Steven Roy Management
Cambyses Financial Advisors, LLC

The Cook's Tour of Real Estate Investment Analysis

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Table of Contents

Income Measurement Basics:

Direct real estate investments derive most of their income from two sources. Those sources reflect the property's ownership cycle: purchase, operate, and sell. In the next few chapters, we develop data analysis skills by "walking through" sample calculations. The model we use is called the "economic investment model." The method parallels the portfolio analysis model used to evaluate many other types of investments, tweaking it to accommodate the peculiar constraints of the real estate market.

Valuing and Purchasing Property – Operating Cash Flow Determines Value:

Look at your investment property purchase as if you were buying the property's cash flow, not the property itself. For the moment, subordinate your emotional and aesthetic preferences and look only at cash flows. Aesthetics play an important role when you validate data. When you purchase property, you concentrate on:

- Net Operating Income (NOI),
- Capitalization Rate (CR),
- Net Present Value of Future Cash Flows (NPV),
- Rates of Return [Return on Equity (ROE) and Return on Investment (ROI)],
- Loan to Value Ratio (LTV), and
- Debt Coverage Ratio (DCR)

Each of these measures tells you something different about how your investments' expected cash flow affects your wealth objective.

Income from Leasing Property - Operating Income:

When you lease property to tenants or provide services to tenants (e.g. laundry, maid service, maintenance, common advertising, internet access, or switchboard services) you receive Operating Income. **Operating Income** is the month-in / month-out income stream that sustains the property (and you) while you own it.

You measure Operating Income in different ways depending on what purpose you intend the measure to serve. You learn to calculate and review several of the most common operating income measures in another installment of this series:

- Net Operating Income (NOI),
- Net Cash Flow (NCF),
- Taxable Net Operating Income (TNOI), and
- After-tax Net Cash Flow (ATNCF)

Income from Selling Property - Disposition or Reversion Income:

Disposition and Reversion are formal names that mean, for our purposes right now, "sell." When you sell some or all of your property you receive **Disposition or Reversion Income**. Dispositions may be

incremental and partial (you sell a partial interest in the property and retain a partial interest) or complete and final (you sell your entire interest in the property).

Like Operating Income, you measure disposition income in different ways for different purposes. You may calculate and review several common disposition measures:

- Cash Proceeds from Sale (CP-Disp),
- After-tax Cash Proceeds from Sale (ATCP-Disp),
- Gain on Sale (Gain-Disp), and/or
- Taxable Gain on Sale (TGain-Disp)

Income Measurement – Procedure and Protocol:

You use essentially the same protocol and procedure whether you are evaluating a potential purchase, assessing an existing investment, evaluating management, or deciding whether to sell, trade, refinance, or continue to hold the property. You eventually evolve your own procedures. Here is an abbreviated version of ours (the one you use in this Section):

Gather, Validate, and Analyze Historic Data:

- Gather historical financial records for the property [balance sheet and income statement, cash flow (statement of changes), tax return data]
- Gather financial records that corroborate key figures in the historical data (rent roll, maintenance records)
- Compile the data in a form that facilitates analysis (Spreadsheets, analysis software, and other things of beauty!)
- Examine the compiled data to identify trends and highlight inconsistencies between different data sources (Trends, or the absence of an expected trend, often reveals more about the data than the numbers themselves.)
- Analyze and resolve any stark differences between historical records from different sources (e.g. between financial statements and tax records)
- Analyze and resolve any stark differences between the corroborating records and the historical data (e.g. between the rent roll and reported gross receipts)
- Assess the financial impact of the differences and adjust the historical data to reflect your findings (this step produces the first of many pro-forma, or estimated, financial statements)
- Ask yourself, is this conclusion reasonable?

Gather, Validate, and Analyze Comparative Market Data:

- Gather comparative market data for similar properties in your area (capitalization rates, occupancy, operating ratios, regional source data)
- Compute operating ratios for both the historical and the pro-forma (adjusted) financial data of the target property
- Compare the comparative market ratios to the property's historical and pro-forma ratios
- Identify, analyze, and resolve stark differences between the comparative data, the historical data, and the pro-forma data (Why has the property performed differently from other local properties?)
- Assess the financial impact of the differences and adjust the pro-forma data to reflect your findings (We preserve the property's historical financials but are less precious about the many pro-formae we generate in the course of the analysis)
- Ask yourself, is this reasonable?

Analyze Proposed Ownership and Use Changes:

There is some science and a good deal of art involved in this step.

- Determine how changes of ownership might affect the historical data
- Determine how proposed use-changes affect the historical data
- If the proposed ownership and use changes differ radically from the property's historical ownership and repeat the Comparative Market analysis – basing your adjustments on the new ownership and use
- Adjust the pro-forma data to reflect changes in ownership and use
- Ask yourself, is this reasonable?

Your pro-forma operating statements now reflect:

- A single period (presumably the "next" fiscal period that concerns you),
- Local market conditions, and
- Your operating strategy for the property.

Most of the critical investment performance parameters for your property (e.g. Capitalization Rate, Fair Market Value, Loan to Value, Debt Coverage Ratio) can be calculated based on the information you now have. Hence, many investors, brokers, and analysts stop here.

When you make relatively simple go-or-no-go decisions (buy or do not buy a particular property), this analysis level is probably sufficient. (We stop here more often than not.)

When you seek more sophisticated answers (How does this plan affect my wealth maximization, risk minimization, or retirement goals 10 years from now?) supplement the single-period analysis with a multi-period approach:

Multi-Period Investment Analysis:

- Pick a planning "horizon" (typically, a number of years, dictated by what you are analyzing)
- Estimate how key operating variables change each period from now until the horizon (due to inflation, predictable market shifts, demographics, etc.)
- Prepare a spreadsheet that computes pro-forma operating results for each period
- Compute investment parameters (ROI, ROE, IRR, and NPV) that summarize the cash flows
- Test to see how sensitive the model is to changes in revenue and cost behavior assumptions

We explore the possibilities and limitations of investment measures (and how they affect your protocol and procedure) in later installments. Before then, a few observations:

- Continuously review and revise your pro-forma as you acquire new data and ideas. The protocol and procedures are considerably less linear than our recitation implies.

