UNDERSTANDING REAL ESTATE ECONOMICS 2020 (WITH EXHIBITS)

THOMAS F. KAUFMAN is a Principal with Montfort Fiduciary Advisors LLC, in Arlington, Virginia. Before joining Montfort, he was a partner with Willke Farr & Gallagher Hunton & Williams (now Hunton Andrews Kurth), and Goulston & Storrs, in Washington, D.C., practicing in the areas of finance, private equity and joint ventures related to real estate, real estate investment trusts, capital markets, mezzanine and subordinated loans, loan workouts, and commercial real estate transactions. He taught as an Adjunct Professor of Law at Georgetown University Law Center and served as law clerk to Chief Judge Harry Phillips. U. S. Circuit Court of Appeals, Sixth Circuit, from 1976 through1977. He is a frequent speaker for ALI CLE and other continuing legal education organizations.

1. INTRODUCTION

A lot has changed in this world since this article was first written. The pandemic has had an enormous effect on commercial real estate, but its long-term impact may not be known for years. Although the pandemic has accelerated change, it has not affected the basic economic indicators and analysis for commercial real estate.

An attorney or other advisor for commercial real estate must have some familiarity and understanding of the fundamental economic analysis of a specific property in order to make judgments about that real property. The purpose of this article is to review some of the concepts and the methodologies for measuring commercial real estate returns and compare and contrast them. In addition, it looks at some mistakes often made in projecting the returns of a specific real estate property as an investment, including the possible pitfalls that confront an investor when the investor pushes the numbers to justify an expensive purchase price.

As an investment, commercial real estate is an asset. The return to an investor is tied to two basic economic components:

- The annual income it produces over the term of ownership; plus
- The proceeds of any capital transaction, such as a refinancing or sale.

Unlike stocks or bonds, real estate also has a tax-shield component. Real estate also has inherent emotional attachments, such as the view from a property overlooking the ocean or the status accruing to the owner of some other kind of "trophy" property. No one acquires stock in a company because the stock certificate is a work of art or because of exciting graphics in the annual report. But the emotional attachments of real estate can definitely influence an investor.

Real estate, as an investment, competes with stocks, bonds, and, other assets. A common misconception in investment analysis is that bonds represent a fixed-income investment that is easy to understand, that individual stocks are difficult if not impossible to correctly predict, and that real estate is a relatively messy investment, but easy to decipher with a proper set of spreadsheets. It was also almost an axiom of investment that the safest investments were in bonds or gold. In his book, Stocks for the Long Run,[1] Jeremy Siegel tracked the real returns[2] from 1802 until 1997 and concluded that one dollar invested in each category of stocks, bonds, and gold in 1802 would have been worth, in constant dollars in 1997, $558,945 for stocks, $803 for bonds and 84 cents for gold.

Real estate investments are more complex to model, at least mathematically, than stocks and bonds. First, what we are looking for is the total return on the asset. Total return is a combination of annual returns, whether they are dividends, rents, refinancing proceeds, or interest payments, and the final payoff from sale of the asset. Most mathematical analysis of stocks assumes that the stock returns are normally distributed, that is the sum of dividends and capital appreciation are normally distributed around an expected value. Bonds, at first blush, appear to be simple, in that their interest payments are usually fixed, or at least determined, according to some simple formula. With bonds it is the sales price that creates the mathematical problems. The pricing of bonds is actually a derivative.[3] Real estate is complex because, for a specific property, an enormous amount of information is available and is usually employed in the modeling. For example, if the property is an office building or retail center, then the rent roll is unique and tracking the scheduled rent increases, lease expirations, projected renewal rates, cost of re-leasing the property, and estimating the cost of providing services to tenants adds great complexity.

There is one last overriding point to remember: Models are important for evaluating real estate, and great care should be exercised in creating, reviewing, and relying on them. Nevertheless, the best real estate investors do not necessarily have the best models. If the key to real estate were the best models, then the best spreadsheet or model would create the most successful investor; and that is clearly not the case. Common sense, single-minded conviction, hard work, intuition, and luck are all key elements of a successful real estate investment portfolio.

2. BASICS

Let's start with the basics. Most real estate professionals are already familiar with these concepts, but they are still worth discussing because the nuances, which are often ignored, can be significant.

2.1. Present value

A dollar today is worth more than a dollar in the future is a fundamental concept that most real estate investors are familiar with. A dollar today invested at five percent per annum will produce $1.63 in 10 years.[4] Likewise, a dollar today invested at five percent will yield a 10-year annuity of 13 cents per year, with no principal left at the end. These are simple concepts, but let's look at a few details. The first is compounding.[5] Is annual compounding the proper gauge? Or should it be something else? Compounding can change the growth rate of an investment. A dollar compounded at an annual rate of six percent grows to $1.79 over 10 years if the compounding is annual, but grows to $1.82 if it is compounded monthly. To put it another way, annual compounding at a rate of six percent produces a six percent annual yield, but compounding the same six percent annual rate monthly produces a 6.17 percent annual yield. For simplicity, most investments are compared using annual compounding.[6]

The next concept to review is the "discount rate" to be applied in determining present value. In computing the present value of a dollar, the discount factor is the value today of a dollar received in the future. It is usually expressed as the reciprocal of one plus the discount rate:

$$\text{Discount Factor} = 1/(1 + \text{Discount Rate})$$

The discount rate is the percentage return that an investor would require in order to accept the delay in receiving the payment. (There are many factors that go into determining the discount rate, and they mimic those used in determining a capitalization rate and will be discussed in detail below in section 3.2.2). Many investors assume that a discount rate is a static number that, if carefully chosen, will help them to evaluate an investment.

