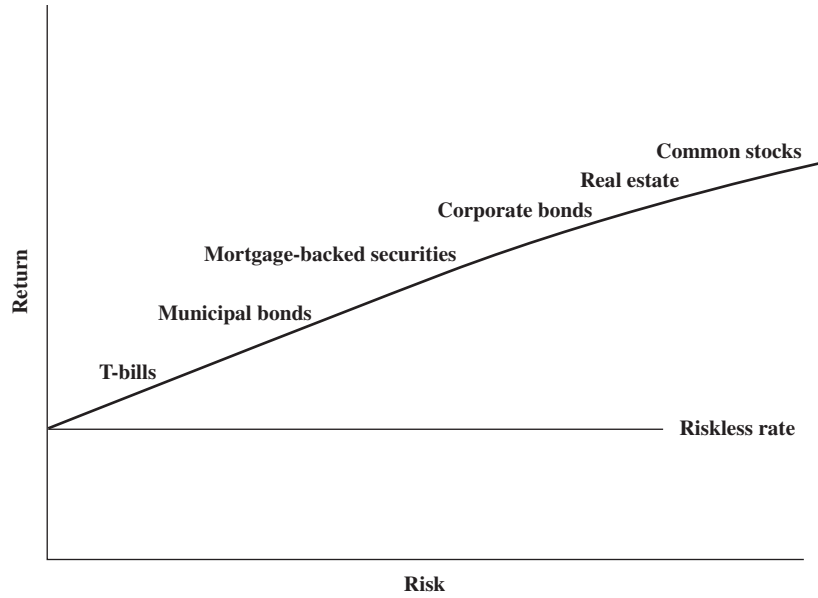
To begin our discussion, we will briefly explore considerations that investors should take into account when comparing the investment returns on a specific real estate investment with the returns on other real estate investments and other investments generally.

After the investor has gone through a reasonably detailed analysis of an income-producing property, and after having developed measures of return on the investment, the investor must decide whether or not the investment will provide an adequate or competitive return. The answer to this question will depend on (1) the nature of alternative real estate investments, (2) other investments that are available to the investor, (3) the respective returns that those alternatives are expected to yield, and (4) differences in *risk* between the investment being considered relative to those alternative investments available to the investor.

In Exhibit 13–1, we have constructed a hypothetical relationship between rates of return and risk for various classes of alternative investments. The vertical axis represents the expected return,[1] and the horizontal axis represents the degree of risk inherent in each category of investment. Note that we are dealing with the average risk for an entire class of assets. There are obviously significant differences in risk within each class. For example, some bonds will be riskier than other bonds within the general bond category. Also, less variance occurs within some asset classes than others (e.g., Treasury bills are considered to be riskless). Assets within one category may have more risk than some of the assets in a higher-risk category. For example, some bonds are riskier than some stocks, even though as a *class,* stocks are riskier than bonds.

[1] To be most comparable, returns should be calculated on an after-tax basis, as discussed later in this chapter.

EXHIBIT 13–1
Risk and Return (Alternative Investments)



Risk, as presented in Exhibit 13–1, is considered only by class of investments in relative terms; that is, as one moves to the right on the axis, an investment is considered riskier and as one moves to the left, an investment is considered less risky. Hence, investments with higher risks should yield investors higher returns, and vice versa.

Note that, based on the risk-return "ranking" indicated in Exhibit 13–1, the security with the lowest return, U.S. Treasury bills, also has the lowest risk.[2] As we move out on the risk-return line in the exhibit, we see that expected before-tax returns on investments in real estate offer a considerably higher expected return but are also much riskier than investing in U.S. Treasury bills.

Types of Risk

What are the investment characteristics peculiar to real estate that make it riskier than investing in government securities? Similarly, what risk characteristics differentiate real estate investment from alternatives such as common stock, corporate bonds, and municipal bonds also shown in Exhibit 13–1? To answer this question we must consider the source of risk differences among various categories of investments. What follows is a brief summary of major investment risk characteristics that must be considered by investors when deciding among alternative investments.

Business Risk

Real estate investors are in the business of renting space. They incur the **business risk** of loss due to fluctuations in economic activity that affect the variability of income produced by the property. Changes in economic conditions often affect some properties more than others depending on the type of property, its location, and any existing leases. Many regions of the country and locations within cities experience differences in the rate of growth due to changes in demand, population changes, and so on. Those properties that are affected to a greater degree than others are therefore riskier. A property with a well-diversified

[2] Treasury bills are free from default risk although they are subject to some interest rate risk and inflation risk.

tenant mix is likely to be less subject to business risk. Similarly, properties with leases that provide the owner with protection against unexpected changes in expenses (e.g., with expense stops in the lease) have less business risk.

Financial Risk

The use of debt financing (referred to as financial leverage) magnifies the business risk. **Financial risk** increases as the amount of debt on a real estate investment is increased. The degree of financial risk also depends on the cost and structure of the debt. For example, a loan that gives the lender a participation in any appreciation in the value of the property in exchange for lower monthly payments may have less financial risk. Chapter 12 provided a discussion of financial leverage and the use of different types of loans such as participation loans. We will explore financial risk further later in this chapter.

Liquidity Risk

This risk occurs when a continuous market with many buyers and sellers and frequent transactions is not available. The more difficult an investment is to liquidate, the greater the risk that a price concession may have to be given to a buyer, should the seller have to dispose of the investment quickly. Real estate has a relatively high degree of **liquidity risk.** It can take from six months to a year or more to sell real estate income properties, especially during periods of weak demand for investment real estate such as occurred during the early 1990s. Special-purpose properties tend to have much more liquidity risk than properties that can easily be adapted to alternative uses.

Inflation Risk

Unexpected inflation can reduce an investor's rate of return if the income from the investment does not increase sufficiently to offset the impact of inflation, thereby reducing the real value of the investment. Some investments are more favorably or adversely affected by inflation than others. Despite **inflation risk,** real estate has historically done well during periods of inflation. This might be attributed to the use of leases that allow the *NOI* to adjust with unexpected changes in inflation. Furthermore, the replacement cost of real estate tends to increase with inflation. During periods of high vacancy rates, however, when the demand for space is weak and new construction is not feasible, the income from real estate does not tend to increase with unexpected inflation.

Management Risk

Most real estate investments require management to keep the space leased and maintained to preserve the value of the investment. The rate of return that the investor earns can depend on the competency of the management, known as **management risk.** This risk is based on the capability of management and its ability to innovate, respond to competitive conditions, and operate the business activity efficiently. Some properties require a higher level of management expertise than others. For example, regional malls require continuous marketing of the mall and leasing of space to keep a viable mix of tenants that draws customers to the mall.

Interest Rate Risk

Changes in interest rates will affect the price of all securities and investments. Depending on the relative maturity (short-term vs long-term investments), however, some investment prices will respond more than others, thereby increasing the potential for loss or gain, that is, the **interest rate risk.** Real estate tends to be highly leveraged, and thus the rate of return earned by equity investors can be affected by changes in interest rates. Even if an existing investor has a fixed-rate mortgage or no mortgage, an increase in the level of

interest rates may lower the price that a subsequent buyer is willing to pay. Furthermore, yield rates that investors require for real estate tend to move with the overall level of interest rates in the economy.

Legislative Risk

Real estate is subject to numerous regulations such as tax laws, rent control, zoning, and other restrictions imposed by government. **Legislative risk** results from the fact that changes in regulations can adversely affect the profitability of the investment. Some state and local governments have more restrictive legislation than others—especially for new development.

Environmental Risk

The value of real estate is often affected by changes in its environment or sudden awareness that the existing environment is potentially hazardous. For example, while it used to be common to use asbestos to insulate buildings, asbestos in buildings is now perceived as a potential health hazard. A property may also become contaminated by toxic waste that has been spilled or previously buried on the site or an adjacent site. **Environmental risk** can cause more of a loss than the other risks mentioned because the investor can be subject to cleanup costs that far exceed the value of the property.

In the final analysis, a prospective investor in a specific real estate project must estimate and compute an expected return on the project and compare that return with expected returns on other *specific* real estate investments as well as all other investments. Any risk differentials must be carefully considered relative to any risk premium, or difference in expected returns, in all such comparisons. Investors must then make the final judgment as to whether an investment is justified.

Due Diligence in Real Estate Investment Risk Analysis

The term **due diligence** is used in the real estate investment community to describe the investigation that an investor should undertake when considering the acquisition of a property.[3] Although this process should be followed by any investor, it is particularly important when a firm is making investments on behalf of other investors. Essentially, due diligence is the process of discovering information needed to assess whether or not investment risk is suitable given a set of investment objectives. Exhibit 13–2 provides a general checklist of the areas that should be investigated along with some commentary regarding the importance of each. In most cases, a prospective investor will insist that any risks discovered in the due diligence process must be remedied by the current property owner as a condition of sale.

Sensitivity Analysis

We have discussed various types of risk that must be considered when evaluating different investment alternatives. Unfortunately, it is not easy to *measure* the riskiness of an investment. We will learn that there are different ways of measuring risk, depending on the degree and manner in which the analyst attempts to quantify the risk.

The performance of some properties will be more sensitive to unexpected changes in market conditions than that of other properties. For example, the effect of unexpected inflation on the net operating income for a property is affected by lease provisions such as expense stops and CPI adjustments. A property that is located in an area that has limited land available for new development is likely to be less sensitive to the risk that vacancy rates will increase as a result of overbuilding.

[3] The term is also used to describe investigations that should be undertaken in corporate mergers, formation of partnerships, and so on.

