features

Where the Overall Cap Rate Meets the Discount Rate

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abstract

This article explores the relationship between the overall capitalization rate (R_o) and the discount rate (Y_o). It illustrates how value equivalency can be achieved between direct capitalization and yield capitalization (i.e., discounted cash flow) when the anticipated percentage change in annual net operating income (*NOI*) is made to correspond to the spread between a uniquely paired R_o and Y_o. A number of investor survey simulations are performed as further support for the premise that each uniquely paired R_o and Y_o is linked by the corresponding income-growth factor, and illustrates that investor surveys can be reliably used as a source for uniquely paired R_os and Y_os in the application of the income capitalization approach.

Property that is capable of generating rental income, and for which an investor represents the most likely purchaser, warrants use of the income capitalization approach as the principal valuation model for ascertaining market value. In the income capitalization approach, the future income that a property is expected to generate is converted into an expression of current (present) value. There are two primary methods by which income streams can be converted into an expression of value:

- application of an **overall capitalization rate**[1] (R_o) in direct capitalization, which is a method used to convert an estimate of a single year's income expectancy into an indication of value in one direct step, either by dividing the income estimate by an appropriate rate or by multiplying the income estimate by an appropriate factor;[2] and
- application of a **discount rate**[3] (Y_o) in yield capitalization, which is a method used to convert future benefits, typically a periodic income stream and reversion, into present value by discounting each future benefit at an appropriate yield rate.[4]

As stated in *The Appraisal of Real Estate*,[5]

> Either direct capitalization or yield capitalization may correctly produce a supportable indication of value when based on relevant market information derived from comparable properties, which should have similar income-expense ratios, land value-to-building value ratios, risk characteristics, and future expectations of income and value changes over a typical holding period. A choice of capitalization method does not produce a different indication of value under this circumstance.

1. The overall capitalization rate is defined as "[a]n income rate for a total property interest that reflects the relationship between a single year's net operating income and the total property price or value." Appraisal Institute, *The Appraisal of Real Estate*, 12th ed. (Chicago: The Appraisal Institute, 2001), 489.
2. Ibid., 529.
3. The discount rate as used here is "[a] rate of return on capital, usually expressed as a compound annual percentage rate. A yield rate considers all expected property benefits, including the proceeds from sale at the termination of the investment." Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 4th ed. (Chicago: The Appraisal Institute, 2002), 315.
4. *The Appraisal of Real Estate*, 549.
5. Ibid., 529-30.

Sophisticated investor-purchasers of large income-producing properties in major urban centers show a preference for discounted cash flow analysis (yield capitalization), while those investing in small income-producing properties in secondary markets rely primarily on direct capitalization. However, both capitalization techniques are interrelated and when properly executed produce similar value estimates.[6]

An annual income pattern that is relatively stable year to year, as in the case of an established income-producing property, may be processed into an expression of value by direct capitalization. Under this scenario, anticipated first-year income is directly processed into value in one step, and the result can be proven to be synonymous with that obtained in a zero-growth discounted cash flow (DCF)[7] model where the forecasted yearly income streams and reversion are expressed in today's dollars.

Start-up real estate operations generally show both real income growth prior to achieving stabilized occupancy and income increases subsequent to stabilization, and typically are valued by use of a DCF model. However, through an adjustment process, it is possible to employ a modified direct capitalization model and obtain the same indication of value. To illustrate the correlation between direct capitalization and DCF valuation techniques, a number of examples have been developed.

Overall Capitalization Rate Derivation

Overall capitalization rates extracted from comparable income-producing property transactions that would appeal to the same category of prospective purchaser provide the most compelling indication of investor expectations.[8] A market-derived R_o for use in direct capitalization must be applied using a consistent measure of net operating income (*NOI*).[9] A market-derived R_o can be characterized as follows:

- The R_o is a rate of return on the entire purchase capital without regard to the contributor of the purchase price (i.e., equity investor or mortgage lender).
- The R_o is not affected by the composition of debt and equity comprising the purchase price (i.e., allocation of debt and equity).
- The R_o is an income rate for a total property that reflects the relationship between a single year's net operating income and the total property price or cash-equivalent property price.
- The R_o does not explicitly consider projected future income or changes in property value over time.
- The R_o does not explicitly measure profitability in terms of specific investor assumptions.
- The R_o represents the going-in rate of return on the investment at the time of acquisition.
- The R_o has a corresponding reciprocal net income multiplier (i.e., an R_o of 12.5% equates to a multiplier of 8.0 [100 ÷ 12.5] times net operating income).