- The amount of attention you pay to details and accuracy depends on the importance of the decision, the consequences of error, and the reliability of the data.

- Your "first blush" analysis of any property is generally based on a seller's (or the seller's broker's) data. Be inherently skeptical.

- Envision as many uses for the property as you can and project the operating results based on each of them. Some alternative use may be far superior to the property's current use.

- Do not confuse "sophisticated" with "meaningful." Sometimes, ad-hoc adjustments are just as useful, and a whole lot cheaper than, sophisticated estimates.

- Realize that data projected far into the future is inherently less reliable than current data.

Measuring Operating Income:

Net Operating Income:

Net Operating Income (NOI) is the heart and soul of property investment analysis! It is the starting point for all other measures of Operating Income, and the benchmark number for valuation calculations. Spend a great deal of "due diligence" determining, analyzing, and validating NOI. Why? Because, if you do not get this right, everything else you do is just arithmetic. NOI is your primary benchmark for:

- Evaluating the property's performance
- Comparing it to other, similar properties, and
- Valuing the property for disposition, insurance, property tax or other purposes.

Net Operating Income (NOI)

Net Operating Income (NOI)	=	Gross rents and service fees from tenants
	Less	Costs of operating the property e.g. accounting, advertising, bank charges, commissions, gardening, janitorial, plumbing, maintenance, security, property tax
	But Not	Interest or principal on debt service, depreciation, and income taxes

Net Cash Flow (NCF) and After-Tax Net Cash Flow (ATNCF):

Net Cash Flow (NCF) and **After-tax Net Cash Flow (ATNCF)** measure "how much is left" after all the bills have been paid and 1) the monthly mortgage satisfied {Net Cash Flow (NCF)} and 2) the tax-man takes his bite {After-tax Net Cash Flow (ATNCF)}.

Net Cash Flow (NCF)

Net Cash Flow (NCF)	=	Net Operating Income (NOI)
	Less	Total Debt Service (interest and principal)
	But Not	Depreciation, or income taxes

After-tax Net Cash Flow (ATNCF)

After-tax NCF (ATNCF)	=	Net Cash Flow (NCF)
	Less	Income Taxes paid by the investor
	But Not	Depreciation

Investors often view NCF and ATNCF as "annuities" that:

- Preserve, upgrade, or pay for the property,
- Provide a cash return on the investment in the property while it is under their stewardship and awaiting disposition. (Investors often adopt the position: "Everything I have is for sale – if the price is right."), and
- Provide capital for their next investment

Taxable Net Operating Income (TNOI):

Like many concepts that employ the word "Taxable," **Taxable Net Operating Income (TNOI)** is an artificial and malleable construct that serves only one purpose; It measures how much of the property's income the tax agencies tax.

Taxable Net Operating Income

Taxable NOI (TNOI)	=	Net Operating Income (NOI)
	Less	Interest on debt secured by the property, and
	Less	Tax Based Depreciation on structures and improvements (not land) associated with the property
	But Not	Principal payments on debt secured by the property, or income taxes

TNOI may be taxed by the

- Federal Government (Through the Internal Revenue Service and Department of the Treasury),
- State Governments {41 states have personal income taxes that resemble or mirror the Federal Income Tax and are administered by Departments of Revenue or Franchise Tax Boards. Seven states (Alaska, Florida, Nevada, South Dakota, Texas, Washington, and Wyoming) have no personal income tax. Two states (New Hampshire and Tennessee) tax only dividends and interest}, and
- City and County Governments (City and County income taxes are often disguised as "license and permit fees" instead of income taxes).

Different priorities among Federal, State, and local agencies and within the same agency at different times created a multitude of variations on this measure. The model we use in this study is the current (2020) Federal model. The Federal model is also the most common model employed by states, counties, and cities – although exact calculations differ between them.

Operating Income occurs throughout your holding period and is typically measured and reported monthly or annually. Dispositions usually happen only once, marking the end of your tenure in the

property. Notwithstanding, investors periodically estimate disposition proceeds on a hypothetical basis – using the result to make disposition and refinance decisions.

Measuring Disposition Income:

Measuring Cash from Sales:

Cash Proceeds on Sale (CP-Disp) and **After-tax Cash Proceeds on Sale** (ATCP-Disp) measure the amount of cash you receive by selling the property.

Both Cash Proceeds and After-tax Cash Proceeds are influenced by your property's refinance history. If you refinance your property you receive cash and reduce your investment. If you sell the property before you repay the refinanced debt, the debt will be settled before your share of the cash proceeds is distributed. In effect, refinancing expedites your cash distribution from the property disposition.

Investors combine appraisal, WAG, and SWAG[1] estimates with accounting data to estimate Cash Proceeds and After-tax Cash Proceeds and to identify refinance opportunities, insurance exposure, tax exposure and the best time to sell, trade or refinance their property.

Cash Proceeds from Disposition (CP-Disp)

Cash Proceeds from Disposition (CP-Disp)	≡	Stated sales price of the property
	Less	Expenses you incur to sell the property e.g. accounting, advertising, commissions, title transfer, banking fees, escrow fees, inspections, notaries, and other fees (limited only by the collective imagination of the real estate agents, banks, and escrow companies involved)
	And Less	The outstanding balance of any debt secured by the property

After-tax Cash Proceeds from Disposition (ATCP-Disp)

After-tax Cash Proceeds from Disposition (ATCP-Disp)	≡	CP-Disp
	Less	Federal, State, and Local income* taxes on your Gain from Disposition (TT-Disp)

* Transfer taxes are a component of CP-Disp. ATCP-Disp reflects the additional effect of income tax exactions. CP-Disp is similar for all investors in the property or entity. ATCP-Disp may be different for each and every investor. Procedurally, you must determine Taxable Gain from Sale and its components before you determine ATCP-Disp.

[1] WAG (Wild A…. Guess) and SWAG (Scientific Wild A…. Guess) are venerable techniques that probably do not get the attention they deserve from investment writers. The authors are disinclined to depart from that tradition.

Measuring Gain:

Cash proceeds measures tell you how much cash you receive when (if) you sell your property. Neither of the most common Cash Proceeds measures depends on the purchase price of the property or the cost of improvements you made to the property. Hence, neither Cash Proceeds measure answers one of your most important questions about the sale: How much did I make while I held the property?