EXHIBIT 13–2 Sample Due Diligence Checklist

Areas of Review	Commentary
1. Rent roll analysis	Review to determine whether rent information and the payment history of tenants provided by the property owner are accurate and to discover whether there are any disagreements between tenants and landlord (e.g., withholding of rent) that may result in a future confrontation with tenants. Tenant creditworthiness and rent arrearages as well as bankruptcies are also important.
2. Lease agreement review Renewal option rights Expansion option rights First refusal rights Permitted uses Restrictive uses Tenant improvements Commissions Parking Signage	Review to determine the contents of leases as well as options that tenants possess and the responsibility and calculation of expenses. This may affect future expansion commitments relative to rents, expenses, expansions, and so on. Also, commitments made to tenants by the current owner regarding parking, future improvements, payment of commissions, rights to sublet, and to erect signs, and so on should be determined. Discover and review any amendments to existing leases.
3. Review of service and maintenance agreements Landscape, janitorial, trash removal, elevator, security, building systems, certificates of occupancy, mechanical, fire inspection, and so on	Review to establish the frequency and extent of any problems with building equipment and the steps taken to remedy/repair/replace by the owner. Chronic problems in this area could indicate future major expenses, problems obtaining insurance coverage, and so on. All equipment warranties should also be reviewed.
4. Pending or threatened matters review	Review to determine if there are any condemnation proceedings, tax suits, regulatory suits, governmental litigation, or private lawsuits that may affect the property.
5. Review of title/deed documents to determine: Nature and extent of easements Deed restrictions Quality of title Existence of liens • Financing liens • Mechanics' liens • Tax liens • Judgment liens	Examine title and deed documents to reveal any easements granted to other parties that could benefit or detract from the value of the property. This examination should also reveal any liens that may exist because of unpaid taxes, disputes over payments due to suppliers and contractors, and the existence of civil judgments against the current property owner.
6. Property survey Boundary lines Location of buildings, structures, and other improvements	Review to determine if any encroachments exist and if physical improvements are properly located on the site, or if they are in violation of any legal boundaries or site restrictions, including rights of way, setback requirements, and so on. This review should also address issues regarding the location of all rights of way, driveways, walkways, curbcuts, utility lines, streams, rivers, and ditches and the location of any setback lines and of all roads, streets, and highways bordering the property, showing access to and from these.
7. Government compliance Compliance with current zoning ordinances, permitted uses/grandfather provisions, including: • Parking ratios • Setback lines • Height limitations	Review to determine whether, the current and intended use of the property is allowed under zoning. Also, review to determine whether any grandfather provisions currently apply. Environmental concerns may include a number of issues, including the existence of toxic wastes, destruction of wetlands, trees, endangered species, and so on and whether a property lies in a designated special flood hazard area or the 100-year flood plain. This review is usually performed by an environmental engineering firm and requires an opinion letter.

(*continued*)

EXHIBIT 13–2 Sample Due Diligence Checklist (Concluded)

Areas of Review	Commentary
• Density limitations (*a*) Number of units (*b*) Floor area ratios • Environmental regulations: toxic waste/air quality	
8. **Physical inspection** Management files on repairs, maintenance, and warranties	Perform survey to determine the physical condition of the structure and if defects exist, whether needed repairs are covered by warranties. A report should be prepared assessing the existence of "as built" plans and specifications, the condition of building systems, structures, utilities, foundation, walls, and adequacy and availability of utilities. The presence of communication devices, such as satellite dishes, any variances from "as built" plans and specifications, and the existence of defects should be noted. This review should also indicate compliance with ADA (Americans with Disabilities Act) regulations.
9. **Tax matters** Property taxes • Assessed value • Special assessments • Payment history	Review to determine whether payment of all taxes and assessments is current as well as to discover any abatements or the existence of special local tax districts, and so on.
10. **Insurance policies** 11. **Engineering studies** 12. **Market studies** 13. **List of personal property**	These reviews include the insurance claims history and any denial of insurance to the current property owner. The investor has a right to ask for any reports commissioned by the current property owner, such as market studies, engineering studies, and so on that may be relevant to the transaction. The investor may request a list of personal property that may be conveyed with the real property in order to avoid disputes.

One of the most straightforward ways of analyzing risk is to perform a **sensitivity analysis,** or a what-if analysis, of the property. This involves changing one or more of the key assumptions for which there is uncertainty to see how sensitive the investment performance of the property is to changes in that assumption. Assumptions that are typically examined in a sensitivity analysis include the expected market rental rate, vacancy rates, operating expenses, and the expected resale price.

A sensitivity analysis starts with a *base case,* that is, a set of assumptions to be analyzed that will provide a frame of reference for the sensitivity analysis. This set of assumptions usually represents the analyst's best estimate of the most likely situation.[4]

Once the base case set of assumptions has been identified, the analyst computes the *IRR, NPV,* and other measures of investment performance using this base set of assumptions. Then, the analyst varies the assumptions one or more at a time to see how each change affects the results. Usually the approach to changing assumptions is (1) to change a single assumption at a time or (2) to identify several scenarios in which more than one variable changes within a particular scenario.

Change a Single Assumption at a Time

The advantage of this approach is that it allows the analyst to isolate the impact of a specific input assumption. For example, in the office building analyzed in Chapter 11, we estimated

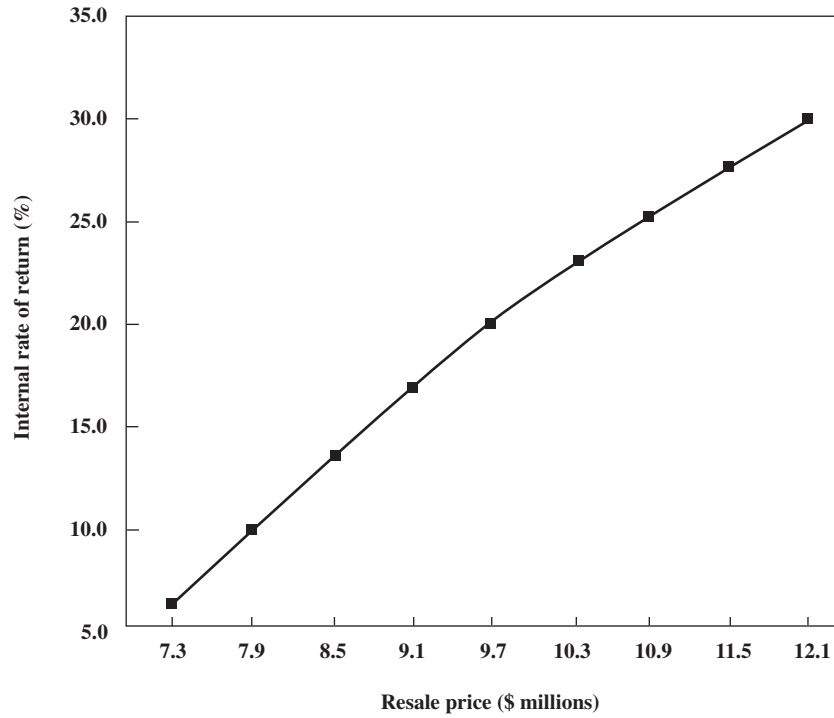
[4] In a statistical sense, the "most likely" case would be the one with the highest probability of occurrence. We will consider probabilities in more detail in a later section.

EXHIBIT 13–3
Sensitivity Analysis

Resale Price	Annual Change*	*BTIRR*
$ 7,300,000	−3.00%	6.69%
7,900,000	−1.45	10.74
8,500,000	0.00	14.23
9,100,000	1.37	17.32
9,700,000	2.68	20.08
10,300,000	3.92	22.60
10,900,000	5.10	24.91
11,500,000	6.23	27.05
12,100,000	7.32	29.05

*Compound annual rate of change from the purchase price of $8.5 million.

EXHIBIT 13–4
Monument Office Building Example: Sensitivity of *IRR* to Resale Price



the *IRR* to be 20.08 percent under a specific set of assumptions that might be considered a base case. Included in these assumptions was an estimate that the property would sell for $9.7 million after five years. What if the property sells for more or less than this? How would a change in sale price affect the *IRR?* Exhibit 13–3 shows the *IRR* for a range of possible resale prices. This chart shows how sensitive the *IRR* is to a change in the resale price. Exhibit 13–4 graphs the results.

Scenarios

An alternative to changing a single variable at a time is to identify different **scenarios.** The base case assumptions might be viewed as a most likely scenario. Similarly, one could conceive of a pessimistic scenario in which the assumptions reflect a situation where things do not go as well as the most likely scenario. For example, vacancy might be higher, which in turn might mean that future market rents are lower and the resale price is lower. Scenario analysis allows the analyst to see how much investment performance is affected

by a combination of negative or worst-case assumptions. Likewise, a set of optimistic assumptions could be identified to indicate how well the investment would perform if everything were to go well. We will illustrate the use of scenarios later in this chapter.

Partitioning the IRR

We have given a considerable amount of attention to the development of the internal rate of return on equity invested in real estate projects. While this measure of return is useful in helping the investor decide whether or not to invest in a project, it is helpful to "partition" that rate of return to obtain some idea as to the relative weights of the components of the return and some idea as to the timing of the receipt of the largest portion of that return.

To illustrate what we mean by **partitioning the *IRR*,** recall that the internal rate of return on equity investment in real estate comprises two sources of cash flow: (1) cash flow from operations and (2) cash flow from the sale of the investment.

In Exhibit 13–5, we present the cash flow from operating the property ($BTCF_o$) and the cash flow from sale of the property ($BTCF_s$) for the office building example discussed in Chapter 11. Recall that the internal rate of return on equity for a five-year holding period was 20.08 percent. However, because both of the above-mentioned sources of cash flow make up the 20.08 percent internal rate of return, we have no way of knowing what proportion *each component bears to the total return.* A breakdown of each component would be useful to an investor concerned with how much of the return is made up of the cash flow from *operations* realized from the project and how much is due to proceeds from the *sale* of the property.