Direct Capitalization Model – Overall Capitalization Rate (R_o)

Assuming that the amount of income from a property in Year 1 is $1,000,000, the indicated value of the income stream capitalized in perpetuity at a market-derived R_o of 10% is $10,000,000, calculated as follows:

Year 1 Income:	$1,000,000
Overall Capitalization Rate (R_o):	10%
Indicate Property Value:	$10,000,000
($1,000,000 ÷ 0.10 = $10,000,000)	

Zero-Growth Discounted Cash Flow Model – Discount Rate (Y_o)

By using a 10-year zero-growth DCF model and discounting both the yearly income streams of $1,000,000 and the reversionary value of the property at the rate of 10%, the indicated value of the property is $10,000,000. The reversionary value of the property at the end of Year 10 has been determined by taking Year 11 income of $1,000,000 and capitalizing it in

6. *The Appraisal of Real Estate* states: "Capitalization in perpetuity can be considered a property valuation model or an income valuation model. If, for example, a property is expected to generate level net operating income for a finite period of time and then be resold for the original purchase price, the property could be valued with capitalization in perpetuity simply by dividing the expected periodic income by an appropriate discount rate. In this model the discount rate [Y_o] and the overall capitalization rate [R_o] are the same because the original investment is presumed to be recovered at the termination of the investment." *The Appraisal of Real Estate*, 560.
7. DCF analysis is defined as "a procedure in which a yield rate is applied to a set of projected income streams and a reversion to determine whether the investment property will produce a required yield given a known acquisition price. If the rate of return is known, DCF analysis can be used to solve for the present value of the property." *The Appraisal of Real Estate*, 569.
8. Published investor surveys that track R_os for various sectors of the real estate market can be used to confirm the magnitude of R_os extracted from comparable sales, or the surveys can be used as a primary source of capitalization rate selection when there is a shortage of market-extracted returns from comparable sales.
9. *NOI* is defined as "[t]he actual or anticipated net income that remains after all operating expenses are deducted from effective gross income, but before mortgage debt service and book depreciation are deducted; may be calculated before or after deducting replacement reserves." *The Dictionary of Real Estate Appraisal*, 195.

perpetuity at 10%. Table 1 details the zero-growth DCF model, with income fixed at $1,000,000 annually and without an allowance for anticipated inflation.

Direct capitalization and zero-growth DCF produce identical value estimates because in each model the income is equal, equidistant, and received at the end of the year.[10] In direct capitalization the pattern of income is implied (not apparent), whereas in zero-growth DCF the pattern of income is explicit. As for a reversionary interest, it is only evident in the DCF model, where there is an assumed disposition of the property at the end of Year 10 with a present value of $3,855,433 and accounting for 38.55% of the indicated property value of $10,000,000.[11]

Concept of Perpetuity

Another way of expressing the equivalency in value is through the concept of perpetuity. An R_o of 10% is analogous to a net income multiplier[12] or factor of 10.0 (present value [PV] factor of 1 per year in perpetuity). The value of 1 per annum for any holding period less than perpetuity can be expressed as a ratio of the factor for the holding period to the factor in perpetuity applying the same interest/discount rate. The present value of 1 per annum for 10 years, discounted at 10% indicates a factor of 6.14457, which as a function of the 10.0 factor for 1 per annum in perpetuity is equal to 61.45%. The 61.45% corresponds to the 61.45% that the present value of the 10-year income stream ($6,144,567) bears to the indicated property value of $10,000,000 ($6,144,567 ÷ $10,000,000). The residual value of 1 per annum not accounted for by the 10-year factor for 1 per annum is simply the difference between the perpetuity factor of 10.0 and the 10-year factor of 6.14457, being 3.85543 and representing 38.55% of the perpetuity factor. As noted, the residual value of 1 per annum at 38.55% of the perpetuity factor is similar to the percentage of 38.55% that the present value of the reversion ($3,855,433) bears to the indicated property value of $10,000,000 ($3,855,433 ÷ $10,000,000).

Illustrating the concept of perpetuity, Table 2 demonstrates that the PV factor in each year can be summed at any point along the timeline to indicate the cumulative value of any income stream discounted at 10% as a percentage of total property value. For example, at the end of Year 5, the income stream accounts for 37.91% of the total property value, with the residual value (i.e., reversion) representing 62.09% (100.00% – 37.91%) of the total property value.

Over 10 years the income stream accounts for 61.45% of the total property value, and the residual (i.e., reversion) represents 38.55% of the total property value.

A valuation model premised on direct capitalization produces the same value result as a zero-growth discounted cash flow model, and R_o equals Y_o. The next step is to inject an inflationary or growth component into the DCF model to illustrate the interrelationship between the overall capitalization rate (R_o) and the discount rate (Y_o).