A discount rate need not be a fixed number and if the risks and other factors used in determining it are accurately reflected, it should probably vary over time. Using a single number as the discount rate over a long period of time is a simplification. For example, in the world of fixed-income securities or bonds, the "spot rate" is the name given to the rate of return on a loan made at the present time for a fixed period of time. If a one-year loan were made today and the rate of interest the market required were four percent, then the spot rate for that year is four percent. But the spot rate changes constantly, sometimes by a little or sometimes significantly. In September 2019, the spot rate for a riskless loan of one year was often 3.00 percent.[7] In August of 2020, that spot rate was approximately 2.50 percent for the same risk-free loan.[8] That is a significant change. Spot rates also will change as the length of the loan term increases or decreases. For example, if the spot rate for a one-year loan is three percent and the spot rate for a two-year loan is four percent, that gives an investor important information about the expected rates from year one to year two. In the real world, the "law of one price" means that two securities having the same cash flow must have the same price.[9]

2.2. Tax effects

As an investment class, real estate benefits from certain tax advantages. This results primarily from the fact that real estate can be depreciated, with the depreciation providing a tax shield for income at ordinary income rates, and then, when the real estate is sold, the taxes due are often recovered at lower capital gains rates.[10] For example, here is an investment in real estate compared against an investment in a bond having the same yield for a five-year period, but resulting in a different return to the investor solely because of the tax impacts.

Holding Period	=	Five years
Bond and Real Estate Purchase Price	=	$10,000,000
Net Operating Income and Coupon	=	$600,000/yr
Depreciation (Annual) for Real Estate	=	$200,000/yr
Purchase Loan Debt – Interest Only	=	$8M at 5.00%
Sale Price	=	$10,000,000

Five Year Summaries	Real Estate	Bond
Net Operating Income	$3,000,000	$3,000,000
Interest on Purchase Loan	2,000,000	2,000,000
Depreciation	1,000,000	---
Taxable Income	0	1,000,000
Taxes	0	350,000
After-Tax Cash Flow	1,000,000	650,000
Sale Price	10,000,000	10,000,000
Tax on Sale	(250,000)	0
Total After-Tax Cash Flow	**$750,000**	**$650,000**

After-Tax Cash Flow	Real Estate	Bond
T0	(2,000,000)	(2,000,000)
Year 1	200,000	130,000
Year 2	200,000	130,000
Year 3	200,000	130,000
Year 4	200,000	130,000
Year 5	1,950,000	2,130,000
IRR =	**7.86%**	**6.50%**

Any reasonable analysis of an investment in real estate needs to take the tax implications into account, so the returns should be done on an after-tax basis. Some investors in real estate, such as pension funds and endowments, do not, as a rule, pay income taxes, so their yields and after-tax returns may be significantly different than for taxpayers.

3. REAL ESTATE RETURN MODELS

3.1. Real estate returns

In computing real estate returns on an after-tax basis, a basic pro forma model is often used to determine the property's economics. A sample pro forma is determined as follows:

Gross Income
– Operating Expenses
Net Operating Income
– Debt Service
Cash Flow Before Taxes
+ Mortgage Principal Payment
– Depreciation
Taxable Income
± Less Taxes due or plus taxes saved
+ Depreciation
After-Tax Cash Flow

The goals of real estate investments vary from investor to investor, but generally they are to invest in projects that generate after-tax returns that exceed alternative investments and the cost of funds of the investor. One way to do that is to acquire real estate assets for less than their intrinsic value (the future value of their cash flows to the investor). To do that, decision models have been created to assist in this analysis. These models vary from single-period models, such as cash-on-cash and the capitalization rate (cap rate) models to more complex multiple-period models such as pay-back period, internal rate of return (IRR) and net present value (NPV).

3.2. Single-period models

Single-period models are the simplest and were often utilized in the days before the general availability of personal computers. They are relatively easy to use, although of limited utility.

3.2.1. Cash-on-cash

The cash-on-cash method is one of the few that does not use after-tax returns. Instead, it is computed as:

Cash-on-cash =
Before-Tax Cash Flow / Invested Capital

This is a measure of initial profitability and shows returns of anywhere from two percent to 10 percent in most commercial real estate. The higher the number, the better the investment. It has many weaknesses, but among the most significant problems are that:

- It does not work well for capital that is invested over time;
- It does not reflect any of the gain upon a sale, where most return is achieved in the present market of high-priced properties.

For real estate investment trusts (REITs) a comparable number is funds from operations (FFO). It is accepted as a more accurate measure of performance for REITs than net income. A variation on this methodology is the "after-tax return on equity," which is simply the after-tax return of the asset for the first year divided by the cash invested.