To consider these problems, it is a simple matter to reconsider the present value of the $BTCF_o$ and $BTCF_s$ in a slightly different manner, as shown in Exhibit 13–5. We should note that all cash flow components the investor expects to receive from the project are discounted to find the internal rate of return of 20.08 percent. Then, the *PV* of $BTCF_o$ and $BTCF_s$ are summed to get the total *PV* of $2,550,000 (rounded). The ratio of the *PV* of $BTCF_o$ and *PV* of $BTCF_s$ can now be taken to the total present value. These ratios now represent the respective proportion of the internal rate of return made up by cash flow (30%) and cash flow from appreciation and sale after five years (70%).

EXHIBIT 13–5
Partitioning the *IRR*—Monument Office Building

PV of $BTCF_o$: Year	Cash Flow	*IFPV*	Present Value
1	$ 233,725	0.832778	$ 194,641
2	259,542	0.693519	179,998
3	285,121	0.577548	164,671
4	286,054	0.480969	137,583
5	319,925	0.400541	128,143
Total			$ 805,035
***PV* of $BTCF_s$:**			
5	$4,356,755	0.400541	$ 1,745,057
PV of $BTCF_o'$		$ 805,035	
PV of $BTCF_s'$		1,745,057	
Total *PV*		$2,550,093	(rounded to $2,550,000)
Ratio of:			
PV, $BTCF_o$ to Total *PV* = 31.6%			
PV, $BTCF_s$ to Total *PV* = 68.4%			

Why is partitioning an internal rate of return important? Because it helps the investor to determine how much of the return depends on annual operating cash flow and how much depends on the projected cash flow from resale. Generally, more certainty is associated with projecting cash flows that will occur during the operating years of the investment—especially when they are partially determined by existing leases. The resale price depends on expected cash flows that will occur beyond the current holding period. Thus, it would seem that the greater a proportion of the internal rate of return is made up of *expected appreciation in the future,* the greater the risk facing the investor. For example, the investment return for the office building example in Chapter 11 is 20.08 percent. This is made up of about 30 percent annual $BTCF_o$, and 70 percent $BTCF_s$. A second project might also require an investment of $2,550,000 and provide the investor with the same *IRR* of 20.08 percent. When the *IRR* is partitioned, however, we may find that the proportions of the return are much different—suppose 3 percent from annual $BTCF_o$ and 97 percent from $BTCF_s$. Hence, even though both investments have a 20.08 percent *IRR,* a much higher proportion of the return in the second case depends on future appreciation in property value.[5] Given this outcome, the investor may want to compare any differences in risk between projects more carefully because even though the two projects are estimated to yield the same *IRR,* the likelihood of significant risk differences between the two is strong.

Variation in Returns and Risk

Many of the sources of risk discussed in the chapter, such as business risk, financial risk, and so on, affect returns on real estate investment by making such returns more *variable.* Generally speaking, the higher the variability in returns, the greater the risk in a project. For example, consider the office building that we have been analyzing. Assume that we are considering two additional properties for investment, a hotel and an apartment building.

To illustrate, Exhibit 13–6 contains an estimate of the internal rate of return over a five-year investment period for the three properties under three different economic scenarios. Essentially, Exhibit 13–6 shows estimates of the *IRR* for all three investments under three general economic scenarios that could occur over the investment period.[6] That is, the investor would estimate rents and expenses for the three investment alternatives under three assumptions regarding economic conditions. Then, given the debt-service effects (and perhaps the tax effects) appropriate for each investment, the cash flow would be projected, as well as an estimate of the property value at the end of the investment period.

After computing the *IRR* under each case, the investor could then estimate the probability that each of the economic scenarios that affect the income-producing potential for each alternative will occur. The estimated *IRR,* when multiplied by the probability that a given economic scenario will occur, produces the expected return for each investment.

Based on the results in Exhibit 13–6, we see that the hotel property produces the highest expected return, 20 percent, compared to the 18.52 percent expected return for the office building and the 15 percent expected return for the apartment building. Does this mean that the hotel property should be selected over the office building and the apartment building? Not necessarily. At this point, the reader should recall our discussion of risk characteristics in the chapter and how each investment may be affected by those considerations. A property that provides a high expected return may also be riskier relative to investments with somewhat lower returns.

[5] Be aware that it is possible to have negative *BTCF* and still have a *positive IRR.* Hence, it is important to take the operating cash flows into account in addition to the *IRR.*

[6] The information in Exhibit 13–3 was used to select the rates of return for the office building. The pessimistic scenario assumes that the building is sold for $7.3 million and the optimistic scenario assumes that it is sold for $12.1 million.

EXHIBIT 13–6
Return and Risk (Office, Apartment, and Hotel Properties)

www.mhhe.com/bf15e

Office Building

	Return (R)	Probability (P)	$R \times P$	R − Expected Return	$P \times (R$ − Expected Return)^2
Pessimistic	6.17%	25.00%	1.54%	−12.35%	0.3812%
Most likely	19.64	50.00	9.82	1.12	0.0062
Optimistic	28.64	25.00	7.16	10.12	0.2559
Σ Expected return			18.52%	Variance	0.6434%
				Std. Dev.	8.02%

Apartment Building

	Return (R)	Probability (P)	$R \times P$	R − Expected Return	$P \times (R$ − Expected Return)^2
Pessimistic	10.00%	25.00%	2.50%	−5.00%	0.0625%
Most likely	15.00	50.00	7.50	0.00	0.0000
Optimistic	20.00	25.00	5.00	5.00	0.0625
Σ Expected return			15.00%	Variance	0.1250%
				Std. Dev.	3.54%

Hotel

	Return (R)	Probability (P)	$R \times P$	R − Expected Return	$P \times (R$ − Expected Return)^2
Pessimistic	5.00%	25.00%	1.25%	−15.00%	0.5625%
Most likely	20.00	50.00	10.00	0.00	0.0000
Optimistic	35.00	25.00	8.75	15.00	0.5625
Σ Expected return			20.00%	Variance	1.1250%
				Std. Dev.	10.61%

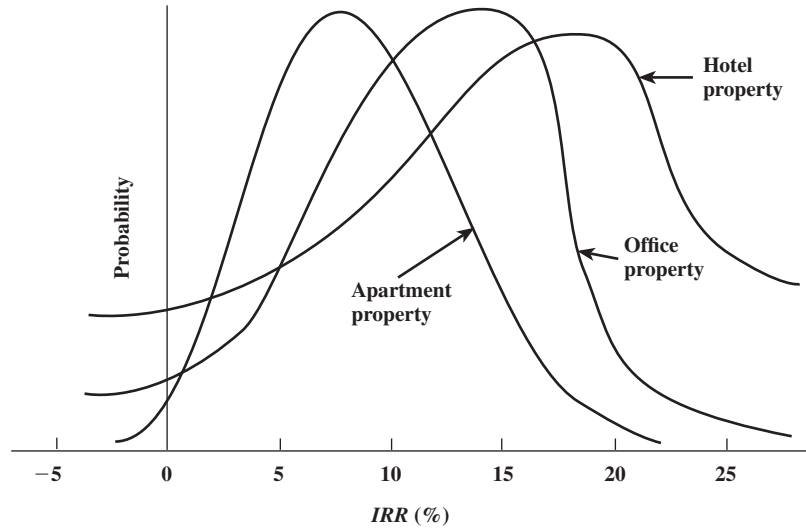
Summary

Property	Expected Return	Risk
Office	18.52%	8.02%
Apartment	15.00	3.54
Hotel	20.00	10.61

In dealing with the problem of comparing risk and return among investments, analysts can use some techniques to complement the qualitative considerations we have discussed. We now turn to a more quantitative discussion of the treatment of projected risk.

In trying to deal with all risk characteristics particular to an investment, some researchers and market analysts argue that in combination these risks (e.g., business risk, financial risk, and the other risks discussed in the chapter) serve to induce *variability in a project's rate of return.* In our above example, the hotel project is riskier than the office or apartment properties, and, in fact, if you closely examine the estimates of *IRR* under each economic scenario, you encounter a much *wider range* in possible *IRR*s with the hotel property compared to the other properties. In fact, if we diagramed the relationship between the probability of the possible economic states of nature and the expected *IRR* for each economic state of nature, we would have a pattern such as that shown in Exhibit 13–7. In that exhibit, we have plotted the probability of the state of the economy and expected *IRR* on each investment, given the state of the economy. We have "smoothed" the curves in the diagram between each probability point to show what the *IRR* would most likely be at points between those specifically estimated. The key concept to grasp from the exhibit is that even though the expected return for the hotel property is higher than that computed for the office building,

EXHIBIT 13–7
Probability Distribution of *IRR*s (Office, Apartment, and Hotel Properties)



the range of expected returns for the hotel property is far greater than that for the office building. The narrowness in the range of outcomes for the office building relative to the outcomes for the hotel property indicates that there is *lower variability* in expected returns for the office building than for the hotel property. Many analysts consider *lower variability* in returns to be associated with *lower risk,* and vice versa. Therefore, by using a statistical measure of *variance,* the investor has an indication of the extent of the risk in an investment.

Measures of Variance and Risk

Computing the statistical variance in returns is a very simple procedure, as Exhibit 13–6 shows for the three properties. The *standard deviation about the mean return* for the hotel property is 10.61 percent, which is *greater* than that for the office building, which is only 8.02 percent, or for the apartment, which is 3.54 percent. This measure of *dispersion* tells us that the actual return for the apartment building is *more likely* to be *closer* to its expected return of 15.0 percent when compared to the hotel property or the office building. Because the standard deviation for the hotel property is 10.61 percent, the actual return for the hotel property is *less likely* to be closer to its expected return of 20 percent when compared to the office building or apartment property. Hence, if variation in returns is a good indicator of risk, then the hotel is clearly the riskiest of the three investments.