Table 1 Zero-Growth Discounted Cash Flow Model—Without Inflation

Year	Net Income	Present Value Discounted @ 10%
1	$1,000,000	$909,091
2	1,000,000	826,446
3	1,000,000	751,315
4	1,000,000	683,013
5	1,000,000	620,921
6	1,000,000	564,474
7	1,000,000	513,158
8	1,000,000	466,507
9	1,000,000	424,098
10	1,000,000	385,543
Subtotal		$6,144,567
Reversion	$10,000,000	$3,855,433
Indicated Property Value		$10,000,000

10. John B. Major, "Cap Rates and Income Multiples with Different Rates of Growth and Financing," *The Real Estate Appraiser & Analyst* (Fall 1990): 45-52.

11. A holding period of any duration in a zero-growth DCF model will not change the estimate of value, but simply redistribute the proportion of value attributable to the income streams during the holding period and attributable to the reversionary value of the investment at the end of the holding period.

12. The net income multiplier is "[t]he relationship between price or value and net operating income expressed as a factor; the reciprocal of the overall rate [R_o]." *The Dictionary of Real Estate Appraisal*, 194.

Table 2 Discounted Present Value

Year	PV Factor of 1 @ 10%	Cumulative Value
1	0.90909	9.09%
2	0.82645	17.36%
3	0.75131	24.87%
4	0.68301	31.70%
5	0.62092	37.91%
6	0.56447	43.55%
7	0.51316	48.68%
8	0.46651	53.35%
9	0.42410	57.59%
10	0.38554	61.45%
Plus: Reversion	(100.0% – 61.45%)	38.55%
Total Value		100.00%

Inflation and Appreciation

A distinction must be made between inflation and appreciation or real value enhancement. The distinction between these two driving forces is described in the following definitions:

> **Inflation** is "[a]n erosion of the purchasing power of currency characterized by price escalation and an increase in the volume of money, i.e., the proliferation of monetary units and consequent decline in the value of each unit. Inflation tends to increase discount rates because investors require a higher nominal rate of return to offset the loss in value due to inflation."[13]

> **Appreciation** is "[a]n increase in property value resulting from an excess of demand over supply.[14]

In the context of income growth projections applied in income capitalization, making explicit provision for expected inflation will cause income and value to grow nominally without an actual increase in real value. Only realized income-growth projections that exceed inflationary expectations will lead to real enhancements in income growth and property value. During periods of anticipated low inflation, the spread between R_os and Y_os is minimized; the reverse holds true during periods of anticipated high inflation. In a noninflationary environment with no expectation of appreciation in income and property value, R_o and Y_o should be equal.

Bridging the Inflation Gap[15]

Assuming that the first-year income of $1,000,000 in the previous example is increased by 5% (the anticipated rate of inflation) to $1,050,000, the capitalization rate of 10% must be increased by the same magnitude to maintain both the same level of purchasing power and value. The overall capitalization rate must be adjusted to 15%, calculated as follows:

Overall Capitalization Rate (R_O):	10%
Plus: Inflation Rate:	5%
Adjusted Capitalization Rate (10 % + 5% = 15%)	15%

The adjusted capitalization rate is now synonymous with a discount rate of 15%, including a protective rate of 5% against the eroding effect of anticipated inflation.

In the inflation-driven DCF analysis shown in Table 3, the reversionary or terminal value of the property is $16,288,946. Year 11 income of $1,628,895 (Year 10 income of $1,551,328 increased by 5%, corresponding to the annual rate of inflation) was capitalized in perpetuity at 10% (consistent with the going-in capitalization rate of 10%).

Compared to the zero-growth 10-year DCF analysis employing a discount rate of 10%, the indication of value is identical. Increasing the discount rate from 10% to 15% in the inflation-driven DCF analysis neutralized the impact of inflation imputed at 5%, compounded annually. The same indication of value in the inflation-driven DCF analysis can also be achieved in one step by applying the frozen cap rate formula.[16] While both value estimates are identical ($10,000,000), in the zero-growth DCF analysis the present value of the 10-year income

13. *The Dictionary of Real Estate Appraisal*, 146.

14. Ibid., 17.

15. Whenever the DCF valuation model assumes an inflationary component as part of the forecasted periodic income stream, the discount rate must always be greater than the corresponding overall capitalization rate used in the direct capitalization valuation model ($Y_o > R_o$).