Estimate **Gain on Sale** (also called Gain on Disposition) (Gain-Disp) and **Taxable Gain on Disposition** (TGain-Disp) to evaluate investment returns and their tax impact during the time you own the property.

Gain from Disposition (Gain-Disp)

Gain from Disposition (Gain-Disp)	=	Stated sales price of the property
	Less	Expenses you incur to sell the property e.g. accounting, advertising, commissions, title transfer, banking fees, escrow fees, inspections, notaries, and other fees (limited only by the collective imagination of the real estate agents, banks, and escrow companies involved)
	And Less	The original purchase price of the property (including expenses you capitalized at the time of the purchase)
	And Less	The cost of improvements and upgrades you made to the property while you owned it.

Taxable Gain from Disposition (TGain-Disp)

Taxable Gain (TGain-Disp)	=	Adjusted Sales Price
	Less	Adjusted Basis in the property

Where

Adjusted Sales Price	=	Stated sales price of the property
	Less	Expenses you incur to sell the property e.g. accounting, advertising, commissions, title transfer, banking fees, escrow fees, inspections, notaries, and other fees (limited only by the collective imagination of the real estate agents, banks, and escrow companies involved)

And

Adjusted Basis	=	Stated purchase price of the property when you purchased it
	Plus	Expenses you incurred (and capitalized) at the time of purchase to secure and perfect title to the property.
	Plus	The cost of improvements you made to the property while you owned it. (Unless those improvements were "inadvertently" offset against operating income when they were incurred. This subject is material, but not discussed here – except in a brief comment below.)
	Less	The greater of • Tax Depreciation claimed on the property and improvements while you owned them, or • Tax Depreciation that <u>should/could</u> have been claimed on the property and improvements while you owned them.

Unlike the Cash Proceeds measures, neither Gain on Disposition nor Taxable Gain on Disposition is influenced by the property's financing history.

Use estimated Gain on Sale, together with appraisal data, to compare one property with another and to determine which of your properties are performing best in their markets.

Real Estate Financial Analysis Basics:

Stability and Sustainability:

Both you, as an Investor, and your bankers need methods to assess the stability and sustainability of your real estate investments.

Former Federal Reserve Chairman Alan Greenspan once observed: "fear is far more potent than euphoria." Except during periods of "unreasonable euphoria" bankers' hard-won experience holds sway over financial analysts' "scientific" approaches to the subject of real estate investment stability. You and your banker use underwriters' rules of thumb regarding Debt Coverage Ratios (DCR) and Loan to Value (LTV) to evaluate your investment's stability. We will not spend a great deal of time on other approaches.

The rules of thumb are far more pervasive and usually more persuasive than analysis of variance or portfolio risk assessments.

Debt Coverage

The **Debt Coverage Ratio** (DCR) measures the amount of "spare change" you expect the property to generate. The Debt Coverage Ratio summarizes the extent to which the property can operate either under-tenanted or over-budget and still service its own debt. You and your bankers have an obvious interest in making this safety cushion as large as possible. Most often, bankers require at least a 20%-30% cushion before they loan on commercial property.

Debt Coverage Ratio

Debt Coverage Ratio (DCR)	=	Net Operating Income (NOI)
	Divided By	Total Debt Service (Interest + Principal)

The DCR cushion places the first of two limits on how much you can borrow and how much interest and debt service you can "afford."

Loan to Value

Bankers' **Loan to Value (LTV)** criteria completes the picture. Loan to Value (LTV) is a "leverage ratio." LTV measures the margin between the amount of money a hypothetical sale would generate, and the amount of money required to retire the loans you owe on the property. For a mature investment property, bankers usually prefer a Loan to Value (LTV) less than 70% of the property's Fair Market Value.

Loan to Value (LTV)

Loan to Value (LTV)	≡	Loan Amount
	Divided By	Fair Market Value of the Property
Loan to Value (LTV)	≤	70% (0.70)

- For bankers, a low LTV (less than 70%) provides a comforting answer to the question: "If I have to foreclose, will I get my money back?"
- For investors, a low LTV indicates: "If I sell the property, I'll have some money left over after the sale." It also implies you have sacrificed some financial leverage to salve the banker's ulcers.

Because of banker's safety concerns, commercial properties are typically less leveraged than personal residential properties. Often, you maintain the leverage on a commercial property at approximately the same level for as long as you own it.

Logically, Debt Coverage Ratio (DCR) and Loan to Value (LTV) mirror the structure of measures you have already encountered.

- The Debt Coverage Ratio (DCR) is an operating ratio. It summarizes, in a single number: Net Operating Income (NOI), Net Cash Flow (NCF), and After-tax Net Cash Flow (ATNCF).

- Loan to Value (LTV) is a strategic ratio. It encapsulates Cash Proceeds, After-tax Cash Proceeds, and Gain on Disposition.

We revisit Debt Coverage Ratio (DCR) and Loan to Value (LTV) in Later installments. In the interim, here is a closer look at how you determine the Fair Market Value (FMV) of your property.

Capitalization Rate - Assessing Your Deal

Sometimes, it is nice to know you closed on a great deal! Capitalization rates (cap rates) routinely provide just such warm-fuzzy assurance.

The **Capitalization Rate (CR)** is expressed as a percentage – the ratio between Net Operating Income (NOI) and property value (or sale price).

Capitalization Rate (CR – or "Cap Rate")

Capitalization Rate (CR)	≡	Net Operating Income (NOI)
	Divided By	Fair Market Value of the Property

If you estimate that an office property will generate Net Operating Income of $90,000 annually, and the seller wants no less than $1,000,000 for the property, then the seller's Capitalization Rate is 9 (90,000/1,000,000 expressed as a percentage).

Investors often deploy Cap Rate estimates in statements like: "I got a cap rate of 15!" or (my personal favorite) "One point two (1.2) is a great cap rate – in this market." when gloating over a (possibly) great price (cap rate = 15) or justifying a (probably) outrageous one (cap rate = 1.2).

As you might suspect however, there is more to this metric than cocktail chatter and bragging rights. If you probe some of Cap Rate's deeper sensibilities, it reveals itself as something more than a standard line in a singles ad:

- The Capitalization Rate (more precisely, 1 divided by the Cap Rate) tells you how fast the property's Net Cash Flow pays for the property. (Logically, if you recover 12.5% of the purchase price in NOI each year, it takes eight years to recover 100% of the purchase price.)