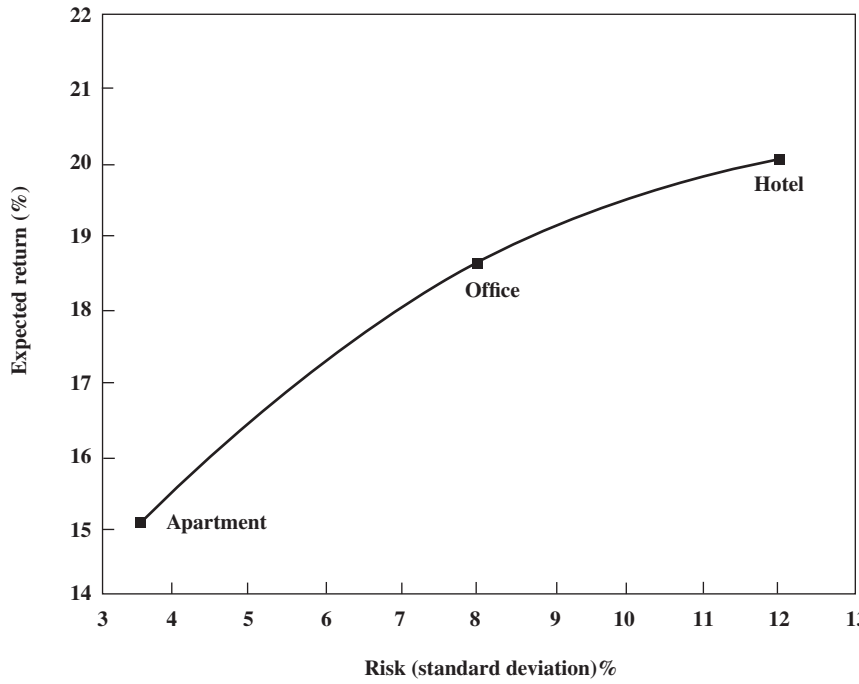
If the probability distribution of *IRR*s for the two investments being considered is normal, the standard deviation of returns for each investment also gives us valuable information. The standard deviation gives us a specific range within which we can expect the actual return for each investment to fall in relation to its expected return. For example, for the hotel property, 68 percent of the time we can expect its *actual* return to fall within + or − one standard deviation of its expected return of 20 percent. This means that 68 percent of the time we can expect the return on the hotel property to fall between 9.39 percent and 30.61 percent. We can expect its actual return to fall within + or − two standard deviations from its expected return approximately 95.5 percent of the time and + or − three standard deviations from its expected return approximately 99.7 percent of the time. In contrast, the actual return on the apartment building will fall in a much more narrow range of + or − one standard deviation from its expected return, or 15 percent + 3.54 percent = 18.54 percent and 15 percent − 3.54 percent = 11.46 percent, about 68 percent of the time, and so on.

Risk and Return

The relevance of these statistical measures, in addition to giving the investor a more quantitative perspective on dispersion and variance as proxies for risk, can also be related to the *IRR* in developing a measure of risk per unit of expected return. To do so for the investments, divide the standard deviation of the *IRR*s by the expected mean *IRR*. For the office building, this computation would be 8.02 ÷ 18.52, or .433; for the hotel property, it would be 10.61 ÷ 20.0, or .5305; and for the apartment it would be 3.54 ÷ 15, or .236. This statistic, called the *coefficient of variation,* is a measure of relative variation; that is, it measures *risk per unit of expected return.* In the case of the hotel property, the coefficient of variation is higher than that of the office building. The apartment has the lowest coefficient of variation. This suggests that return per unit of risk for the apartment building is not as high as it is for the office building and hotel. This comparison does not necessarily mean that the investor will decide not to accept the additional risk in exchange for the additional return; it depends on the investor's attitude toward risk. All investors are assumed to be *risk averse,* which means that they require a higher expected return as compensation for incurring additional risk. We cannot say, however, how much that return should be for a particular investor. If the returns for each of the three properties we have analyzed are based on market prices for each property, then the trade-off between risk and return reflects the price of risk in the market, which implies that investors would purchase each of the above properties based on their risk and return characteristics.

In Exhibit 13–8, we plot the expected return versus the risk (standard deviation) for each of the three properties. This exhibit is similar to Exhibit 13–1, which showed the risk and return trade-off for all assets. In fact, the part of the curve represented by Exhibit 13–8 can be thought of as a small slice from the portion of Exhibit 13–1 that passes through real estate as an asset class.

EXHIBIT 13–8
Risk versus Return



Portfolio Considerations

We have not considered the possibility of reducing risk (variance) by combining investments into a *portfolio*. By developing a portfolio of *different* investment properties, and also including stocks and bonds, the investor can significantly reduce risk through *diversification.* For example, economic events that result in the pessimistic scenario for the hotel property do not necessarily affect the apartment or office properties, and vice versa. Hence, the returns for the three properties may not be perfectly correlated. Diversifying among the three investment types rather than choosing only one can reduce the overall risk of the portfolio. Diversification lowers the variance of total returns from all investments in a portfolio because high and low returns tend to offset one another when combined, resulting in less variation about an expected mean return for the entire investment portfolio. In the context of Exhibit 13–8, then, the portfolio would have an expected return and variance that is to the left of the curve in the exhibit, in other words, less risk for the same expected rate of return. Chapter 22 discusses the role of diversification in reducing risk.

Retail Case Study—Westgate Shopping Center

Westgate Shopping Center is a neighborhood strip center that is 100,000 square feet. An investor is considering purchasing the property. He would hold the property for five years and expects to sell it based on a terminal cap rate of 10.5 percent applied to end-of-year-6 *NOI.* Selling costs would be 3 percent of the sale price. He hopes to get an 11 percent rate of return (before tax, unleveraged) over the five years.

Inflation over the next five years is expected to be 3 percent per year. In general, vacancy for similar shopping centers is about 5 percent, with credit loss an additional 1 percent. Although none of the existing tenants are expected to leave before the end of their lease, a 5 percent "general" vacancy rate will be assumed to allow for the possibility of losing a tenant before their lease expires.

Expenses for the center are projected as follows:

Real estate taxes are $40,000 the first year—increasing 2.5 percent per year.

Insurance is $.18 per square foot—increasing 3 percent per year.

Common area maintenance[7] is $.75 per square foot—increasing 3 percent per year.

Management fee will be 6 percent of effective gross income.

There are currently three tenants.

The first tenant is a drug store leasing 25,000 square feet. It has five years remaining on its lease. Its base rent is $12 per square foot and it will pay expense recoveries for real estate taxes, insurance, and common area maintenance on a net basis. At the expiration of its lease, the space is projected to be re-leased based on market rents at that time. Market rents are currently $12 per square foot and are projected to increase by 3 percent per year until the lease is renewed. The new lease is projected to have a five-year term with no expense recoveries.

The second tenant is a food store leasing 60,000 square feet. Its lease has 13 years remaining. Its base rent is $8.50 per square foot and it will pay expense recoveries for real estate taxes, insurance, and common area maintenance on a net basis. At the expiration of its lease the space is projected to be re-leased based on market rents at that time. Market rents are currently $9 per square foot and are projected to increase by 3 percent

[7] These are charges to maintain public areas such as walkways and parking.

per year until the lease is renewed. The new lease is projected to have a 10-year term with no expense recoveries.

The third tenant is a restaurant leasing 5,000 square feet. It has three years remaining on its lease. Its base rent is $15 per square foot and it will pay expense recoveries for real estate taxes, insurance, and common area maintenance on a net basis. This tenant also pays **percentage rent** based on its retail sales volume. It pays an **overage** percentage of 5 percent of retail sales in excess of $225 per square foot **breakpoint** sales volume. Its sales are currently $250 per square foot. At the expiration of its lease, the space is projected to be re-leased based on market rents at that time. Market rents are currently $16 per square foot for in-line space and are projected to increase by 3 percent per year until the lease is renewed. The new lease is projected to have a three-year term with no expense recoveries. In-line tenants would expect to receive tenant improvements,[8] which are currently $5 per square foot but are expected to increase 3 percent per year. Leasing commissions will be 4 percent per year of the base rent for the lease.[9]

There is also 10,000 square feet of vacant in-line space in the shopping center. It is projected that this space will be leased to two additional tenants. The first lease is expected to be signed this year, and the second, one year later. Each will be a three-year lease. Current market rents for in-line space are $16 per square foot. Leasing costs are 5 percent of the rent collected. Tenant improvement costs for the new tenants are expected to be $10 per square foot and the tenants will have expense recoveries on a net basis for real estate taxes, insurance, and common area maintenance. It is assumed that when these leases are renewed after three years they will be typical leases for in-line space. Exhibit 13–9 summarizes the key tenant assumptions.

Exhibit 13–10A shows the projected cash flow from operations. Rental income from existing leases, as well as market rent from lease renewals, is projected for each tenant. Total income also includes expense recoveries and overage rent for the restaurant. Income from lease up of

EXHIBIT 13–9
Westgate Shopping Center: Key Tenant Assumptions

Inputs	Tenant 1	Tenant 2	Tenant 3
Name	Drug Store	Food Store	Restaurant
Tenant size	25,000	60,000	5,000
Rent/sq. ft.	$12.00	$8.50	$15.00
Original lease term (years)	10	15	3
Market rent	$12.00	$9.00	$16.00
Market rent increase	3.00%	3.00%	3.00%
Sales volume/sq. ft.			$250.00
Sales annual change			3.00%
Breakpoint/sq. ft.			$225.00
Overage %			5.00%
Lease renewal term (years)	5	10	3
Lease renewal tenant improvement	$0.00	$0.00	$5.00
Lease renewal commissions	0.00%	0.00%	4.00%
Tenant improvement inflation	0.00%	0.00%	3.00%

[8] Recall that the leasing of a space to a new tenant often requires fixing up or "up fitting" the interior space to suit the tenant's need. Frequently, the landlord sets a standard base amount for up fit, and if the tenant exceeds the allowance, either the rent is increased or the tenant pays the overage amount directly to the building owner.