16. Income and value to increase @ 5% per annum, indefinitely, and to yield 15%: the frozen cap rate is 10% (15% – 5% = 10%). Applying the frozen cap rate of 10% to an annual income of $1,000,000 in Year 1 indicates a value of $10,000,000, the same result as in the zero-growth DCF and the direct capitalization models.

Table 3 Inflation-Driven DCF Model

Year	Net Income	Present Value Discounted @ 15%
1	$1,000,000	$869,565
2	1,050,000	793,951
3	1,102,500	724,912
4	1,157,625	661,876
5	1,215,506	604,321
6	1,276,282	551,772
7	1,340,096	503,792
8	1,407,100	459,983
9	1,477,455	419,985
10	1,551,328	383,465
Subtotal		$5,973,622
Reversion	$16,288,946	$4,026,378
Indicated Property Value		$10,000,000

stream and reversion account for 61.45% ($6,144,565) and 38.55% ($3,855,432) of the value estimate compared to 59.74% ($5,973,622 ÷ $10,000,000) and 40.26% ($4,026,378 ÷ $10,000,000) of the value estimate in the inflation-driven DCF analysis.

Real Rate of Return

Inflation is an important consideration in the development of prospective yield rates anticipated by real estate investors. The objective behind every investment is to ensure that its value is sustained or enhanced over the holding period. Whether employing direct capitalization using an overall capitalization rate (R_o) or DCF using a discount rate (Y_o), the value estimate should be similar and provide the investor with the same real rate of return after taking into account the impact of inflation.

A comparative analysis of discount rates between mutually exclusive real estate investments cannot be reconciled unless the inherent assumption about the rate of inflation in each investment is addressed. The following two mutually exclusive but similar real estate investments are expected to yield 15% over a holding period of 10 years, and the anticipated compound annual rate of inflation is 5% for Investment A and 6% for Investment B:

Investment	Yield Rate (Y_o)	–	Inflation Rate	=	Real Rate of Return
A	15%		5%		10%
B	15%		6%		9%

After adjustment of each yield rate (Y_o) to reflect the corresponding rate of inflation, Investment A is shown to provide the greater real rate of return (10%). It is the real rate of return (i.e., the return on investment adjusted for inflation) that measures purchasing power and investment performance.

Discount Rate Selection in Discounted Cash Flow

Much of the appraisal literature on DCF links the selection or construction of Y_o to the anticipated or implied annual income growth factor in combination with the going-in R_o at stabilized occupancy. A market-derived R_o can be directly applied in an income capitalization model such as direct capitalization. Extracting a Y_o from comparable investment property sales for use in a yield capitalization model (such as DCF), however, is a more challenging and complex exercise. Discount rates in the form of prospective overall yield rates (Y_o) extracted from recent sales of comparable real property cannot necessarily be directly applied for use in a specific discounted cash flow valuation. The anticipated pattern of future income growth is an important link in selecting the appropriate discount rate (Y_o). A market-derived Y_o is extracted by Fisher[17] using as an example a property selling for $300,000 with an expected *NOI* of $36,000 during the first year of ownership with the buyer indicating an expected increase in income and value of 3% per year over a 5-year holding period. As income and value are expected to change annually at a constant ratio (*CR*) of 3% and the going-in R_o is 12% ($36,000 ÷ $300,000), the implied Y_o is 15%. (12% + 3% = 15%).

If two other investors were prepared to purchase the same property at the same price of $300,000, but anticipated income and value to change at annual compound rates of 4% and 5% respectively, the cor-

17. Clifford E. Fisher Jr., *Rates and Ratios Used in the Income Capitalization Approach* (Chicago: Appraisal Institute, 1995), 37.

responding Y_os would be 16% and 17%, while the R_o would remain unchanged at 12%. It becomes evident that a particular investment property acquisition can reflect an infinite number of prospective Y_os greater than the R_o, with the magnitude of the Y_os entirely dependent on the annual income growth factor (*CR*). The standard equation is $R_o + CR = Y_o$ in the three scenarios reveals the following Y_os:

Scenario	Overall Cap Rate (R_o)	+	Income Growth (*CR*)	=	Overall Yield (Y_o)
A	12%		3%		15%
B	12%		4%		16%
C	12%		5%		17%

In this investment example it also means that the reversionary or terminal capitalization rate (R_N) is equal to the going-in R_o. For the going-in R_o to be meaningful as a component measure of the Y_o and as a proxy for the (going-out) terminal capitalization rate, first-year *NOI* must reflect stabilized occupancy, and the annual rate of change in income and property value must be presumed to remain constant during and after the holding period. The going-out terminal capitalization rate on disposition of the property is also the next investor-purchaser's going-in capitalization rate.