  Looking at three examples:
  - Cap Rate = 15 → the property pays for itself in about 7 years
  - Cap Rate = 9 → make that 11 years
  - Cap Rate = 1.2 → your great-great grandchildren can burn the mortgage in 85 years

- The Capitalization Rate tells you how your property's income stream compares to other assets' income streams. Citing just the most obvious example: Ask yourself if you would happily put your money in a ten-year Certificate of Deposit that paid 1.2% (interest penalty for early withdrawal, yadda yadda yadda).[2] So, why would you take the risk of commercial property investment for the same return? (You may already know the answer to that one!)

    - Hint 1: Cap Rates reflect only the property investment's current income stream – not the potential to increase the income stream.
    - Hint 2: Cap Rates reflect only the property investment's current income stream – not the investment's potential appreciation.
    - Hint 3: Odds are, the low Cap Rate investment is fairly safe, the high Cap Rate investment, not very.

- After you do your homework, the Capitalization Rate tells you something about the risk level and volatility of your property's income stream. Remember Uncle Dave's sage generalization – "Higher yield means higher risk?" If you look at any single investment Uncle Dave if probably right! Assuming that your homework indicates that the Cap Rate you have calculated is appropriate for the property, what do our three examples tell us?

    - Cap Rate = 1.2 → This investment is probably Gold Standard. You may never have to worry about your tenant missing a lease payment.
    - Cap Rate = 9 → White bread investment at its finest. About average historical risk and return for commercial property investments.
    - Cap Rate = 15 → Look for things the Seller's broker does not want you to know!

If you turn the Cap Rate equation on its algebraic head, the same formula gives you an estimate of your property's Fair Market Value:

Fair Market Value (FMV)

Fair Market Value of the Property (FMV)	≡	Net Operating Income (NOI)
	Divided By	Capitalization Rate (CR)

To use this observation effectively, access a database of recently sold commercial properties in your area. By "mining" the data in the database, you are able to answer several of the most important questions that affect your investment:

- How much should I pay for this property?
- How much is this property worth?
- How much should I sell this property for?

[2] When we first wrote this material in 2006 a rate that low would have been unthinkable. In the 2020 environment, it almost sounds like a good deal, doesn't it?

Professional Appraisers spend a great deal of time estimating and validating Capitalization Rates. Shouldn't you? You learn what influences Cap Rate and how to evaluate them in later installments.

Measuring Performance

So far, all the metrics we have discussed are "comparative static" measures. They measure a specific aspect of investment performance at a point in time. That is, the cash flow, income, and disposition measures we have developed reveal "how much" income (or cash flow) a property generates (or may generate).

As an Investor you also need measures that tell you:

- "How soon will my investment generate a reasonable return?"
- "How much will it cost to get there?"
- "How does my investment compare to my other options?"

Four measures assess these "dynamic" performance issues:

- Internal Rate of Return (IRR)
- Net Present Value (NPV)
- Return on Investment (ROI), and
- Return on Equity (ROE)

Internal Rate of Return (IRR)

To use the **Internal Rate of Return (IRR)** method:

1. Choose a planning horizon that suits your investment objectives (e.g. 7 or 10 years from now) and divide it into time periods (e.g. yearly or monthly) to produce a "time series."
2. Estimate the cash flows needed in each time period to purchase, operate, or dispose of the property. Information you develop about Net Operating Income and Cash Proceeds from Sale are the crucial components.
3. Calculate an "interest rate" (the internal rate of return, or IRR) that exactly balances the present value of cash inflows against the present value of the cash outflows.
4. Compare the calculated IRR to similar properties (and to your expectations) to facilitate purchase, operation, or disposition decisions.

The IRR method's arithmetic and algebra are daunting. There is no analytic algebraic solution to the equations that define IRR. You find a solution by trying a series of solutions to see which one comes closest (a process called, by mathematicians, iteration, by most of the rest of us, hunt-and-peck). Hence, the IRR method is almost always done using spreadsheets (*Excel*) or specialized programs[3] (e.g. Argus). You learn to use these devices in later installments.

[3] In theory, you can also do this analysis on your HP-12CP or a similar calculator. We do not recommend it! The 12C's IRR function is "error intolerant." The amount of data you have to input virtually guarantees you make errors. At best, you have to start over. At worst, you will not notice you have made an error until you have done a whole lot of unnecessary agonizing over an answer that makes no sense.

Net Present Value (NPV)

The **Net Present Value (NPV)** approach turns the IRR method on its head.

1. Choose a planning horizon that suits your investment objectives (e.g. 7 or 10 years from now) and divide it into time periods (e.g. yearly or monthly) to produce a "time series."
2. Estimate the cash flows needed in each time period to purchase, operate, or dispose of the property. Information you develop about Net Operating Income and Cash Proceeds from Sale are the crucial components.
3. Specify a rate of return (sometimes called the "hurdle rate") that you think (for one reason or another) is acceptable. The hurdle rate you choose should inculcate your (and other investors') expectations and be based on realistic assessments of similar properties.
4. Use the hurdle rate to "discount" each of the cash flows to its "Present Value." Sum the present values to calculate "Net Present Value" of all the cash flows.
5. Compare the calculated Net Present Value to 0.00. If the property's performance exceeds your expectations, NPV is positive (present value of cash inflows exceeds present value of cash outflows). If not, NPV is negative (present value of cash outflows exceeds present value of cash inflows).

Arithmetically and algebraically, Net Present Value calculations are considerably easier to perform than Internal Rate of Return calculations. All it takes is a bit of care and a whole lot of patience. Still, spreadsheets are probably your best answer. Since they use the same data set, we suggest you perform both the calculations in the same spreadsheet.[4]

Return on Investment (ROI) and Return on Equity (ROE)

Internal Rate of Return (IRR) and Net Present Value (NPV) are well adapted to answer the questions:

- "How soon will my investment generate a reasonable return?"
- "How does my investment compare to my other options?"

However, the two method's cash flow and cash flow timing emphasis addresses the remaining question only indirectly:

- "How much will it cost to get there?"