[9] Generally, the leasing of a space to a new tenant requires the payment of leasing commissions to an outside broker or to a leasing agent in the owner's firm. There are multiple options as to how the actual commission is calculated and paid. The typical method used is to multiply the first-year rent times a leasing commission percentage times the lease term.

vacant space is also included. Tenant improvements (TI) and leasing commissions also have to be paid for lease up of the vacant space and renewal of the restaurant lease (in-line space).

Exhibit 13–10B shows the projected cash flow from resale, and Exhibit 13–11 shows the unleveraged *IRR,* which is 10.48 percent.

Using the 10.48 percent *IRR* as a discount rate, we can partition the *IRR,* as shown in Exhibit 13–12. Based on this exhibit, we see that about 38 percent of the *IRR* is from cash flow from operations and about 62 percent is from the cash flow from resale.

EXHIBIT 13–10A **Westgate Shopping Center—Projected Cash Flow from Operations**

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Year	1	2	3	4	5	6
Rental income:						
Drug store rent	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 0
Drug store market rent*	0	0	0	0	0	347,782
Drug store recoveries	33,250	34,198	35,172	36,175	37,206	0
Food store rent	510,000	510,000	510,000	510,000	510,000	510,000
Food store market rent	0	0	0	0	0	0
Food store recoveries	79,800	82,074	84,413	86,820	89,295	91,841
Restaurant rent	75,000	75,000	0	0	0	0
Restaurant market rent	0	0	84,872	87,418	90,041	92,742
Restaurant recoveries	6,650	6,840	0	0	0	0
Restaurant overage rent	6,250	8,125	0	0	0	0
Vacant space 1 rent	80,000	80,000	80,000	0	0	0
Vacant space 1 renewal rent	0	0	0	87,418	90,041	92,742
Vacant space 1 recoveries	6,650	6,840	7,034	0	0	0
Vacant space 2 rent	80,000	80,000	80,000	80,000	0	0
Vacant space 2 renewal rent	0	0	0	0	90,041	92,742
Vacant space 2 recoveries	0	6,840	7,034	7,235	0	0
Total income	$1,177,600	$1,189,915	$1,188,526	$1,195,066	$1,206,623	$1,227,849
Vacant space vacancy	80,000	0	0	0	0	0
General vacancy	58,880	59,496	59,426	59,753	60,331	61,392
Effective gross income	$1,038,720	$1,130,419	$1,129,100	$1,135,312	$1,146,292	$1,166,457
Management fee	62,323	67,825	67,746	68,119	68,778	69,987
Property tax	40,000	41,000	42,025	43,076	44,153	45,256
Insurance	18,000	18,540	19,096	19,669	20,259	20,867
CAM	75,000	77,250	79,568	81,955	84,413	86,946
Total expenses	195,323	204,615	208,435	212,818	217,602	223,056
NOI	$ 843,397	$ 925,804	$ 920,665	$ 922,494	$ 928,690	$ 943,401
Vacant space TIs	$ 50,000	$ 50,000	$ 0	$ 0	$ 0	
In-line space TIs	0	0	26,523	27,318	28,138	
Total TIs	$ 50,000	$ 50,000	$ 26,523	$ 27,318	$ 28,138	
Vacant space leasing commissions	$ 12,000	$ 12,000	$ 0	$ 0	$ 0	
In-line space leasing commissions	0	0	10,185	10,490	10,805	
Total leasing commissions	$ 12,000	$ 12,000	$ 10,185	$ 10,490	$ 10,805	
Cash flow from operations	$ 781,397	$ 863,804	$ 883,958	$ 884,686	$ 889,747	

*Market rent is from lease renewals.

EXHIBIT 13–10B
Westgate Shopping Center—Cash Flow from Resale

Cash flow from resale	
Resale	$8,984,768
Selling cost	$269,543
Net resale	$8,715,225

EXHIBIT 13–11
Westgate Shopping Center—Calculation of *IRR*

Year	0	1	2	3	4	5
Total cash flow:						
Cash flow	($8,500,000)	$781,397	$863,804	$883,958	$884,686	$9,604,972
IRR	10.48%					

EXHIBIT 13–12
Westgate Shopping Center—Partitioning the *IRR*

Partitioning the *IRR:*		
Using *IRR* as a discount rate:		
PV of cash flow from operation	$3,204,921	37.70%
PV of cash flow from resale	5,295,079	62.30
Total *PV*	$8,500,000	100.00%

Westgate Shopping Center Scenario Analysis

www.mhhe.com/bf15e

The investor also would like to know what his rate of return would be under a "pessimistic" scenario as follows:

- Market rents do not increase for the lease renewals of the existing tenants.
- Retail sales do not increase for the restaurant.
- The general vacancy rate is 10 percent instead of 5 percent to allow for the possibility of one tenant's defaulting on the lease.

Note that this will also result in a lower resale price because the year 6 *NOI* that is capitalized is lower.

Exhibit 13–13 shows the results. The *IRR* has dropped from 10.48 percent to 7.33 percent.

Lease Rollover Risk

In the previous chapters and in the Westgate Shopping Center example in this chapter, we made assumptions about what rate either the existing tenant or a new tenant would pay when the current lease expired. For simplicity, we assumed that what would happen at lease renewal was known with certainty.

In practice, there is uncertainty as to whether the existing tenants will renew their lease. Some may renew, while others may vacate. The difference can be significant. If the existing tenant renews the lease, then there will be no additional vacancy due to the tenant's leaving, and the owner may not have to pay any tenant improvements to get the tenant to renew (because the space already meets the tenant's needs). Also, if there is any commission paid to a broker for the lease renewal, it is often a lower rate than that which would have to be paid to find a new tenant. On the other hand, the owner may be willing, in order to avoid these additional costs and vacancy, to provide a discount from current market rents to get an existing tenant to renew the lease.

If the existing tenant does not renew the lease, there will often be some vacancy for several months until a new tenant is found to lease the space. Furthermore, the new tenant is likely to require money for tenant improvements as part of the deal, and commissions may have to be paid to a leasing agent.

EXHIBIT 13–13 Westgate Shopping Center—Pessimistic Scenario

Year	1	2	3	4	5	6
Rental income:						
Drug store rent	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 0
Drug store renewal rent	0	0	0	0	0	300,000
Drug store recoveries	33,250	34,198	35,172	36,175	37,206	0
Food store rent	510,000	510,000	510,000	510,000	510,000	510,000
Food store renewal rent	0	0	0	0	0	0
Food store recoveries	79,800	82,074	84,413	86,820	89,295	91,841
Restaurant rent	75,000	75,000	0	0	0	0
Restaurant renewal rent	0	0	80,000	80,000	80,000	80,000
Restaurant recoveries	6,650	6,840	0	0	0	0
Restaurant overage rent	6,250	6,250	0	0	0	0
Vacant space 1 rent	80,000	80,000	80,000	0	0	0
Vacant space 1 renewal rent	0	0	0	80,000	80,000	80,000
Vacant space 1 recoveries	6,650	6,840	7,034	0	0	0
Vacant space 2 rent	80,000	80,000	80,000	80,000	0	0
Vacant space 2 renewal rent	0	0	0	0	80,000	80,000
Vacant space 2 recoveries	0	6,840	7,034	7,235	0	0
Total income	$1,177,600	$1,188,040	$1,183,654	$1,180,229	$1,176,501	$1,141,841
Vacant space vacancy	80,000	0	0	0	0	0
General vacancy	117,760	118,804	118,365	118,023	117,650	114,184
Effective gross income	$ 979,840	$1,069,236	$1,065,289	$1,062,206	$1,058,851	$1,027,657
Management fee	58,790	64,154	63,917	63,732	63,531	61,659
Property tax	40,000	41,000	42,025	43,076	44,153	45,256
Insurance	18,000	18,540	19,096	19,669	20,259	20,867
CAM	75,000	77,250	79,568	81,955	84,413	86,946
Total expenses	191,790	200,944	204,606	208,432	212,356	214,728
NOI	$ 788,050	$ 868,292	$ 860,683	$ 853,775	$ 846,495	$ 812,929
Vacant space TIs	$ 50,000	$ 50,000	$ 0	$ 0	$ 0	
In-line space TIs	0	0	26,523	27,318	28,138	
Total TIs	$ 50,000	$ 50,000	$ 26,523	$ 27,318	$ 28,138	
Vacant space leasing commissions	$ 12,000	$ 12,000	$ 0	$ 0	$ 0	
In-line space leasing commissions	0	0	9,600	9,600	9,600	
Total leasing commissions	$ 12,000	$ 12,000	$ 9,600	$ 9,600	$ 9,600	
Cash flow from operations	$ 726,050	$ 806,292	$ 824,560	$ 816,857	$ 808,757	
Cash flow from resale						
Resale					$7,742,180	
Selling cost					232,265	
Net resale					$7,509,915	

Year	0	1	2	3	4	5
Total cash flow						
Cash flow	($8,500,000)	$ 726,050	$ 806,292	$ 824,560	$ 816,857	$8,318,672
IRR	7.33%					

When we are projecting cash flows to perform a discounted cash flow analysis for investment analysis, as discussed in Chapter 11, or valuation of income properties, as discussed in Chapter 10, we need to make an assumption about what will happen when the existing lease expires. Because we do not know whether the existing tenant will renew or not, one way this issue is handled in practice is to make an assumption about the **renewal probability** at the end of existing leases. For example, if the renewal probability is 60 percent, this means that there is a 60 percent chance that the existing tenant will renew the lease and a 40 percent chance that a new tenant must be found.