3.2.2. Capital rate or return on asset

The cap rate is still a widely used, or at least widely discussed, method of analyzing real estate returns. It is computed as:

Cap Rate =
Net Operating Income (stabilized) / Purchase Price

Its related number is the "multiplier," which is the reciprocal of the Cap Rate:

Multiplier = 1 / Cap Rate

The prospective purchase price of a property is the stabilized net operating income times the multiplier. For example, if the cap rate is five percent, the multiplier is 20 (1/.05) and a property purchase price would be 20 times the stabilized net operating income. So a property with a stabilized net operating income of $1 million should be priced at $20 million. Cap rates historically ran from eight percent to 12 percent for low-risk properties and up to 20 percent for troubled or high-risk properties, but in today's market they seem to run from five percent to 8.5 percent. Stabilized operating income is intended to reflect steady state income for the property after fixing whatever temporary shortcomings burden the property, such as an above-normal vacancy rate, and balances possible additional lease-up and adjustments to operating costs assumed by the purchaser.

The advantages of the cap rate method are:

- Its simplicity makes it easier to understand; and
- It does not necessarily need a spreadsheet to compute, although to calculate a reliable stabilized net operating income, a spreadsheet would normally be used.

The problems with this method are legendary:

- Most importantly, it fails to specifically reflect the returns from a sale of the property;
- It does not accurately reflect future tenant rollovers and the costs of re-leasing;
- The costs of additional capital improvements are not reflected;
- Increases in operating costs and in rents are ignored except to the extent they are taken into account in the initial stabilized net operating income.

How is a cap rate, or for that matter a "discount factor," calculated?[11] That depends upon many factors, and there is as much judgment (or lack thereof) in such a calculation as there is mathematical certainty. There are at least four factors involved in these determinations:

1. The expected rate of inflation;
2. The perceived risk in the asset;
3. The market rate of return for a risk-free asset; and
4. The supply and demand for capital and the asset in question. The cap rate is determined more by the perceived rate of inflation than actual inflation.[12]

Much like bonds, the higher the expected rate of inflation, the higher the cap rate needed to attract investment. No purchaser wants to acquire a property for a cap rate that dramatically underestimates inflation so that the inflation adjusted return is negative. The risk of the asset is also an important category. In the investment world, U.S. Treasury securities have historically been the benchmark and are generally perceived as riskless investments, at least as far as the possibility of a payment default. Today's massive participation by the U.S. Federal Reserve has definitely reduced, but not eliminated, that relationship. Real estate cap rates with historic spreads that are 100 basis points (one percent) over 10-year U.S. Treasuries leave little premium for risk and may be assumed to be driven by a short supply of investment real estate meeting certain investor requirements. However, these extremely low cap rates appear to apply primarily to trophy properties or very low-risk projects. As of the end of 2019, the cap rates[13] stood at about 6.0 percent for all property types, ranging from 5.5 percent to over eight percent for varying property types, which, some would argue, at about 200-300 basis points over U.S. 10-year Treasuries is not out of line with historic standards. Most investors are looking for higher cap rates today during the pandemic, given the dramatically increased risk in commercial real estate. Only time will tell where these rates will stabilize and provide the correct answer.

There are numerous academic articles and studies of real estate returns.[14] Many of them deal with risks versus returns, the benefits of real estate versus other investments, and inflation and real estate returns. Only a small percentage deal with the analysis of real estate return projections and modeling problems or financial analysis models.

3.3. Multi-period models

Multi-period models allow a dynamic projection of future events. These future events can range from projected increases in rents and expenses to accurate modeling of expected tenant lease expirations, projected renewals, and tenant improvement costs modeled after the specific rent roll existing in the property. They also allow more variable methods of modeling the resale and refinancing process, as is discussed below. The most common multi-period models are the IRR and NPV methods. The mathematical methodologies and examples for the IRR and NPV are shown on Exhibit 1, along with other computations. To many people, the IRR is the most frequently cited measurement of real estate return over a projected holding period. It sets forth in a single percentage rate the return expected from continuous monthly cash flows, and capital events such as refinancing or ultimate sales of the property.

3.3.1. Payback

The payback method calculates how many years it takes to repay the investor a cumulative cash flow equal to the amount invested in the project. It looks at when a project breaks even and is rooted in the idea that it is better to recover your investment sooner rather than later. For example, if the investments of $5 million and $10 million, respectively, produce the cash flows shown below, then the payback periods are as shown below:

	Example 1	Example 2
C0	(5,000,000)	(10,000,000)
Cash Yr. 1	3,000,000	3,000,000
Cash Yr. 2	2,000,000	4,000,000
Cash Yr. 3	1,000,000	8,000,000
Payback	2.0	2.4

The payback decision matrix often says that any selected investment must pay back within a set time period and the investment is not made if the payback period is longer. The payback rule is problematic in that:

- It treats all cash flow returned as being of equal value. There is no reduction in value to take into account the present value discount for cash received later; and
- It fails to take into account any cash flow received after the invested capital has been repaid.

The payback rule often favors a choice different from the other methodologies. In the examples above, most investors would find Example 2 to be a superior investment compared to Example 1, but the payoff period for Example 1 is shorter and therefore the preferred choice under the payback rule.

Another variation of the payback rule is the discounted payback. It calculates how many years in discounted cash flow it takes to pay back the initial investment.

DISCOUNTED PAYBACK

	Example 1	Example 2
C0	(5,000,000)	(10,000,000)
Cash Yr. 1*	2,727,272	2,727,272
Cash Yr. 2	1,652,893	3,305,785
Cash Yr. 3	751,315	6,010,518
Payback	2.83	2.66

Uses discounted payments assuming discount rate = 10%.