The **Return on Investment (ROI)** and **Return on Equity (ROE)** approaches address this question more directly – at the expense of some precision with respect to the first two questions.

The Return on Investment (ROI) and Return on Equity (ROE) approaches each begin with a measure of the resources that are committed to the project.

[4] Under most conditions, the IRR and NPV methods are mathematically "congruent." i.e. If you analyze several sets of data and rank them by IRR or NPV (e.g. highest to lowest) the preference order is usually the same. Thus, the two methods usually suggest the same decision. The two measures do, however, convey a slightly different sense of the investment. Hence, we suggest that you compute both.

- The ROI approach begins with the total purchase price or Fair Market Value of the property.
- The ROE approach typically starts with your (or your bankers') equity commitment.

A measure of the project's cash flow is then compared to resource commitments, allowing you to evaluate dispositions, operations, or (with a bit more sophistication) both. Typically:

- ROI methods use your anticipated purchase price, sales price, or Gain on Sale (Gain-Disp) to evaluate dispositions.
- They use Net Cash Flow (NCF) or Net Operating Income (NOI) to evaluate ongoing operations,

- ROE methods use Cash Proceeds from Disposition (CP-Disp) or After-tax Cash Proceeds for Disposition (ATCP-Disp) to assess dispositions,
- ROE methods use Net Cash Flow (NCF) or Net Operating Income (NOI) to assess operations.

Use a simplified Return on Investment (ROI) and Return on Equity (ROE) approach "on the fly" to assess project feasibility in the field. Eventually, combine your field estimates with additional data and more sophisticated Net Present Value (NPV) or Internal Rate of return (IRR) models to "fine tune" the assessment when you return to the office.[5].

[5] IRR and NPV approaches are computation intensive. Therefore, they are seldom used for field estimates.

Quick Review – Investment, Interest, and "Time Value of Money" Concepts

Interest and the "time value of money" form the foundation for most financial analysis.

We already observed that receiving a dollar today is worth more than a promise to receive a dollar tomorrow. We call the difference between the two values interest.

- Interest is rent paid for the use of money.

Interest has many things in common with rent. The amount of interest (I) you pay depends on:

- How much money you use (the Principal Amount = P),
- How long you use it (the Term = T), and
- How much you pay to "rent" it each period (the Rate =R)

Simple Interest: In the simplest case – which is called "Simple Interest" – the interest charge is:

Simple Interest Formula
I ≡ P x T x R

Interest (I)	≡	Principal (P)
	Times	Term (T)
	Times	Rate (R)

Suppose, for example, that you borrow $10,000 for one year, and that the lender charges 7% per year for the money. How much will you pay to "rent" the banker's money for one year?

Simple Interest Example
I ≡ P x T x R = $10,000 x 1 year x 0.07 per year = $700

Interest (I)	≡	Principal (P)
	Times	Term (T)
	Times	Rate (R)
	=	$10,000
	Times	1 Year
	Times	7% per year (0.07/year)

Logically, the answer is the same ($700) if you rephrase it as: "How much would I earn if I invest $10,000 for one year and earn 7% per year?"

Future Amount: You could extend your analysis to include the questions: "How much must I pay to retire the debt and accumulated interest at the end of the loan?" "How much will I receive if I liquidate the investment and the interest it earns?" Again, the answer to this "Future Amount" question is the same whether you are borrowing or investing the funds:

Future Amount Formula[6]

FA ≡ P + I = P + (P x T x R) = [1 + (R x T)] x P

Future Amount (FA)	≡	Principal (P)
	Plus	Interest
Future Amount (FA)	=	[1 + (R x T)]
	Times	Principal (P)

From which you conclude:

Future Amount Example

Future Amount (FA)	=	P + I
	=	$10,000 + $700 = $10,700
	=	[1 + (R x T)] x P
	=	[1 + (0.07 per year x 1 year)] x $10,000
	=	1.07 x $10,000 = $10,700

Present Amounts: Change your focus just a little and consider two new questions: How much can I borrow now if I want to pay a particular amount sometime in the future? How much should I deposit now if I want to accumulate a particular amount at some time in the future?

The answers to these questions are logically and algebraically related to what you already know:

Logically:

- My deposit (D) grows to [1 + (R x T)] x D between now and the time I liquidate it.
- The future amount I want (FA*) has to equal [1 + (R x T)] x D.
- So, D must equal FA* divided by [1 + (R x T)]

Algebraically:

Present Amount Formula

Desired Future Amount (FA*)	=	D + I
	=	D + (D x T x R)
	=	[1 + (R x T)] x D

So

Deposit or Present Amount (D or PA)	=	FA* / [1 + (R x T)]

[6] We use parentheses to define the order of operations, even when they are not necessary. We hope this makes the algebraic logic more transparent.

To see how this works, imagine that you want to accumulate a fund that has $20,000 in it when you liquidate it two years from now. If you think the fund may yield 8% per year:

Present Amount Example

Deposit or Present Amount (D or PA)	≡	FA* / [1 + (R x T)]
(D or PA)	=	$20,000
	Divided By	[1 + (R x T)] = [1 + (0.08 x 2)]
(D or PA)	=	$20,000
	Divided By	1 + 0.16 = 1.16
(D or PA)	=	$17,241.38

Compound Interest – Present and Future Values: Multi-period simple interest calculations are more an intellectual exercise than a practical one. In today's real world, multi-period investments (loans) receive (charge) interest on a "compound interest" basis. The compound interest computation builds on the model you already know:

1. Start with a principal amount,
2. Compute the interest on the principal for one period,
3. Add the principal and interest together,
4. Compute the interest on the sum for one period,
5. Add that amount to the sum,
6. Compute the interest on your running sum for one period,
7. Add it to the running sum,

Continue to compute and accumulate interest on the running sum for each period until you liquidate the investment (pay off the loan). Compound interest calculations assume that you receive (pay) interest in the current period on the interest that you received (paid) in all of the previous periods. I.e. you "pay interest on the accumulated interest."