As applied to a specific valuation by DCF, on the basis of the three investment scenarios presented, a Y_o of 17% would be warranted only if the annual income growth factor were 5%. Likewise, a Y_o of 16% would be warranted only if the annual income growth factor were 4%. Either pairing will produce the same indication of value and R_o of 12%. However, the inappropriate pairing of an annual income growth factor of 5% with a Y_o of 15% would result in an over-valuation of the property and reflect an R_o of 10%. Conversely, the inappropriate pairing of an annual income growth factor of 3% with a Y_o of 17% would result in an undervaluation of the property and reflect an R_o of 14%. The Y_os extracted from actual sales or obtained from investor surveys are a prospective measure of investment performance incorporating explicit investor assumptions of future income growth and changes in property value.

Real Estate Investor Surveys

Surveys that monitor investor expectations of discount rates (Y_os), going-in capitalization rates (R_os), reversionary or terminal capitalization rates (R_Ns), investment holding periods, and assumed or implied annual income growth rates (i.e., combined rent and expense inflators[18]) are commonly relied upon by appraisers and analysts for use in DCF valuation modeling. Improper linkage of the annual income growth factor between the R_o and the Y_o can cause a distortion in value when using DCF as the valuation model.

Investor surveys often reflect prospective overall yields (i.e., discount rates) that are less than the corresponding going-in capitalization rates and annual income growth factors combined ($Y_o < R_o + CR$). Some of the reasons for the mathematical inequality are as follows:

- The expenses are inflated at a higher compound annual percentage than revenues throughout the holding period.
- The assumed annual vacancy rate fluctuates (i.e., not at stabilized occupancy) throughout the holding period.
- The actual or assumed lease rollovers include provision for leasing commissions and/or tenant inducements.
- The reversionary or terminal capitalization rate is greater than the going-in overall capitalization rate (i.e., $R_N > R_o$).
- The reversionary value or deemed disposition price at the end of the holding period includes a provision for selling costs (i.e., real estate commission).
- The revenues and reversionary value are expected to decline over the holding period.

Any one of these assumptions underlying the DCF valuation model will cause the discount rate (Y_o) to be less than the going-in overall capitalization rate and the income growth factor combined ($Y_o < R_o + CR$).

Reliability of Investor Surveys

A growing number of analysts and appraisers are relying on investor surveys as the primary source of their global input assumptions in DCF valuation modeling. Appraisal literature on the reliability of investor surveys is virtually nonexistent. Numerous

18. Sometimes rents and expenses are inflated at different percentages, for which the percentage change in net income from Year 1 to Year 2 and from Year 10 to Year 11 can be averaged for use as the constant ratio (*CR*) in the expansion of an R_o to a Y_o in DCF valuation. For example, rent inflated at 5% coupled with a 40% expense ratio inflated at 6% will cause net income to grow by 4.3333% from Year 1 to Year 2 and by 4.2282% from Year 10 to Year 11, averaging 4.28%. Assuming an R_o of 10%, combined with a *CR* of 4.28%, the indicated Y_o is 14.28%.

investor surveys that cover various categories of income-producing real estate are readily available for most major urban centers throughout North America. Secondary real estate markets are not typically covered. Some investor surveys are available at no charge, while others can be obtained only through paid subscription. Surveys obtained through paid subscription are more comprehensive in their coverage of investment criteria and investment trends. Reliance on, and the proper use of, any investor survey requires an understanding of the following:

- the number and composition of survey participants
- the geographical location (state or province) of each sector of the real estate market covered by the survey
- the category or product, grade or quality, and locational attributes (e.g., downtown, suburban) of each sector of the real estate market surveyed
- the manner in which measures of financial performance such as overall capitalization rates (going-in and terminal), and discount rates (overall yields) are derived
- the investment holding period for each category of real estate surveyed
- the global composite annual average income growth assumption throughout the holding period (Some surveys show annual inflators separately for rentals and expenses.)
- the manner in which the implied reversionary or terminal value of the investment has been estimated, and what, if any, disposition costs are to be incurred
- whether reserves are included for R_O survey data

Provided the investor survey is representative of the type of income-producing property being appraised and consistent with the prospective-purchaser profile, it is possible to simulate the investor-specific inputs and measure the degree of reliability of the survey results. For illustration purposes, inputs were taken from investor surveys of three categories of income-producing properties (Suburban Office, Community Shopping Center, Multi-Tenant Industrial) and prepared at two different times by the same company. The reported going-in capitalization rate, the reversionary or terminal capitalization rate, the compound annual income inflator, the discount rate, and the holding period of the investment (10 years) form the basis of the inputs of the investor survey simulation for each category.