The results varied here between the payback method and discounted payback method, but they need not. We will look at this example again using a different decision process.

3.3.2. NPV calculation

The NPV is a discounted cash flow calculation.[15] It computes a discounted cash flow for each and every payment to and from the investor. In other words, each item of investment in and cash flow out of a project is discounted to present value and then summed up. The convention for dealing with such cash flows is to treat cash invested in a project as negative, while cash flow from the project to the investor is treated as positive.[16] For example, the following chart shows the present value of each cash flow, including the initial investment.

In an NPV calculation, an investor should use the imputed cost of the investor's capital as the discount rate. The investor then computes the NPV. The decision rule is, if the NPV is positive, then the investment creates value for the investor and should be selected. If the NPV is negative, the investment should not be made. If the projects are mutually exclusive, select the project with the greatest NPV. Most academics[17] argue that this is inherently the best system because it allows a better allocation of resources when resources are constrained. In other words, if a developer cannot undertake all projects because of limited resources, the NPV method allows a better allocation to maximize the benefits of capital budgeting given the limitations. Examples below will show how this and other methods can be used to determine the best investments when resources are limited.

The benefits of using NPV are:

- The method recognizes that cash today is worth more than tomorrow;
- Complex models of pricing for the ultimate sale of the property are options;
- Since all amounts are discounted to today's dollars, they can be added and subtracted;
- Complex modeling of rent streams and lease terminations fundamentally reflects the known rent roll for a property;
- The model permits estimates of future rentals as vacancies appear;
- Capital expenditures common for most real estate projects are extensively modeled;
- The method of accounting does not affect the value; and
- The model allows an investor to more easily determine the costs and benefits of increases or decreases in the time to complete or lease-up the project.

Problems with using an NPV calculation are:

- The discount rate is generally fixed for the entire period[18] while the comparable spot discount rates vary over time;
- In complex examples of limited resources with multiple projects, linear programming is needed to determine the optimum investment; and
- The NPV calculation effectively assumes that monies received during the term of the investment earn an amount equal to the discount rate, which is usually set at the investor's cost of funds. In most short-term environments this investment rate cannot be obtained.

3.3.3. IRR calculation

The IRR method is a variation of the NPV which calculates the discounted cash flow of each and every payment into and out of the project. In fact, the IRR is a specific solution in which the NPV is equal to zero. In other words, the IRR method iteratively calculates the discount rate that leads to an NPV of zero and this becomes the IRR. The major attraction of the IRR is that it reduces to a single number the return on a real estate investment. If the imputed cost of capital to the investor is less than the IRR, then the decision should be to invest in the project. If the imputed cost of capital is greater than the IRR, then the investment should be passed over. For example, if the imputed cost of capital for a REIT is seven percent, then accepting a property with an IRR of 10 percent creates value for the REIT, but a property with a projected IRR of six percent should not be selected as it destroys value.

An IRR calculation assumes that all payments from and additions to the project earn the same rate of return. In reality, the IRR assumption on the earnings on cash distributed to the investor often results in earnings assumptions that cannot be met. For example, if an investor is able to get a 20 percent IRR, the model assumes that the investor can invest all payments received during the investment period at the same 20 percent.[19] In a short-term interest rate environment of three percent, it introduces a distortion to assume that all payments receive the same 20 percent yield. One of the ways to remedy that is to set a re-investment rate that is realistic given short-term rates, and compute a modified IRR. Another issue with an IRR calculation is that, mathematically, every time there is a year in which contributions to the project exceed the return for that year, there is an additional solution to the IRR.[20] In other words, if there is a major capital investment in year two (perhaps to pay for a significant addition to or improvement of the property), the IRR mathematically yields two solutions not one.[21]

3.3.4. NPV vs. IRR

The NPV and IRR are the major methods used in decision-making with respect to real estate. As a result, it is useful to look more deeply into the differences in the two methodologies. Some of the major problems inherent in using an IRR versus the NPV are:

- The IRR mathematically can have multiple rates of return. As described above, there can be more than one solution if there is a year after the initial investment in which more capital is invested than distributed to the investor;
- An investment can have a negative NPV and still have a positive IRR;[22]
- IRR is not as useful a tool when there are competing projects and limited resources. NPV helps allocate among projects to achieve the highest return when there are mutually exclusive investments. Simply investing in a project with the highest IRR is not always the best solution when resources are limited. Maximizing the NPV is a better methodology;
- NPV assumes that any cash distributed to the company is reinvested at the company's cost of capital, while the IRR assumes that such funds are reinvested at the IRR, which is usually significantly higher. When the capital is repaid over a long period of time, this has an even larger effect; and
- Modeling the term structure of discount rates is more complex in doing the IRR calculation.

For all of these reasons many analysts prefer the NPV method to the IRR. Although, as is shown below in Section 4, in actual practice the IRR method was more widely used in the past, it is now second to the NPV analysis. Nevertheless, IRR continues to be a widely discussed comparison tool.