How does this affect the way we calculate present and future amounts? Let's look at how much a deposit accumulates on a period by period basis. The first period is easy: Starting with Principal = P_0, use the simple interest formula to compute the interest for period one (I_1) at rate R. (throughout our series of calculations, we compute interest for one period at a time, so T = 1 in every period). Add the first period interest (I_1) to starting principal (P_0) to determine how much is in the fund at the end of the first period:

Beginning Principal	Interest Added	Interest so Far	Ending Principal
P_0	$I_1 = P_0 \times R$	$I_T = I_1$ $I_T = P_0 \times R$	$P_1 = P_0 + I_1$ $P_1 = P_0 + (P_0 \times R)$ $P_1 = P_0 \times (1 + R)$

Except for the additional subscripts, this looks suspiciously like your simple interest formula! The difference between the two approaches begins to emerge in the second period: In the second period, we start with Principal = P_1:

Beginning Principal	Interest Added	Interest so Far	Ending Principal
P_1 $P_1 = P_0 + I_1$ $P_1 = P_0 \text{ x } (1 + R)$	$I_2 = P_1 \text{ x } R$ $I_2 = P_0 \text{ x } (1 + R) \text{ x } R$	$I_T = I_1 + I_2$ $I_T = (P_0 \text{ x } R) +$ $[P_0 \text{ x } (1 + R) \text{ x } R]$ $I_T = P_0 \text{ x } [R +$ $(1 + R) \text{ x } R]$	$P_2 = P_0 + I_1 + I_2$ $P_2 = P_0 + (P_0 \text{ x } R) +$ $[P_0 \text{ x } (1 + R) \text{ x } R]$ $P_2 = P_0 \text{ x } [1 + R +$ $(1 + R) \text{ x } R]$ $P_2 = P_0 \text{ x } [1 + 2R +$ $R^2]$

Applying what little we remember of high school algebra, the expression $[1 + 2R + R^2]$ is a quadratic equation whose factors are both (1 + R). Thus, the rather complicated looking expression for P_2 simplifies to $P_2 = P_0 \text{ x } (1 + R)^2 = P_1 \text{ x } (1 + R)$. Indeed, we could extend this even further:

- $P_3 = P_2 \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^2 \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^3$
- $P_4 = P_3 \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^3 \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^4$
- $P_5 = P_4 \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^4 \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^5$
- … ad infinitum -- $P_n = P_{n-1} \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^{n-1} \text{ x } (1 + R) = P_0 \text{ x } (1 + R)^n$

And

- $I_{T, n} = P_n - P_0 = P_0 \text{ x } (1 + R)^n - P_0 = P_0 \text{ x } [(1 + R)^n - 1]$

We find these results surprisingly useful:

- How much must I deposit today to pay off a balloon note for $1,000,000 ten years from now, if I expect the funds to grow at 8% per year? (What is the present value of $1,000,000 ten years from now, if I expect the funds to grow at 8% per year?)

  $P_{10} = \$1{,}000{,}000 = P_0 \text{ x } (1 + R)^{10} = P_0 \text{ x } (1 + 0.08)^{10} = P_0 \text{ x } 2.16$
  $P_0 = P_{10} / 2.16 = \$1{,}000{,}000 / 2.16 = \$463{,}193$

  How much interest will I have earned?

  $I_{T, 10} = P_{10} - P_0 = \$1{,}000{,}000 - \$463{,}193 = \$536{,}807$

- If I deposit $ 1,000,000 today, how much will I have in ten years if I expect the funds to grow at 6% per year? (What is the future value of $1,000,000 ten years from now, if I expect the funds to grow at 8% per year?)

  $P_{10} = P_0 \text{ x } (1 + R)^{10} = \$1{,}000{,}000 \text{ x } (1 + 0.06)^{10} = \$1{,}000{,}000 \text{ x } 1.79 = \$1{,}790{,}848$

How much interest will I have earned?

$I_{T,\,10} = P_{10} - P_0 = \$1{,}790{,}848 - \$1{,}000{,}000 = \$790{,}848$

It is also instructive to see how this result compares to the result if the investment pays simple interest:

- How much must I deposit today to pay off a balloon note for $1,000,000 ten years from now, if I expect the funds to grow at 8% per year, assuming simple interest?

  $PA \equiv P / [1 + (R \times T)] = \$1{,}000{,}000 / [1 + (0.08 \times 10)] = \$555{,}555$

  How much interest will I have earned?

  $I_{T,\,10} = P_{10} - P_0 = \$1{,}000{,}000 - \$555{,}555 = \$444{,}445$ (~ 83% of compound interest)

- If I deposit $ 1,000,000 today, how much will I have in ten years if I expect the funds to grow at 6% per year, assuming simple interest?

  $FA \equiv [1 + (R \times T)] \times P = [1 + (0.06 \times 10)] \times \$1{,}000{,}000 = \$1{,}600{,}000$

  How much interest will I have earned?

  $I_{T,\,10} = P_{10} - P_0 = \$1{,}600{,}000 - \$1{,}000{,}000 = \$600{,}000$ (~ 75% of compound interest)

Does anyone still wonder why banks prefer to charge compound interest? Hang on: "Cuz' b-baby, you just ain't seen n-n-nothin' yet."[i]

Annuities; Present and Future Value: The compound interest formulas you just developed allow you to answer even more complicated questions:

- If I deposit D dollars at the beginning of each period for N periods, how much will I have in the fund, assuming a compound yield = R? (A Future Value question)

- How much should I deposit at the beginning of each of N periods if I want to accumulate a fund that contains G dollars assuming a compound yield = R? (Another Future Value question)

- If I have G dollars in hand right now, assuming a compound yield = R, how much can I draw from the fund at the end of each period for N periods so that the fund will be exhausted at the end of the payments? (A Present Value question)

- How much should I pay right now, assuming a compound yield = R, to receive a stream of N payments of D dollars? (Another Present Value question) This question plays a key role in determining the purchase price of your investment properties. Phrased another way; How much should someone give me right now, assuming a compound yield = R, to receive a stream of N payments of D Dollars from me? (The basic mortgage question)

A series of equal payments, at set intervals, that bears a constant interest rate is called an annuity. If the annuity payments occur at the beginning of each period (rent, for example), the annuity is called an "annuity due." If the annuity payments occur at the end of each period (mortgage payments, for example), the annuity is called an "ordinary annuity."