The inputs were applied to an assumed stabilized Year 1 *NOI* of $1,000,000 for each property type (Suburban Office, Community Shopping Center, Multi-Tenant Industrial), and in every simulation the internal rate of return (*IRR*) actually generated exceeded the reported discount rate (overall yield). The results of the investor survey simulations are summarized in Table 4 and shown in detail in Table 5.

Table 4 Summary of Investor-Survey Simulations

Set I	**Suburban Office**	**Community Shopping Center**	**Multi-Tenant Industrial**
Assumed stabilized *NOI* (Year 1)	$1,000,000	$1,000,000	$1,000,000
Reported R_O	9.30%	9.75%	9.33%
Indicated property value	$10,752,688	$10,256,410	$10,718,114
Reported holding period	10 years	10 years	10 years
Reported annual *NOI* inflator	2.40%	2.43%	2.65%
Implied reversionary property value	$13,068,563	$12,355,387	$13,530,639
Implied ann. prop. val. growth rate	1.97%	1.88%	2.36%
Calculated *IRR*	11.42%	11.83%	11.79%
Reported discount rate	11.10%	11.54%	11.05%
Difference (understatement)	(0.32%)	(0.29%)	(0.74%)

Set II	**Suburban Office**	**Community Shopping Center**	**Multi-Tenant Industrial**
Assumed stabilized *NOI* (Year 1)	$1,000,000	$1,000,000	$1,000,000
Reported R_O	9.82%	10.14%	9.46%
Indicated property value	$10,183,299	$9,861,933	$10,570,825
Reported holding period	10 years	10 years	10 years
Reported annual income inflator	2.21%	2.21%	2.21%
Implied reversionary property value	$12,057,414	$11,772,234	$12,223,233
Implied ann. prop. val. growth rate	1.70%	1.79%	1.46%
Calculated *IRR*	11.71%	12.08%	11.19%
Reported discount rate	11.43%	11.68%	10.86%
Difference (understatement)	(0.28%)	(0.40%)	(0.33%)

Table 5 Investor-Survey Simulations—Detail

		Suburban Office	Community Shopping Center	Multi-Tenant Industrial
Assumed net operating income (Year 1)		$1,000,000	$1,000,000	$1,000,000
Reported overall capitalization rate (R_O)		9.30%	9.75%	9.33%
Indicated property value		$10,752,688	$10,256,410	$10,718,114
Reported compound annual income inflator (*CR*)		2.40%	2.43%	2.65%
Net operating income (Year 11)		$1,267,651	$1,271,369	$1,298,941
Reported terminal capitalization rate (R_N)		9.70%	10.29%	9.60%
Reversionary property value		$13,068,563	$12,355,387	$13,530,639
Implied change in property value		21.54%	20.47%	26.24%
Compound annual change in property value		1.97%	1.85%	2.36%
NOI:	Year 1	$1,000,000	$1,000,000	$1,000,000
	Year 2	1,024,000	1,024,300	1,026,500
	Year 3	1,048,576	1,049,190	1,053,702
	Year 4	1,073,742	1,074,686	1,081,625
	Year 5	1,099,512	1,100,801	1,110,288
	Year 6	1,125,900	1,127,550	1,139,711
	Year 7	1,152,922	1,154,950	1,169,913
	Year 8	1,180,592	1,183,015	1,200,916
	Year 9	1,208,926	1,211,762	1,232,740
	Year 10	1,237,940	1,241,208	1,265,408
	Reversion	$13,068,563	$12,355,387	$13,530,639
Actual *IRR*		11.42%	11.83%	11.79%
Reported discount rate (*IRR*)		11.10%	11.54%	11.05%
Difference (understatement)		-0.32%	-0.29%	-0.74%

		Suburban Office	Community Shopping Center	Multi-Tenant Industrial
Assumed net operating income (Year 1)		$1,000,000	$1,000,000	$1,000,000
Reported overall capitalization rate (R_O)		9.82%	10.14%	9.46%
Indicated property value		$10,183,299	$9,861,933	$10,570,825
Reported compound annual income inflator (*CR*)		2.21%	2.21%	2.21%
Net operating income (Year 11)		$1,244,325	$1,244,325	$1,244,325
Reported terminal capitalization rate (R_N)		10.32%	10.57%	10.18%
Reversionary property value		$12,057,414	$11,772,234	$12,223,233
Implied change in property value		18.40%	19.37%	15.63%
Compound annual change in property value		1.70%	1.79%	1.46%
NOI:	Year 1	$1,000,000	$1,000,000	$1,000,000
	Year 2	1,022,100	1,022,100	1,022,100
	Year 3	1,044,688	1,044,688	1,044,688
	Year 4	1,067,776	1,067,776	1,067,776
	Year 5	1,091,374	1,091,374	1,091,374
	Year 6	1,115,493	1,115,493	1,115,493
	Year 7	1,140,146	1,140,146	1,140,146
	Year 8	1,165,343	1,165,343	1,165,343
	Year 9	1,191,097	1,191,097	1,191,097
	Year 10	1,217,420	1,217,420	1,217,420
	Reversion	$12,057,414	$11,772,234	$12,223,233
Actual *IRR*		11.71%	12.08%	11.19%
Reported discount rate (*IRR*)		11.43%	11.68%	10.86%
Difference (understatement)		-0.28%	-0.40%	-0.33%