3.3.5. Monte Carlo method

Another method for modeling is the Monte Carlo method. This name was first widely used in modeling the first nuclear weapons tests in the 1940s. Monte Carlo simulations create a model and then feed in random numbers, allowing all parameters to change in some prescribed way for thousands or millions of simulations and derive projected yields, an expected range of values and an estimate of the dispersion of the results. Economists like to determine results when only one factor changes and the other factors remain constant, and often use the term "ceteris paribus" (all other things being the same) to describe it. In a Monte Carlo simulation, many parameters can be modeled and changed simultaneously. The technique is most useful when the mathematical inter relationships are so complex that simulations are needed to give insight as to the results. For example, some derivatives can be valued only when you know the value of the underlying assets for many points in time throughout their history. These "path dependent" derivatives can best be modeled by Monte Carlo simulations. Many retirement plan models now also involve some type of Monte Carlo simulation to determine how likely retirees are to exhaust their resources during their lifetimes under many varying parameters. For retirement plans, among the factors that are varied are the asset allocations, the rates of return and inflation, and the expected lifespan of the retiree.

In real estate, the Monte Carlo method can be applied against the entire project or simply a part, such as determining an expected value and variance or standard deviation of the final sale price of the property. Many variables go into determining the final sale price of the property. Among them are what is the likely discount rate applied by a new purchaser. If interest rates go up, then this discount rate may go up as discussed above. What is the likelihood of a lease being renewed if it expires near the projected sale date, and, if the lease is renewed, then what is the likely distribution of the rent paid by the tenant? What is the likely vacancy rate at the time of sale? All of these can be modeled in a Monte Carlo simulation to determine the expected sale price and statistics about the distribution of that sale price, including possible likely high and low prices.

The strengths of the Monte Carlo method are:

- It allows insights into the range of values that are possible and some idea of their distribution. For example, the final sale price of a project in many models is often one or two projected sale prices. In fact, the projected sale price often extends through a wide band of possible values and the Monte Carlo method may give a deeper understanding of these numbers;
- It allows complex models with intricate interactions that are otherwise difficult to model; and
- By incorporating uncertainty estimates into the model, the Monte Carlo method more accurately models real estate risk.

The weaknesses of the method are:

- Its effectiveness relies on the user having some estimate of the range of individual parameters and their distribution. These estimates are not easy to derive, and the estimates of their dispersion may be extremely inaccurate;
- Technically, many models assume normal distributions of model parameters and that may not be true; and
- Many models assume that the correlation coefficient between parameters is zero when it is not. In fact, changes in one parameter may greatly influence changes in another.[23]

3.4. Allocations of limited resources

An investor would normally accept every project or investment in which the return exceeds its investment criteria as determined by the relevant tests, whether the decision is based upon NPV, IRR, payback or any additional test or combination. These tests determine whether the proposed project, its pricing, and other parameters are profitable enough to undertake. In finance parlance, the required rate of return is often called the "hurdle rate." Undertaking every project in which the return exceeds the required hurdle rate would maximize the investor's wealth. But often that is not enough. Most investors have limited resources and can only deploy so much capital over any given period. The constraint may be the capital itself or, more often, human or other resources. Staffing might permit only one or two major projects to be undertaken even if there is sufficient investment capital. In these circumstances, another primary use of projections and decision-making rules is to allocate resources among potential new investments.

Sometimes, two projects may be mutually exclusive. For example, let's say that a company has turned to constructing office buildings from the ground up because the costs of acquiring existing projects are so high that the expected returns do not exceed the company's hurdle rate. The staff of the company is already operating near capacity and can only undertake one project in the relevant time period. Let's assume that the company has a hurdle rate of 10 percent and the projected cash flows for the two projects are as set forth below:

	Project 1	Project 2
C0	($10,000,000)	($15,000,000)
C1	$12,000,000	
C2		
C3		$22,500,000
IRR	20.00%	14.47%

Here, Project 1 has a higher IRR than Project 2. That would usually be the end of the inquiry. Since, in the example, both projected IRRs exceed the hurdle rate of 10 percent, the company could undertake both projects, but due to the limits, if it uses IRR as the sole decision factor, it will accept Project 1 and bypass Project 2. But that might not maximize the return for the company. In this example, if we compute the NPVs using a 10 percent discount rate, the NPV for Project 2, $1,905,000, exceeds the NPV for Project 1,

$909,000. The NPV calculation means, assuming the projections are accurate, that the company would have increased its net worth and benefited more from doing Project 2. So the NPV calculation would lead the company to accept Project 2. This is a relatively simple example. In the realm of medium-size and larger enterprises, these decision matrices can become enormously complex and involve many inputs. Also, in a larger company, there are even more demands for resources and capital, so strategic planning and logical capital allocation become more important for proper investment decisions.

Another tool used in resource allocation among competing projects is the "profitability index." The profitability index is computed as follows:

Profitability Index = NPV / Investment[24]

Using this system, an investor chooses the project that has the highest profitability index. The result is that each project is ranked in the order of the greatest NPV for each dollar of investment. Using this as a decision tool, an investor would select projects in the descending order of profitability index until all of the capital was allocated. For example, in the problem immediately above in this Section 3.4, Projects 1 and 2 have profitability indexes of .091 and .127 respectively. Thus, the index would lead to a choice of Project 2. The problems with the profitability index are:

- It does not work when there are multiple constraints on resources. In our formulation, the profitability index worked when capital was the sole constraint, and the result allowed the investor to compute which project gave the best return for that constrained resource. If another resource was limited too, then the index would not work; and
- The index also does not work when the restraint applies to more than one period. In the examples above, the sole time period for the constraint was the initial year. If there was a constraint in another time period as well, it could not easily be dealt with by the profitability index.