Market Leasing Assumptions with Renewal Probabilities

Because most tenant leases will expire during the holding period used in a discounted cash flow analysis, some releasing forecast must be made as discussed above. Typically, this is handled by selecting a series of market base forecasts for the various types of spaces in a building. These forecasts are referred to as **market leasing assumptions.** The forecast could be as simplistic as those made in previous chapters, that is, that there is a 100 percent probability of renewal.

In more sophisticated analysis, the market leasing forecast typically includes different market rents for new versus renewal leases, renewal probabilities to reflect the likelihood that an existing tenant will sign a new lease, the number of months vacant until a new tenant is found if the existing tenant does not renew the lease, leasing commissions for new and renewal leases, and the amount of tenant improvements for new and renewal leases. There can be a single market leasing assumption that applies to the entire property or different market leasing assumptions for groups of leases or even for each individual lease.

Using only one market leasing assumption could satisfy a simple office building where all tenant spaces are similar. However, more complicated retail properties may require using multiple market leasing assumptions. For example, a community shopping center may require separate market leasing assumptions for large tenant spaces, medium-sized tenant spaces, and small spaces. It is unusual to have different assumptions for each lease, although a particular lease may have its own market leasing assumption if the analyst feels that it is unique or the analyst has a better idea of the likelihood of that tenant renewing or vacating at the end of the lease.

Market Rent

When a renewal probability is less than 100 percent and there is a difference between market rent for new and renewal tenants, the implied rent is the weighted average of the two. For example, suppose that the renewal probability is 60 percent and the market rent for a new tenant would be $18 but for a renewal tenant it would be $17. The implied new market rent when the lease is renewed would be

$$(.60 \times \$17) + (.40 \times \$18) = \$17.40$$

Months Vacant

Typically, when a lease expires and is not renewed, the building owner will suffer some downtime until a new tenant is found and therefore will experience vacancy for a period of time. This is sometimes referred to as **turnover vacancy.** When the renewal probability selected is 100 percent, the months of expected vacancy is zero. When a renewal probability is less than 100 percent, the implied **months vacant** is equal to (1 − renewal) times the months vacant entry. For example, if the renewal probability is 60 percent and the number of months vacant would be 10 if the tenant does not renew the lease, then this is equivalent to

$$10 \times (1 - .60) = 4 \text{ months vacant}$$

The number is typically rounded up to the nearest integer.

Leasing Commissions

As discussed earlier, the leasing commission rate may be lower for renewal tenants than new tenants. When a renewal probability is less than 100 percent and there is a difference between the leasing commission for new tenants and the leasing commission for renewal tenants, the implied rate is the weighted average of the two multiplied by the lease term. For example, if the renewal probability is 60 percent and the leasing commissions for new tenants and renewal tenants are 5 percent and 3 percent, respectively, then the implied leasing rate is

$$(.60 \times 3\%) + (.40 \times 5\%) = 3.80\%$$

Tenant Improvements

As discussed above, tenant improvement rates may differ for new and renewal leases. When a renewal probability is less than 100 percent and there is a difference between the tenant improvement for new leases and the tenant improvement for renewal leases, the implied rate is the weighted average of the two multiplied by the lease term. For example, if the renewal probability is 60 percent and the amount of tenant improvements would be $20 for a new tenant and $5 for a renewal tenant, then we have

$$(.60 \times \$5) + (.40 \times \$20) = \$11.00$$

Industrial Case Study—Worthington Distribution Center

Worthington Distribution Center is a 140,000-square-foot building that is currently being analyzed. It is assumed that it will be sold after five years based on a terminal capitalization rate of 9.75 percent applied to the year 6 *NOI.* Selling costs will be 5 percent of the resale price. The rate of inflation over the next five years is projected to be 3 percent per year. There are currently three tenants occupying the property.

An electrical supply company is leasing 50,000 square feet of space. It has three years remaining on its lease. It pays rent of $6 per square foot with no expense recoveries in the lease. It has already indicated that it may renew its lease at the end of the lease term at market rents.

The second tenant is a sign company that is leasing 42,500 square feet with two years remaining on its lease at a rent of $6.50, and there are no expense recoveries in the lease. This tenant is expected to vacate its space.

The third tenant is a computer distribution company leasing 47,500 square feet. It has four years remaining on its lease. Its rent is $5.75 with no expense recoveries. It is not certain at this time whether it will renew its lease or not. The renewal probability is estimated to be 70 percent.

The market rent is currently $7.00 per square foot for a new tenant and $6.50 per square foot for existing tenants who renew their lease. There would be no expense recoveries in either case. Market rents are projected to increase at the inflation rate of 3 percent from now until leases are renewed. The typical lease term for new leases (new or renewal) is five years. Tenant improvements would be $5 for new leases and $2 for renewal leases.

Leasing commissions would be 3 percent for either new or renewal tenants payable to the property manager. If a tenant does not renew the lease, the downtime is expected to be six months until a new tenant would start paying rent.

Expenses and capital expenditures associated with operating the property are projected as follows:

Real estate taxes of $23,000 the first year, increasing 2.5 percent per year.

Insurance of $.15 per square foot the first year, increasing 4 percent per year.

Common area maintenance charges of $.20 per square foot, increasing 3 percent per year.

Management fee of 5 percent of effective gross revenue paid to the property manager.

Roof repair of $45,000 in year 1.

What is the value of this property using a before-tax unleveraged discount rate of 10.5 percent?

Exhibit 13–14 summarizes some of the key assumptions outlined above. Note that it was assumed that tenant 1 would renew for sure, tenant 2 would vacate for sure, but tenant 3 would use a renewal probability based on market leasing assumptions.

Exhibit 13–15 summarizes the calculations for months vacant, market rent, leasing commissions, and tenant improvements based on weighting the new and renewal assumptions by the renewal probability. Note that the weighted numbers are as of the first year of the analysis. They will increase over time with the inflation assumptions.

Exhibit 13–16 shows the projection of cash flows for Worthington Distribution Center. For each tenant, the rent from the current lease, as well as the "market" rent from the lease renewal assumptions, is projected. Turnover vacancy is a result of tenant 2 vacating for sure and the 30 percent probability that tenant 3 will not renew.

Note that tenant improvements and leasing commissions as well as the capital cost associated with the roof replacement must be deducted from *NOI* to calculate the cash flow.

Finally, Exhibit 13–17 shows the cash flow from resale and property value calculations. The resale is based on applying the terminal cap rate to the year 6 *NOI.* Selling costs are deducted to arrive at the net resale of $8,863,598. The property value is then calculated by adding the present value of the annual cash flow plus the present value of the resale. The property value is $7,629,201.

EXHIBIT 13–14
Worthington Distribution Center—Key Assumptions

Building name	Worthington Distribution Center		
Address			
City		Anywhere	
State		USA	
Building size (sq. ft.)		140,000	
Analysis begin date		6/1/2000	
Holding period		5	
Discount rate		10.50%	
Terminal cap rate		9.75%	
Selling cost		3.00%	
Inputs	**Tenant 1**	**Tenant 2**	**Tenant 3**
Name	Electric Supply	Sign Company	Computer Dist.
Tenant size	50,000	42,500	47,500
Rent/sq. ft.	$6.00	$6.50	$5.75
Lease term (years)	3	2	4
At expiration	Renew	Vacate	Market

EXHIBIT 13–15
Worthington Distribution Center—Market Leasing Assumptions

	Lease Term	Renewal Prob.	Months Vacant	Market Rent	Leasing Commissions	Tenant Improvements
New	5	70.0%	10	$7.00	3.00%	$5.00
Renewal			0	6.50	1.00	2.00
Weighted			3	6.65	1.60	2.90

EXHIBIT 13–16 Estimated Cash Flows for Worthington Distribution Center

	Year					
	1	2	3	4	5	6
Income:						
Electric supply rent	$300,000	$300,000	$300,000	$ 0	$ 0	$ 0
Electric supply market rent	0	0	0	355,136	355,136	355,136
Sign company rent	276,250	276,250	0	0	0	0
Sign company market rent	0	0	315,618	315,618	315,618	315,618
Computer dist. rent	273,125	273,125	273,125	273,125	0	0
Computer dist. market rent	0	0	0	0	355,520	355,520
Total income	$849,375	$849,375	$888,743	$943,879	$1,026,274	$1,026,274
Turnover vacancy	0	0	263,015	0	88,880	0
Effective gross income	$849,375	$849,375	$625,728	$943,879	$ 937,394	$1,026,274
Expenses:						
Management fee	$ 42,469	$ 42,469	$ 31,286	$ 47,194	$ 46,870	$ 51,314
Property tax	23,000	23,575	24,164	24,768	25,388	26,022
Insurance	21,000	21,840	22,714	23,622	24,567	25,550
CAM	28,000	28,840	29,705	30,596	31,514	32,460
Total	$114,469	$116,724	$107,870	$126,181	$ 128,339	$ 135,345
Cash Flow:						
NOI	$734,906	$732,651	$517,858	$817,698	$ 809,055	$ 890,929
Tenant improvements	0	0	225,441	109,273	155,039	
Leasing commissions	0	0	47,343	17,757	28,442	
Total TI and LC	0	0	272,784	127,030	183,480	
Capital costs	45,000	0	0	0	0	
Cash flow	$689,906	$732,651	$245,074	$690,669	$625,575	
PV factors	0.90498	0.81898	0.74116	0.67073	0.60700	
Present value of cash flow	$624,350	$600,030	$181,640	$463,256	$379,724	

EXHIBIT 13–17 Worthington Distribution Center—Resale and Estimated Value

Resale Calculations:		**Value:**	
Resale	$9,137,730	PV resale	$5,380,203
Selling cost	274,132	PV cash flow	2,248,999
Net resale	$8,863,598	Value	$7,629,201
PV factor	0.60700		
PV resale	$5,380,203		

Risk and Leverage

As discussed earlier, "financial risk" is one type of risk that is due to the use of financial leverage. The use of financial leverage increases uncertainty as to what the equity investor's rate of return will be. This can be illustrated with an example that shows how leverage affects the expected return and the standard deviation of returns.