Let's look first at the **Future Value of an Annuity Due.** Logically:

- Your first deposit to the annuity grows for a total of N periods,
- Your second deposit to the annuity grows for N - 1 periods,
- Your third deposit to the annuity grows for N - 2 periods,
- …
- Your next-to-last deposit to the annuity grows for two periods, and
- Your last deposit to the annuity grows for one period.

Using the compound interest formula you developed in the last section,

Deposit Number	Earns Interests for ___ Periods	And Accumulates To ___ at the end of period N
1	N	$D \times (1 + R)^N$
2	N – 1	$D \times (1 + R)^{(N-1)}$
3	N – 2	$D \times (1 + R)^{(N-2)}$
…	…	…
N – 1	2	$D \times (1 + R)^2$
N	1	$D \times (1 + R)$

Thus, we determine how much will be in the fund at the end of N periods (the Future Value of the Annuity – FVA) by adding up the amount accumulated by each deposit:

$$FVA_D = [D \times (1 + R)^N] + [D \times (1 + R)^{(N-1)}] + [D \times (1 + R)^{(N-2)}] + \ldots + [D \times (1 + R)^2] + [D \times (1 + R)]$$

Or

$$FVA_D = D \times \sum_{M=1}^{N} (1 + R)^M$$

Good luck doing that arithmetic on your calculator – even if you know the answer:

$$FVA_D = D \times (1 + R) \times \{[(1 + R)^N - 1] / R\}$$

Determining the **Present Value of an Ordinary Annuity** is equally daunting:

- Your first payment to (or from) the annuity occurs 1 period from now,
- Your second payment to (or from) the annuity occurs 2 periods from now,
- Your third payment to (or from) the annuity occurs 3 periods from now
- …
- Your next-to-last payment to (or from) the annuity occurs N - 1 periods from now, and

- Your last (Nth) payment to (or from) the annuity occurs N periods from now.

Payment Number	Occurs ___ Periods From Now	Its Present Value Is
1	1	$D / (1 + R)$
2	2	$D / (1 + R)^2$
3	3	$D / (1 + R)^3$
…	…	…
N – 1	N-1	$D / (1 + R)^{(N-1)}$
N	N	$D / (1 + R)^N$

Sum of the present values for each payment to get:

$$PVA_O = \frac{D}{(1+R)} + \frac{D}{(1+R)^2} + \frac{D}{(1+R)^3} + ... + \frac{D}{(1+R)^{N-1}} + \frac{D}{(1+R)^N}$$

$$PVA_O = D \times \sum_{M=1}^{N} \frac{1}{(1+R)^M}$$

This, just in case you are curious, reduces to:[ii]

$$PVA_O = D \text{ x } \{[1 - (1 / (1 + R)^N)] / R\}$$

Back in the olden' days analysts and Realtors carried books of "interest rate and loan factors"[iii] that helped them look up answers instead of solving complex algebraic problems (some of which could only be solved by iteration).

Today we perform interest and present value calculations using one-or-more:

- Financial calculators: Hewlett Packard's HP-12CP ($60 - $85) or Texas Instruments BA-II Professional Financial Calculator ($40 - $75) – We use the HP-12CP to illustrate calculations in the Toolbox. The HP-12CP is the de-facto standard for financial services professionals.

- Spreadsheet programs; Microsoft's *Excel*, almost exclusively

- On-line Financial Calculators: There is a plethora of them, some good-some abysmal. Many are restricted to particular types of calculation, and a substantial number of them are entry points for "service offers" from their sponsors. We do not use any of them in the Toolbox.

- Specialized Real Estate Investment programs; ARGUS is the most prominent – the price tag is staggering, and the software is worth it! We occasionally illustrate calculations in the Toolbox using ARGUS. If you plan to make a living analyzing commercial real estate you eventually need to learn the ins and outs of ARGUS.

Introduction to Financial Calculators and Spreadsheets:

Hewlett Packard's HP-12CP: We use **Hewlett Packard's HP-12CP** to illustrate calculations. Here are some things you should know about the HP-12CP:

- The HP-12CP is the de-facto standard for financial services professionals. Introduced in 1981, the calculator quickly captured the lion's share of the financial services market. The original chipset was so advanced that HP retained the design unchanged until 2006. The 2006 chip set is approximately 6 times as fast as the original, has about 80 times its memory, and allows data transfer and archiving.

- The HP-12CP seems to be virtually indestructible. I (SJR) am still using the one I purchased – complete with 24-month warranty - on 08/27/1982.

- There are a number of on-line simulators that mimic the HP-12CP. Some of them, particularly those that display a record of your keystrokes, are very good learning tools.

- There are innumerable books and manuals that tell you "how to use the HP-12CP" Many of the manuals are very good.[iv] Ironically, Hewlett Packard's own manual still contains several errors (mostly sins of omission), and sometimes takes-the-long-road when a shorter calculation sequence is possible.

- Trivia time: According to HP, many users associate a vertical shape with "calculator," and a horizontal shape with "computer." The HP-12CP's layout was designed to feel like a computer to users and to summon the same image for users' customers when they see them using it.

On its face, the HP-12CP looks almost as forbidding as the algebra.

The 12CP has over 120 built in functions that calculate everything from declining balance depreciation to means and standard deviations.

- You will probably never use most of them!
- Learn to use spreadsheets to avoid the data entry process for some of them!
- You will use a few of them constantly!

In earlier versions of this piece, we included an extensive discussion of the HP12C notation convention known as Reverse Polish Notation. New versions of the HP12C, including the HP12CP allow you to use the more conventional algebraic entry system… thus obviating the need for the RPN discussion in this and future editions. Old hands, like Steven, will probably miss that HP12C backward logic – but we doubt anyone else will.

The Microsoft Excel Spreadsheet: Since the demise of Borland and Novell, Microsoft's *Excel* spreadsheet has become the industry standard. Indeed, very few competing products remain on the market.[7]

[7] Purists are sure to point out that Borland's *Quaatro* spreadsheet software suite is still available through Corel software. Microsoft's *Excel*, however, has captured over 95% of the market. *OpenOffice* is an open source program that can read and

Excel's complement of advanced data and printing features (particularly some of those added in the 2007 and 2013 editions) compensate for many of its annoying inadequacies. We do not have room here to teach you how to use *Excel*. There are a number of very good sources of that information elsewhere.[v] We, however, offer a few suggestions and comments:

- *Excel*'s financial functions use most of the same conventions as the HP-12CP (cash inflows are positive, cash outflows negative).