4. THE METHODS THAT MAJOR COMPANIES USE

Numerous studies have been done on which methods financial managers actually use in capital budgeting and projections.[25] Some of the results are not surprising. Small projects used less sophisticated methods of decision-making, and very small projects might require no formal analysis. But the definition of "very small" varied widely depending on the size of the company.[26] For an individual, any investment could be significant, but for larger companies such analysis might be used only for projects with capital expenditures over $500,000. Even so, for a company with a capital budget of over $1 billion, $500,000 is only five one-hundredths of one percent (.05 percent)—a tiny figure.

PERCENTAGE USE OF BUDGETING TOOLS[27]

Budget Tool	Always (100%)	Often (75%)	Sometimes (50%)	Rarely (25%)	Never (0%)	Always or Often (75%)
NPV	49.8%	35.3%	10.9%	3.0%	1.0%	**85.1%**
IRR	44.6%	32.2%	15.3%	6.4%	1.5%	**76.7%**
Payback	19.4%	33.2%	21.9%	16.8%	8.7%	**52.6%**
Discount Payback	15.5%	22.2%	19.1%	21.1%	22.2%	**37.6%**
Profitability Index	5.9%	15.5%	22.5%	21.9%	34.2%	**21.4%**
Accounting Rate of Return	5.3%	9.5%	18.5%	16.4%	50.3%	**14.7%**

Also not surprising is that many companies use multiple methods of decision analysis. The most popular being the NPV and IRR methods. The chart above summarizes the methods used and their frequency. The results show that NPV and IRR are preferred over all other capital techniques, and their prevalence shows the alignment between theory and practice, while the chart shows that in most cases several methods of analysis were used.

5. PROBLEMS WITH MODELS IN GENERAL

Real estate models are projections based upon estimates of future events and, like all projections, are subject to uncertainties. Only in hindsight can the actual performance of an asset be judged with certainty. Some of the difficulties that affect models are discussed below.

5.1. Unforeseeable events

Sometimes, projections are wrong because events occur that are truly unforeseeable. Hotel performance has suffered since the onset of the pandemic in a way that no one could have predicted in 2019. And sometimes the unforeseeability is debatable. Long-term Capital Management went into a notorious financial meltdown back in 1998 as a result of highly unusual events after the collapse of the Russian bond market.[28] Two Nobel laureates and the legendary trader John Meriwether were key figures in Long-term Capital Management, but they did not see the debacle in their models before it arrived. Upon further review, some analysts suggested that more stress testing could have predicted the problem and more liquidity would have allowed the company to wait out the crisis.[29] Other authors believe that most investors do not adequately account for the part that randomness plays in investments and that these risks of major changes are not adequately built into the pricing of investments.[30] Another way to deal with these unknown risks is to greatly increase liquidity and capital reserves to be able to wait out these often temporary market distortions.[31]

5.2. Unrealistic sale prices

Many modeling problems can be self-induced. In a red-hot market with high real estate prices, analysts are tempted to push the models to justify ever-higher acquisition prices. Since real estate rents are generally slower to react in such a market, the obvious pressure is to assume continued increases in the sale price of the project. In most cases, the success of the acquisition often turns on the sale price obtained at the end because rents and, therefore, cash flow during the holding period, have not escalated as quickly as the property values. In the present era of low cap rates still-high real estate prices, using ending cap rates many years out that are still low by historic standards to calculate the final sale price can be hard to justify. Many analysts often increase the cap rate on the final sale by .5 percent to one percent and think that is conservative, but if the initial price was based upon a discount rate or IRR that was at a 20-year low, wouldn't it be prudent to assume that upon a final sale that discount rate or IRR had returned to more normal historic levels?

5.3. Income and expense growth

Many models have a difficult time modeling the growth rates for income and expense items. The use of rent stops and pass-throughs of most utility and other operating expenses have removed the risk for landlords of past problems in which rapidly escalating utilities, with no ability to pass them to the tenant, turned good investments into bankruptcies. Nevertheless many models project increasing operating efficiencies that will be achieved, but do not create a contingency adequate to cover problems that they did not anticipate. Studies have shown that older buildings have an increasing ratio of expense to income, and these studies, and the costs of aging, are often ignored in the modeling.

5.4. Projected rent increases and lease-up

Often, rent renewal rates or future lease rents are based upon optimistic assumptions that will not be fulfilled. Very few models also show any flat periods of rent growth after maybe the first year or two, even in markets that have historic rent drops and cyclical leasing problems. Models must take into account the local market and its historic cycles. The same is true for the period of lease-up. It often takes much longer than expected to get a new tenant into a space and paying rent. Also, the costs of replacing a single large tenant with multiple tenants, both in terms of time and tenant improvements, is often greater than modeled. A corollary is that many purchasers over-estimate the likelihood that an existing tenant will renew the lease upon expiration. This also produces unrealistic models for tenant turnover costs.

5.5. Vacancy and collection losses

Vacancy rates vary widely over time, yet most models show a fixed percentage for vacancy loses over the entire time of ownership after some re-leasing period. Local models are usually available to better predict these vacancies. Are vacancies shown as five to 7.5 percent after stabilization, when historic vacancies in the locality are often in double digits? Clearly, a property that is entirely net leased to a credit tenant does not have to deal with vacancy, but most rent rolls have to model it.