Assume that a property can be purchased for $100,000 and its initial *NOI* is $9,000. It will be sold after five years based on a 10 percent terminal capitalization

rate applied to year 6 *NOI*. There are three possible scenarios for the investment as follows:

Scenario	*NOI* Growth	Probability (*P*)
Pessimistic	−3.00%	30%
Most likely	0.00	50
Optimistic	3.00	20

The *IRR* for each scenario is shown in Exhibit 13–18 on an unleveraged basis. The returns range from 4.33 percent to 10.21 percent. Exhibit 13–19 shows that the expected return is 6.98 percent and the standard deviation of returns is 2.06 percent.

Now assume that the investor finances the purchase with a 70 percent loan ($70,000) at a 6 percent interest rate and a 25-year loan term with annual amortization for simplicity. The leveraged return calculations are shown in Exhibit 13–20.

The returns now range from −.45 percent to 18.59 percent. For the pessimistic scenario, recall that the unleveraged return was 4.33 percent. With a loan at a 6 percent interest rate, there is negative leverage in this scenario. (Recall from the previous chapter that unfavorable leverage occurs when the unleveraged return is less than the cost of debt.) Thus, the leveraged return is lower than the unleveraged return under this scenario.

For the most likely scenario, the unleveraged return was 7.27 percent. Thus, the leverage is slightly positive and the leveraged return is 10.22 percent under this scenario.

EXHIBIT 13–18
Unleveraged Returns for Each Scenario

www.mhhe.com/bf15e

Pessimistic							
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Purchase	−100,000						
NOI		9,000	8,730	8,468	8,214	7,968	7,729
Resale						77,286	
Total cash flow	−100,000	9,000	8,730	8,468	8,214	85,254	
IRR	4.33%						

Most Likely							
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Purchase	−100,000						
NOI		9,000	9,000	9,000	9,000	9,000	9,000
Resale						90,000	
Total cash flow	−100,000	9,000	9,000	9,000	9,000	99,000	
IRR	7.27%						

Optimistic							
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Purchase	−100,000						
NOI		9,000	9,270	9,548	9,835	10,130	10,433
Resale						104,335	
Total cash flow	−100,000	9,000	9,270	9,548	9,835	114,464	
IRR	10.21%						

EXHIBIT 13–19
Expected Return and Standard Deviation of Unleveraged Returns

Scenario	Return (*R*)	Probability (*P*)	(Return × Probability)	*R* − Expected *R*	*P* × (*R* − Expected *R*)^2
Pessimistic	4.33%	30%	1.30%	−2.64%	0.0210%
Most likely	7.27	50	3.64	0.29	0.0004
Optimistic	10.21	20	2.04	3.23	0.0209
		Expected return	6.98%		
		Variance	0.04%		
		Standard deviation	2.06%		

For the optimistic scenario, the unleveraged return was 10.21 percent. The leverage is even more positive under this scenario, and the leveraged return is 18.59 percent.

We can also compute the expected return and standard deviation of the leveraged returns. This is shown in Exhibit 13–21.

The expected leveraged return is 8.69 percent, which is higher than the unleveraged return. This is because the *expected* unleveraged return of 6.98 percent exceeds the interest cost of 6 percent. It is important to note that the leverage relationship discussed in Chapter 12

EXHIBIT 13–20
Leveraged Returns for Each Scenario

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Pessimistic

Year	0	1	2	3	4	5	6
Purchase	−100,000						
Loan	70,000						
NOI		9,000	8,730	8,468	8,214	7,968	7,729
Payment		−5,476	−5,476	−5,476	−5,476	−5,476	
Resale						77,286	
Loan balance						−62,808	
Total cash flow	−30,000	3,524	3,254	2,992	2,738	16,970	
IRR	−0.45%						

Most Likely

Year	0	1	2	3	4	5	6
Purchase	−100,000						
Loan	70,000						
NOI		9,000	9,000	9,000	9,000	9,000	9,000
Payment		−5,476	−5,476	−5,476	−5,476	−5,476	
Resale						90,000	
Loan balance						−62,808	
Total cash flow	−30,000	3,524	3,524	3,524	3,524	30,716	
IRR	10.22%						

Optimistic

Year	0	1	2	3	4	5	6
Purchase	−100,000						
Loan	70,000						
NOI		9,000	9,270	9,548	9,835	10,130	10,433
Payment		−5,476	−5,476	−5,476	−5,476	−5,476	
Resale						104,335	
Loan balance						−62,808	
Total cash flow	−30,000	3,524	3,794	4,072	4,359	46,181	
IRR	18.59%						

EXHIBIT 13–21
Expected Return and Standard Deviation of Leveraged Returns

Scenario	Return (*R*)	Probability (*P*)	(Return × Probability)	*R* − Expected *R*	*P* × (*R* − Expected *R*)²
Pessimistic	−0.45%	30%	−0.13%	−9.14%	.25%
Most Likely	10.22	50	5.11	1.53	.01
Optimistic	18.59	20	3.72	9.90	.20
		Expected return	**8.69%**		
		Variance	**0.46%**		
		Standard deviation	**6.77%**		

also applies when using expected returns. That is, *if the expected unleveraged return exceeds the cost of debt, then the expected leveraged return will be positive.*

Also note that in Exhibit 13–21 the standard deviation for the leveraged returns (6.77%) is much higher than the standard deviation for the unleveraged returns (2.06%). This is because the variability of returns increases with the use of leverage. The return for the pessimistic scenario is more negative, and the return for the optimistic scenario is more positive.

It is also important to note that the risk and standard deviation of the leveraged returns will be higher than for the unleveraged returns regardless of whether the leverage is positive or negative. That is, even if the leverage is negative based on expected returns, the standard deviation of the leveraged returns will still be higher than the standard deviation of the unleveraged returns.

A "Real Options" Approach to Investment Decisions

Earlier in this chapter, we saw how to calculate the "expected value" or "expected return" on investments by taking into consideration the probabilities associated with different outcomes. This captures the uncertainty of future events when making investment decisions. This approach is often used to evaluate the expected return on an investment when we must decide whether to purchase the property at a specific price *today* where there is uncertainty as to what the performance of the investment will be in the future.

There are often situations, however, where we do not have to fully commit to invest all our capital at one point in time. For example, on a development project we could purchase the land today but wait for a while before deciding whether or not to begin construction of a building. The market may not be such that starting construction immediately is feasible, but the developer may think that there is a good chance that the market will improve over the next year or so such that development will be feasible. On the other hand, the market may not improve and the building should not be constructed. The developer may want to go ahead and purchase the land, however, so that he has the land tied up to be able to construct the building if the market does improve. The land might be available for sale today and the developer may be concerned that another developer will purchase the land if he doesn't.

In situations like this, the developer who purchases the land, but can wait to decide whether to start construction, is said to have a **real option** on the land. The option is to develop the building in the future. The developer does not have to decide to construct the building. The land can remain vacant (perhaps it is leased to a farmer so that it generates some income). Thus, the developer has an option either to construct or not to construct a building depending on economic conditions in the future.

It is important to note that we are *not* talking about the developer getting an option from the seller of the land to purchase the land after some point in time. This is also often done as a way of dealing with uncertainty as to whether the property should actually be developed or not—especially when the developer may need to get zoning changes or development

approvals which he may not be certain of getting. This strategy involves the use of options by the developer to deal with risk. But what is important to realize is that purchasing the land outright without the use of an option from the seller still gives the developer an option to either develop or not develop the land. It is this option that is referred to as a *real option.*

The reason that it is important to recognize the existence of an option when land is purchased is because this affects the way we should analyze what we would be willing to pay for the land. To illustrate, we will use an example where we first ignore the option aspect of owning the land, and then we will return to the importance of considering the option.

Consider the following assumptions:

- The developer plans to start construction of a building in one year if at that point rent levels make construction feasible.
- The building will cost $800,000 to construct.
- During the first year after construction would take place, there is a 50 percent chance that *NOI* will be $130,000 and a 50 percent chance that *NOI* will be $70,000.
- In either case, *NOI* is expected to increase at 2 percent per year after the first year.

How much should the developer be willing to pay for the land if she wants a 12 percent return?

Traditional Approach to Land Valuation

Note that this looks very similar to the "highest and best use" analysis that was discussed in Chapter 9. In that chapter, we found the land value by first calculating the value of the property based on its *NOI* and then subtracting the construction cost of the building to get the residual land value. This process was applied to several possible uses of the site in order to determine the highest and best use which maximized the land value.

But in Chapter 9, we assumed that the *NOI* for each potential use was either certain or that the *NOI* was really the "expected" *NOI,* even though we did not explicitly consider probabilities for different *NOI* scenarios.

In this case the expected *NOI* is as follows:

$$\text{Expected } NOI = (.50 \times \$130{,}000) + (.50 \times \$70{,}000) = \$100{,}000$$

The capitalization rate would be 10 percent (12% discount rate less 2% growth rate for *NOI*). Thus, the value of the property after construction would be $100,000/.10 = $1,000,000. Subtracting the construction cost of $800,000 results in a value at the beginning of the first year (after construction is complete) of $200,000. Since construction will not begin for a year, we have to discount this back for one additional year at the 12 percent discount rate so that the value of the land today under this approach would be $200,000/1.12 = $178,571.