- Some versions of *Excel* consider the "Analysis Pack" that contains financial and statistical functions to be an add-on. If you use Microsoft's "Typical Installation" pattern, the financial and statistical functions may not load during the initial set-up. Add them by accessing the <Tools><Add-Ins> menu and clicking the Analysis Pack and Analysis Pack VBA boxes. You may also enable the Conditional Sum, Look-up, and Solver wizards at the same time.

- *Excel*'s Workbook-Worksheet format allows you to create data entry pages that are separate from your calculation and presentation pages. We recommend you put all your variable data in one (or several) Worksheets at the "front" of your Workbook and confine your calculations and results to the "back" of the Workbook. This facilitates data entry and lets you "protect" calculation worksheets from accidental (or intentional but ham-handed) alterations.

- *Excel*'s built in rounding and truncation algorithms sometimes lead to annoying glitches – e.g. a column of displayed numbers that does not equal the sum that *Excel* computes for it. To avoid, or at least control, make use of *Excel*'s ROUND(), ROUNDUP(), and ROUNDDOWN() functions. Our computation motto: Round early, Round often.

- Try to avoid "non-linear" computations – those in which a cell formula refers to cells that are not above and to the left of the cell you are working in. De-bugging non-linear computations can be both frustrating and un-rewarding. You can often avoid non-linear references by repeating the same result in several places in your spreadsheet. Memory and processing speeds make this much more practical than it used to be.

- Multiple branched IF propositions can often be simplified using the MAX and MIN functions. (branched IF propositions are common in financial decision applications)

We point out important *Excel* functions throughout the next few chapters.

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write *Excel* files. *Excel*'s market dominance limits your options in another way as well – you will not be able to exchange files in any format that *Excel* cannot read/write. The person you send the file to will probably not have your software and will not be able to open the files. *OpenOffice, Quaatro,* and a smattering of rich internet applications are *Excel*'s sole competitors.

You can mimic *Excel*'s functions in most database programs, but it is usually not worth the effort to do so unless you need to integrate an extensive reference database at the same time. You can convert *Excel* files to database files, but the resulting flat-file structure is usually not as efficient as a custom database application.

Real Estate Investment Software, ARGUS, and Friends: If *Excel* is the eight-hundred-pound-gorilla of spreadsheets, ARGUS[vi] is the Golden Lion Tamarin[8] of real estate analysis software. ARGUS applications permit you to perform many real estate investment tasks with a minimum of brain strain. ARGUS includes solutions for:

- Acquisition and Disposition Analysis
- Asset and Portfolio Management
- Budgeting and Forecasting
- Development and Construction Planning
- Property Management and Accounting
- Valuation and Appraisal

So, why not use ARGUS and skip the rest of this book?

- ARGUS is expensive – each module costs between $1,500 and $7,000. The full suite costs in excess of $15,000. Therefore, it is not a viable software solution unless you plan to do a great deal of analysis.

- ARGUS requires some sophistication and training. It is not a "take it from the box and use it" software. It can do so much you will probably never use all of its functions.

- ARGUS hides many of its calculations. Therefore, it is not a great learning tool if you want to understand the calculations and procedures as well as use them.

- AEGUS is still using technology and database concepts that are 15 years out of date, including only limited ability to use it in anything but a "desktop" mode.

If you continue your real estate investment career you need to learn to use ARGUS (or some similar package). [vii] However, we will not spend a lot of time on the software in this work.

[8] The Golden Lion Tamarin (*Leontopithecus rosalia*) or Golden Marmoset, is a small monkey native to the Atlantic coastal forests of Brazil.

End Notes and References

[i] Bachman Turner Overdrive, the "Not Fragile" album published by Island/Mercury Records in 1974 included the hit single "You Ain't Seen Nothing Yet"

[ii] For the mathematically inclined, the term $\sum_{M=1}^{N} \frac{1}{(1+R)^M}$ comprises the first N elements of the Taylor series $\sum_{M=1}^{\infty} \frac{1}{(1+R)^M}$ $= \frac{1}{R}$, for any 0 < R < 1. The value of the series' tail, $\sum_{M=N+1}^{\infty} \frac{1}{(1+R)^M} = \frac{1}{(1+R)^N} \times \frac{1}{R}$ (the present value of the entire series, if the series commences N+1 periods from now). Subtracting the value of the tail from the entire series' value and rearranging the terms yields the parenthetic expression $\{[1 - (1 / (1 + R)^N)] / R\}$ that appears in the PVA_O formula.

[iii] These books have largely gone the way of the dinosaur. If you want one, you will probably have to settle for a used copy – available through Amazon.com: e.g. Jack C. Estes and Dennis R. Kelley; *McGraw-Hill's Interest Amortization Tables*; McGraw Hill, 1992 – 46 available at $0.01 each. There are very few sources of similar tables available on-line. It has become easy to do the calculations instead. We know of no one who grieves for their passing.

[iv] Hewlett-Packard Company, *HP-12CP Solutions Handbook* (1984) and their *HP-12CP Owner's Handbook and Problem-solving Guide* are available on-line. Albert Santi, *The HP-12CP Real Estate Solutions Manual: An Easy-To-Use, Step-By-Step Guide*, Probus Pub. Co. (1990); and Chris Coffin, Ted Wadman, *An Easy Course in Using the HP-12CP and Other HP Financial Calculators*, Grapevine Publications (1984)

[v] Microsoft's own publishing company, MSPress, offers a good introduction: Curtis D. Frye, *Microsoft® Office Excel® 2013 Step by Step*, as does Cengage Press, *Microsoft® Excel® 2013 Introductory*. The "For Dummies" series includes Greg Harvey's, *Excel 2013 for Dummies*. A quick trip to your local bookstore will probably give you ten to twenty titles to choose from.

[vi] Argus Software (Formerly Realm Software Solutions): http://www.argussoftware.com/en/default.aspx

[vii] If you would like to try ARGUS, get a copy of David M. Geltner, Norman G. Miller, Jim Clayton, and Piet Eichholtz, *Commercial Real Estate Analysis and Investments (with CD-ROM),* South-Western Educational & Professional – about $120. It includes a "student version" of ARGUS.