5.6. Failing to model events after the projected holding period

An ancillary problem to that of unjustifiably increased exit sale price discussed in section 5.2 above is that many models use a simplistic cap rate model to project the sales prices. Typically sales prices are established by capitalizing the last year of net operating income. In many cases, that is fine since the property is already at a stabilized income, but in a large number of properties there is additional information available. Some models do not always take into account known rental information that extends beyond the projected sales date. The more property-specific information used in modeling the sales price, the more reliable the price. For example, if some of the leases run for 15 years, then a specific model of actual rents over for that extended period provides a more accurate reversion sales price. Another possibility is to use Monte Carlo modeling to generate some additional feel for and sensitivity to the likely range of sale values.

6. REAL ESTATE RETURNS IN RECENT TIMES

While it is not the purpose of this article to exhaustively analyze real estate returns, a quick review can provide a baseline for comparison with the results of the real estate projection models. In general, the returns on real estate in the past have substantially outperformed those of stocks, bonds, and government securities. Over the longer term, the performance of real estate has rivaled stock, until the most recent stock run-up beginning in 2019, especially the tech-heavy S&P 500 and Nasdaq. The most widely used index is the National Property Index (NPI). That index is maintained by the National Council of Real Estate Investment Fiduciaries and represents the results of a quarterly survey of institutional holdings of real estate that is unleveraged. In other words, the performance is driven solely by the underlying asset with no boost from loan leverage.

7. SUMMARY

Financial modeling of real estate is still as much an art as a science. Projections using a discounted cash flow, and particularly the NPV and IRR methodologies, are the most widely used. As discussed in detail above, each decision process has its strengths and weaknesses, and most large companies apply more than one form of analysis and decision process to determine whether a project is worth pursuing. Real estate models should use as detailed information as is available to more accurately project future performance. In an era when real estate prices reflect strong demand and ever increasing prices, care must be taken not to push the models too hard to justify the increased price. Particular attention should be given to modeling the final sale of the property because so much of the return on the property is derived from such a sale.

Notes

1 Jeremy J. Seigel, Stocks for the Long Run: The Definitive Guide to Financial Market Returns and Long-Term Investment Strategies (McGraw Hill, 5th ed.).

2 Real cash flows are determined as follows:

Real cash flow = normal cash flow (t)
(1 + inflation rate) where t + number of time periods

3 They are a derivative because for a fixed coupon bond the price changes with interest rates. As rates go up, for example, the price of the bond goes down so that the overall yield matches that required by the market. The fact that the price varies in accordance with another value, here interest rates, means that the price of the bond is a derivative. See Pietro Veronisi, Handbook of Fixed-Income Securities (Wiley 2016) and Bruce Tuckman and Angel Serrat, Fixed Income Securities: Tools for Today's Markets (Wiley, 3d ed. 2012).

4 Ignoring taxes and using annual compounding.

5 Compound interest means that interest earned during a period is added to the principal to which interest is computed on for the next interest period. For example, monthly compounding means that interest is computed each month at 1/12th of the annual interest rate and that interest is added to the principal for each of the 12 months. The effective rate for compounding is equal to (1 + i/n) n, where i = the interest rate and n= the number of compounding periods.

6 As the rate of growth increases so does the impact of compounding. If the rate of increase was 12 percent, then over 1 year the rate of return would be 12 percent if increased annually, but 12.68 percent if compounded monthly.

7 Duff & Phelps, https://www.duffandphelps.com/insights/publications/cost-of-capital/us-normalized-risk-free-rate-lowered-june-30-2020.

8 Duff & Phelps, https://www.duffandphelps.com/insights/publications/valuation/us-normalized-risk-free-effective-september-30-2019.

9 If the two did not have the same price, then an arbitrage opportunity would be available, and there would be a profitable and riskless opportunity to buy and sell the two securities until the prices moved to be the same.

10 These are broad generalizations. Great care must be taken in computing the actual tax effects of any investment. Certain assets in a real estate project are depreciated [at] over different time periods and may be subject to recapture at ordinary income tax rates.

11 These factors also apply to the interest rate related to a particular property or investment.

12 The most widely used estimator of inflation is the CPI, but many economists are critical of that measure. First, it is based upon a hypothetical purchase of a market basket of goods and services. Second, its methodology has been constantly revised in recent years and there is great debate about its accuracy and seasonal adjustments. As a result, many investors have a slightly different measure of projected inflation than those projected by the agencies. Many economists use the "chain deflator" adopted by the US to adjust indicators like the GNP.

13 An example is NCREIF Transaction Capitalization Rate as published by the National Council of Real Estate Investment Fiduciaries. Visit their website at www.ncreif.com.

14 See Chambers, D., Spaenjers, C., & Steiner, E. (2019). The rate of return on real estate: Long-run micro-level evidence from Cornell University, School of Hotel Administration site: https://scholarship.sha.cornell.edu/workingpapers/52.

15 The present value, net present value and internal rate of return formulas and calculations are shown on Exhibit 1.

16 The NPV is really a discounted cash flow model in which the present value of all invested cash is subtracted from the total net present value of payments to the investor.

17 See Richard A. Brealey, Stewart C. Myers, and Franklin Allen, Principles of Corporate Finance (McGraw Hill/Irwin 13th ed. 2019).