Legend: R_O: going-in cap rate *CR*: constant ratio change in income R_N: reversionary/terminal cap rate

The six investor-survey simulations covering three types of income-producing properties and two different timeframes show a high degree of accuracy for the survey results tested. Compared to the actual calculated *IRR*s (overall yield), the reported discount rates understated the calculated returns by a range 0.28% (28 basis points) to 0.74% (74 basis points) or an average of 0.39% (39 basis points). Most of the variance between the reported discount rates and calculated yields can be attributed to the implied annual growth rate in property appreciation (value) over the holding period, not keeping pace with the reported annual income growth rate.

Real Income Growth (Appreciation)

Real income growth only occurs when future income exceeds the rate of inflation. Start-up operations, such as recently constructed real estate projects, generally show real income growth during the initial years prior to achieving full or stabilized occupancy levels.

DCF valuation models are designed to simulate both real income growth due to increasing occupancies and income increases attributable to inflation and/or increases attributable to real estate market dynamics (e.g., supply-constrained areas). The cash flows shown in Table 6 reflect yearly net income (both real income growth and income increases propelled by an annual inflationary factor of 5%) and the corresponding yearly net income (real dollars) adjusted downward by the assumed 5% annual rate of inflation.

By extracting the 5% rate of inflation as in the preceding net income projections, it is possible to express the annual income streams in terms of constant dollars[19] and isolate the portion of the income streams representing real growth. In the example in Table 7, both the income streams and reversionary value, after being adjusted and expressed in constant dollars, have been discounted at 10%, indicating a value of $9,694,311.

By reducing the projected net annual income streams by the anticipated rate of inflation, it is evident that the property will experience real income growth and capital appreciation during the first four years of the investment holding period. After adjustment for inflation, the income in constant dollars increases from $644,000 in Year 1 to $1,021,056 in Year 4, and the indicated compound annual real rate of income growth is 16.61%. The results also suggest that the DCF model is only valid if the forecasted annual income streams include real income growth above and beyond inflation, and that the length of the forecast should correspond with the year in which stabilized earnings are achieved.

Modified Direct Capitalization Model—Overall Capitalization Rate

As with zero-growth DCF models employing discount rates, it is possible to achieve the same indications of value by direct capitalization models with overall capitalization rates. Discounted cash flow models that reflect both real and inflationary income growth, after adjustment of the income streams to constant dollars without inflation, may be converted into expressions of value by use of a modified direct capitalization model and overall capitalization rate, as shown in Table 8.

Based on the preceding model, stabilized Year 4 income expressed in constant dollars is capitalized in perpetuity at an overall capitalization rate of 10%, and the result is adjusted by the present value of the rental losses during the first three years, also expressed in constant dollars, discounted at 10%.

The value estimate of $9,694,312 in the modified direct capitalization model is similar to the value indicated in the preceding DCF model and reinforces the posture that the length of the income forecast need not exceed the year of stabilized earnings (in constant dollars) achieved in Year 4. Beyond Year 4 all of the annual gains in projected net income shown in the preceding DCF model are solely attributable to anticipated inflation, which has been proven not to enhance the value of the project.

Conclusion

Because yield capitalization (DCF) and direct capitalization are interrelated valuation models, applying either methodology to the same income-producing property should generate a similar estimate of market value. However, in DCF analysis, the improper selection or construction of a discount rate has the potential for misstating financial performance and for producing an unreliable indication of value. Income growth assumptions determine the magnitude of discount rates, which are ultimately tied to capitalization rates.

Discount rates for use in DCF analysis need to be tested for consistency of application. A discount rate is a prospective measure of financial performance, reflecting the future expectations of real estate inves-

19. Constant dollars are "[d]ollars that account for real growth only, not for inflation." *The Dictionary of Real Estate Appraisal,* 61.