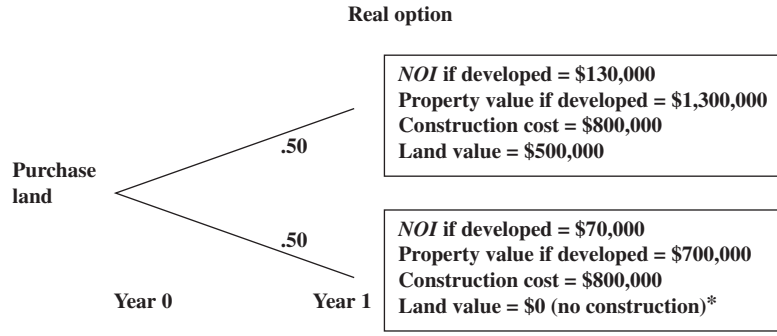
Assuming this use results in the highest land value and is the highest and best use of the site, we would expect the developer to pay $178,571 for the land.

Real Option Approach to Land Valuation

What we failed to consider in the approach above is that the developer *does not have to decide today* whether the building will be constructed in a year. The developer can buy the land (so he has the land tied up) but wait until the end of the year to find out what the *NOI* is at that time before making a decision.

If at the end of the year the *NOI* is $130,000, then the property would be worth $130,000/.10 = $1,300,000, which far exceeds the construction cost of $800,000, making the land worth $500,000. But if the *NOI* is $70,000 after a year, the property would be worth only $700,000, which is less than the construction cost of the building, so development would not be feasible. The land value would be zero, assuming no interim use like farming.

Thus, the developer is really looking at the following situation. There is a 50 percent chance that the *NOI* will be $130,000, that he will construct the building, and that the value of the property will be $1,300,000. There is also a 50 percent chance the land will be worth nothing after a year. But the land will not have a negative value after a year! The developer will just decide to keep it vacant. In fact, he still has the option to construct something on it at some future point in time, but for simplicity we will assume that it is worth nothing. The scenarios are summarized in the following diagram:



*Land value is the maximum of Property value if developed—Construction cost, or zero.

Based on the above scenarios and probabilities related to the different possible land values after a year, the land value would be as follows after a year:

$$\text{Land value} = (.50 \times \$500{,}000) + (.50 \times \$0) = \$250{,}000$$

Discounting this back for one year to today at a 12 percent rate, we have

$$\$250{,}000/1.12 = \$223{,}214$$

Note that this implies a higher land value than we arrived at with the traditional approach considered earlier where the land was $178,571. The difference is $223,214 − $178,571 = $44,643. This difference represents the value of the option to wait to decide whether to construct the building. It is the value of the real option inherent in the ownership of vacant land with an option to develop the land in the future.

Web App

Environmental risk is of great concern to real estate investors because of the significant costs that can be associated with mitigating this type of risk. Visit one of the sites recommended in the "Useful Web Sites" for this chapter, such as **www.environmental-center.com,** or use a search engine like Google (**www.google.com**) and search for "environmental risk." Select a type of environmental risk and summarize the nature of the risk and why it is a concern for real estate investors.

Real Options Extensions and Strategy

The above example was simplified to illustrate the importance of thinking in terms of having options in real estate investments. In the above example, the value of the land was higher when this was considered. The developer most likely to purchase the land, and in turn determine the highest and best use of the site, will be the one that recognizes the value of this option.

There are many other situations where implicit options exist in real estate investments. Some additional examples are as follows:

Excess land purchased with a site that is not needed for the initial use is an option for future development. For instance, a developer for a shopping center may purchase more land than needed for the shopping center (including parking). This land might be developed into additional retail developments in the future, or even apartments or office space.

A development project can have different phases to the development. For example, a site might allow for three different apartment or condominium buildings but only one may be constructed initially. In this way, the developer can wait to see how well the first apartment building rents or sells before deciding to construct the additional buildings. Similarly, a land development project (discussed more in Chapter 17) can have different phases to the development so that roads, sewers, and so forth are first put in only for one phase and then additional funds committed only if the lots in the first phase sell well enough.

Having the ability to renovate a building is also an option. The building does not have to be renovated. It can be used "as is." So the owner/investor can wait to see whether the market will support a renovation before committing the funds. Purchasing the building under its current condition (before renovation) is analogous to purchasing the land.

These are just a few examples of the way that real options can exist in real estate investments. Considering these options can significantly affect how investors view the value of real estate investments. Furthermore, an astute developer can often create options in the way that he or she creates a development strategy. Projects should be designed to give the developer options to decide whether to commit additional funds at future points in time (such as the phasing examples discussed above) to maximize the expected value of the project and mitigate the risk.

Conclusion

This chapter discussed the importance of considering risk when analyzing investments. Rates of return for alternative investments cannot be directly compared if the investments have different degrees of risk. We introduced several methods the investor can use to attempt to evaluate the riskiness of a real estate investment, including sensitivity analysis, scenarios, partitioning the return, and the use of probability distributions to compute the expected return and standard deviation of returns.

We were able to look more closely at the effect of leverage (introduced in the previous chapter) on risk by seeing how leverage affects the expected return and standard deviation of returns. We saw that the standard deviation increases with leverage regardless of whether it is positive or negative.

Two case studies (an industrial property and a shopping center) were introduced to illustrate risk analysis as well as provide insight into some of the unique aspects of modeling cash flows for these property types. Previous chapters introduced apartment and office building investments.

The use of renewal probabilities was discussed to illustrate how to deal with the uncertainty regarding whether a tenant will renew the lease at the end of the lease term. We saw how this affects tenant improvements, leasing commissions, and vacancy rates at lease renewal.

Finally, the concept of real options was introduced as a way of thinking about the value of real estate investments where the investor has options after the initial investment is made as to whether additional funds should be invested in the project. We saw that having the option to delay or abandon any additional investment can increase the value of the investment. This was illustrated with the use of vacant land, the purchase of which gives the owner an option to either develop a building on the land in the future or keep the land vacant.

Although this is the only chapter that formally deals with risk, the concepts and techniques introduced in this chapter should be kept in mind throughout the remainder of this book.

Key Terms

breakpoint, *442*
business risk, *430*
due diligence, *432*
environmental risk, *432*
financial risk, *431*
inflation risk, *431*
interest rate risk, *431*
legislative risk, *432*
liquidity risk, *431*
management risk, *431*
market leasing assumption, *446*
months vacant, *446*
overage, *442*
partitioning the *IRR*, *436*
percentage rent, *442*
real option, *452*
renewal probability, *446*
scenarios, *435*
sensitivity analysis, *434*
turnover vacancy, *446*

Useful Web Sites

www.ecologeris.com—This site has a searchable environmental risk database for Canada.

Questions

1. What is meant by partitioning the internal rate of return? Why is this procedure meaningful?
2. What is a risk premium? Why does such a premium exist between interest rates on mortgages and rates of return earned on equity invested in real estate?
3. What are some of the types of risk that should be considered when analyzing real estate?
4. What is the difference between business risk and financial risk?
5. Why is the variance (or standard deviation) used as a measure of risk? What are the advantages and disadvantages of this risk measure?
6. What is meant by a "real option"?
7. What is meant by the term *overage* for retail space?
8. How does the use of scenarios differ from sensitivity analysis?

Problems

1. Two investments have the following pattern of expected returns:

Investment A					
Year	1	2	3	4	4 (Sale)
BTCF	$5,000	$10,000	$12,000	$15,000	$120,000

Investment B					
Year	1	2	3	4	4 (Sale)
BTCF	$2,000	$4,000	$1,000	$5,000	$180,000

Investment A requires an outlay of $110,000 and Investment B requires an outlay of $120,000.

a. What is the *BTIRR* on each investment?

b. If the *BTIRR* were partitioned based on $BTCF_o$ and $BTCF_{s'}$ what proportions of the *BTIRR* would be represented by each?

c. What do these proportions mean?

2. Mike Riskless is considering two projects. He has estimated the *IRR* for each under three possible scenarios and assigned probabilities of occurrence to each scenario.

State of Economy	Probability	Estimated *BTIRR* Investment I	Estimated *BTIRR* Investment II
Optimistic	0.20	0.15	0.20
Most likely	0.60	0.10	0.15
Pessimistic	0.20	0.05	0.05
	1.00		

Riskless is aware that the pattern of returns for Investment II looks very attractive relative to Investment I; however, he believes that Investment II could be more risky than Investment I. He would like to know how he can compare the two investments considering both the risk and return on each. What do you suggest?

3. An investor has projected three possible scenarios for a project as follows:

   Pessimistic—NOI will be $200,000 the first year, and then decrease 2 percent per year over a five-year holding period. The property will sell for $1.8 million after five years.

   Most likely—NOI will be level at $200,000 per year for the next five years (level *NOI*) and the property will sell for $2 million.

   Optimistic—NOI will be $200,000 the first year and increase 3 percent per year over a five-year holding period. The property will then sell for $2.2 million.

   The asking price for the property is $2 million. The investor thinks there is about a 30 percent probability for the pessimistic scenario, a 40 percent probability for the most likely scenario, and a 30 percent probability for the optimistic scenario.

   a. Compute the *IRR* for each scenario.

   b. Compute the expected *IRR.*

   c. Compute the variance and standard deviation of the *IRR*s.

   d. Would this project be better than one with a 12 percent expected return and a standard deviation of 4 percent?

4. Use the same information as in problem 3. Now assume that a loan for $1.5 million is obtained at a 10 percent interest rate and a 15-year term.

   a. Calculate the expected *IRR* on equity and the standard deviation of the return on equity.

   b. Contrast the results from (*a*) with those from Problem 3. Has the loan increased the risk? Explain.

5. A developer plans to start construction of a building in one year if at that point rent levels make construction feasible. At that time the building will cost $1,000,000 to construct. During the first year after construction would take place, there is a 60 percent chance that *NOI* will be $150,000 and a 40 percent chance that the *NOI* will be $75,000. In either case, *NOI* would be expected to increase at 2 percent per year after the first year. How much should the developer be willing to pay for the land if he wants a 12 percent rate of return?