18 Although a spreadsheet easily could be devised to use different discount rate for each year during the entire investment term, few models do so. Failing to model the term structure of the discount rate is a simplification that itself can lead to errors, especially when the term structure of interest rates shows a large difference between long-term and short-term interest rates.

19 The NPV assumes that the reinvestment rate during the term of the investment is equal to the discount rate. Since for most successful investments the discount rate is materially less than the IRR rate, the problem of the returns on distributions is greater for an IRR computation than for an NPV computation.

20 For solving for a polynomial, every change in sign yields another solution. See, Principles of Corporate Finance at footnote 15.

21 For example, an investment with annual returns, as follows, has two IRRs:

C0	C1	C2	IRR1	IRR2
($60)	$155	($100)	25%	33.333%

22 For example, an investment with a positive IRR can have a negative NPV:

C0	C1	IRR	NPV(at 12%)
($1000)	$1500	50%	$339
$ 1000	($1500)	50%	($339)

23 A simple example is the flow of traffic on a freeway. Are the number of times drivers use their brakes on a freeway uncorrelated? Some traffic mathematical models assume so, but anyone who has driven on a California freeway intuitively knows that one person hitting the brakes sets off a sea of red brake lights and that there is indeed a correlation.

24 If the investment is not all made at the initial time, then the present value of all investment sums is used as the denominator.

25 Patricia A. Ryan and Glenn P. Ryan, Capital Budgeting Practices of the Fortune 1000: How Have Things Changed, 4 J. Bus. & Mgmt. 355 (Oct. 1 2002) ("Budgeting"), looked extensively at the capital investment analysis habits of the "Fortune 1000." See also, Lawrence J. Gitman and Charles E. Maxwell, Financial Activities of Major U.S. Firms: Survey and Analysis of Fortune's 1000, 14 Fin. Mgmt. 57 (Winter 1985).

26 Budgeting, supra.

27 Id.

28 The flight to liquidity and away from the portfolios of Russian and other illiquid bonds were outside the margins of likely behavior used in the models. Roger Lowenstein, When Genius Failed: The Rise and Fall of Long-Term Capital Management (Random House 2000) (LTCM). See also, Nicholas Dunbar, Inventing Money: The Story of Long-Term Capital Management and the Legends Behind It (Wiley 2000).

29 LTCM, supra.

30 Nassim Nicholas Taleb, Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets (Random House, 2d ed. 2005).

31 In Long-term Capital Management, if they had the capital and liquidity, the investors could have waited out the market and extracted themselves with a profit. Instead, many of them lost all their investment and several, including John Meriwether, had huge personal financial losses. See, LTCM.

EXHIBIT 1
COMPUTATIONS AND EXAMPLES

Present Value

n

$$PV = \frac{o\ Ci}{(1+r)i}$$

i = 1

Where:
Ci = Cash Flow
i = Time period
r = Discount Rate

i	Ci	Ri
1	100	.04
2	100	.05
3	1100	.06

$$PV = \frac{(100 + 100 + 1100)}{(1.05)2\ (1.06)3} = 1.04$$

Net Present Value

Net Present Value (NPV) = n

$$C0 = \frac{o\ Ci}{(1+r)i}$$

i = 0

Where:
C0 = initial investment

i	Ci	Ri
0	(1000)	.04
1	100	.04
2	100	.05
3	1100	.06

If Ci is an investment Ci is negative.

Example 1:

Assume:
Co = -1000
C1 = 100
C2 = 100
C3 = 1100 and
r1 = .05 for all time periods

$$NPV = \frac{-1000 + 100 + 100 + 1100}{(1.05)2\ (1.05)3} = 1.05$$

Example 2

Building Purchase Price = $10,000,000

Cash Flow (after tax)

Year 1	400,000
Year 2	450,000
Year 3	500,000
Year 4	600,000
Net Sale Price (3% annual increase)	11,255,000

Discount Rate = 6%

a. PV of Cash Flow

Purchase Price = -10,000,000/1 = -$10,000,000

Year 1	400,000/1.06	=	377,358
Year 2	450,000/(1.06)**2	=	400,498
Year 3	500,000/(1.06)**3	=	419,810
Year 4	600,000/(1.06)**4	=	475,256
Sale Price	11,255,000/(1.06)**4	=	8,915,014

b. IRR Calculation

IRR = 7.62%

CFO	=	-10,000,0002
C1	=	400,000
C2	=	450,000
C3	=	500,000
C4	=	600,000
Sale	=	11,055,000

c. NPV Calculation

NPV	=		PV[C1 + C2 + C3 + C4 + Sale Price]
Co	+		+ [377,358 + 400,498 + 419,810 + 475,256 + 8,915,014]
	=	-10,000,000	
	=	$587,936	

Analysis:

Based upon assumptions the IRR = 7.62% and the NPV is positive; so the Investor should do project. If, however, the Discount Rate = 8%, the NPV is negative; so the Investor should pass on the property.

Cash-on-cash

400,000 / 10,000,000 = 4%

Payback

Time until payback is four years.

EXHIBIT 2
SELECT ASSET CLASS PERFORMANCE (% ANNUALIZED RETURNS) FOR YEAR ENDING 2018

Asset Class	1 Yr	3 Yr	5 Yr	10 Yr
NCREIF Property Index (NPI)	6.72	7.21	9.33	7.49
S&P 500	4.38	9.26	8.49	13.12
Dow Jones Industrial Average	5.63	5.68	5.53	8.38