Table 6 Real Income Growth & Inflation-Driven Net Income vs. Inflation-Adjusted Net Income

Year	Net Income	Inflation Adjustment Factor 5%	Inflation-Adjusted Net Income
1	$644,000	0.000000	$644,000
2	919,000	0.952381	875,238
3	1,048,000	0.907029	950,567
4	1,182,000	0.863838	1,021,056
5	1,241,100	0.822702	1,021,056
6	1,303,155	0.783526	1,021,056
7	1,368,313	0.746215	1,021,056
8	1,436,728	0.710681	1,021,056
9	1,508,565	0.676839	1,021,056
10	1,583,993	0.644609	1,021,056

Table 7 Real Income Growth DCF Model—Without Inflation

PV of	Projected Net Income	Inflation Adjustment Factor 5%	Constant Dollars	Discounted @ 10%
Year 1	$644,000	0.000000	$644,000	$585,455
Year 2	919,000	0.952381	875,238	723,337
Year 3	1,048,000	0.907029	950,567	714,175
Year 4	1,182,000	0.863838	1,021,056	697,395
Year 5	1,241,100	0.822702	1,021,056	633,995
Year 6	1,303,155	0.783526	1,021,056	576,360
Year 7	1,368,313	0.746215	1,021,056	523,963
Year 8	1,436,728	0.710681	1,021,056	476,330
Year 9	1,508,565	0.676839	1,021,056	433,027
Year 10	1,583,993	0.644609	1,021,056	393,661
Subtotal				$5,757,698
Reversion			$10,210,560	3,936,613
Indicated property value				$9,694,311

Table 8 Modified Direct Capitalization Model—Overall Capitalization Rate

Stabilized Year 4 income in constant dollars		$1,021,056
Overall capitalization rate (R_o)		10%
Indicated property value before adjustment of rental shortfall ($1,021,056 ÷ 0.10 = $10,210,560)		$10,210,560
Less rental shortfall in constant dollars		
• Year 1: $377,056 discounted @ 10% ($1,021,056 – $644,000.00 = $377,056 × 0.909091 = $342,778)	$342,778	
• Year 2: $145,818 discounted @ 10% ($1,021,056 – $875,238 = $145,818 × 0.826446 = $120,511)	120,511	
• Year 3: $70,489 discounted @ 10% ($1,021,056 – $950,567 = $70,489 × 0.751315 = $52,959)	52,959	
Total rental loss adjustment		$516,248
Indicated property value		$9,694,312

tors, and cannot be directly extracted or obtained from comparable sales. However, an R_o, which is a partial measure of financial performance, can be directly obtained from comparable transactional data. When coupled with a specific anticipated annual rate of income growth, an R_o can be used in the construction of a discount rate (Y_o) for use in DCF analysis. Both the comparable transactions and the subject property must have similar income growth expectations. A transaction-derived R_o also often serves as a benchmark in establishing the R_N for calculating the reversionary value of an investment at the end of the holding period in DCF analysis.

Real estate investor surveys have become another source of discount and income growth rates for use in DCF analysis, in particular when valuing major income-producing assets. Consistency of application requires that the reported discount rate and the corresponding income growth rate for a particular category of investment real estate be used as a paired set, as both rates tend to move in tandem with the magnitude of the discount rate dependent on the income growth rate.

In a zero-growth DCF model, the discount rate (Y_o) and overall capitalization rate (R_o) are interchangeable, and produce identical estimates of value. However, only in the zero-growth DCF model are the investment assumptions made explicit.

In an inflation-driven or income-growth DCF model, the discount rate cannot be interchanged with the overall capitalization rate. Value equivalency can only be achieved when the discount rate equals the overall capitalization rate increased by the magnitude of income growth (real or inflationary) annually ($R_o + CR = Y_o$).

Income growth projections that are attributed solely to anticipated inflation are purely mythical gains and do not enhance or create value. Similarly, the true measure of investment performance is the real rate of return (real discount rate), which is the investment return indicated after deducting the inflation component (either realized or prospective)[20] from the discount rate (Y_o). Since value is the present worth of future benefits, it is the anticipated rate of inflation (per period) that is deducted from the discount rate in DCF analysis in measuring the real rate of return.

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20. Kenneth A. Barnes, "Real Rates: Judging Discount Rates and Inflation Hedges," *The Appraisal Journal* (January 1990): 23–28, 23. Also see Norman G. Miller and Michael E. Solt, "Using a Real Discount Rate Model is Better than Predicting Inflation," *The Appraisal Journal* (April 1986): 188–197, and "Errata," *The Appraisal Journal* (July 1986): 442.

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