Taking the Mystery out of Discounted Cash Flow Analysis

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Introduction

It is the job of the assessor or appraiser to estimate market value, the cash price a property would bring in a competitive and open market. "Market value may not be the same as price. Prices are historical facts. Values are opinions, or *hypothetical* prices. . . . Market value can also be viewed as the present value of future benefits. This view of market value is the basis of the income approach to value" (International Association of Assessing Officers 1990, 35, emphasis added).

To assess or appraise a property, the analyst must understand the real estate market for the particular property, understand the motivations and mind-set of the buyers and sellers in the market, and be able to reflect the actions and considerations of the market participants in the property's valuation.

The nuances in each local real estate market and the motivations and mind-set of the buyers are too varied to address here. However, the techniques used by the buyers and sellers are fairly uniform. Before purchasing a particular income-producing property, the potential buyer attempts to understand the property from the rent roll, the operating expenses, anticipated repairs, the surrounding market, and competing properties. The technique a potential buyer uses to synthesize this information into a single sale price is a discounted cash flow (DCF) analysis. A DCF analysis is a model of expected income and expense cash flows.

An appraiser, whether a fee appraiser or assessor, is interested in deriving the market value of the same income-producing property, whether for mortgage lending or ad valorem purposes. Although a sales comparison, cost, or direct capitalization approach may be useful in defining the range of values for the property, the DCF should generally produce the most reasonable estimate of value because it best mimics the actions of the marketplace participants.

One prejudice against using or accepting DCF analyses for assessment purposes is the fear that the basic spreadsheet can be manipulated to produce a valuation of the analyst's choosing. However, rather than reject all DCF analyses, the assessor can take steps to ensure "good practice" among property owners and their representatives. The first steps are to understand the valuation theory behind DCF analysis and the mechanics of the analytical process and spreadsheet design. The next step is to create several spreadsheet analyses from scratch on a *Lotus* or *Excel* base. Thus, the assessor will become more comfortable with the concepts of the analysis and more adept at auditing or reviewing third-party analyses. The final step is to maintain uniformity of practice within the office by creating a standard spreadsheet model that can test the property owner's assumptions. This can readily be accomplished using software such as *ARGUS* and *Pro-Ject.*

Because of the time and detail involved in a DCF analysis, it is not practical for mass appraisals. The technique is best for single-property appraisals, generally in an administrative review or appeal.

A DCF analysis is an attempt to model the future, to account for investment risk, and to estimate what a potential purchaser might pay for a particular property, which is the basis of the statutory and judicial definitions of market value.

A DCF analysis is a logical, well-documented, and

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supported valuation technique and is the analytical model of choice for most income-producing property. An appraiser must understand the motivations and actions of the market participants and be able to model their thinking to arrive at the value estimate.

In a DCF analysis, the concept is to produce a valuation that depends on a series of annual cash flows anticipated by the owners of a property. The analysis is meant to be more detailed than a direct capitalization analysis (also known as a stabilized-year analysis) because it can account for annual (or monthly, depending on the software package) cash flow variations resulting from rent increases or decreases. A DCF analysis can account for anticipated changes in inflation factors, property condition, changing insurance requirements, lease structures (net, gross, full service), or changes in the local or national economy.

Techniques

A DCF analysis is a series of annual analyses for a "holding period"; generally ten years is the industry standard. Beginning with the twelve months immediately after the date of valuation (for example, January to December 1995 for a January 1, 1995 date of valuation), the analyst attempts to list all of the sources of income for the property as well as the anticipated expenses associated with generating that income. This exercise is similar to the direct capitalization analysis, but there is no specific quantification of the owner/investor's return *on* the investment and a return *of* the investment. In a DCF, the return *on* the investment is the annual series of net operating income cash flows; the return *of* the investment is the reversion modeled as a cash flow at the end of the last year of the projected holding period.

Analysis of Cash Flows for First Year

The analyst must review all leases to understand the rent levels the ownership is expected to attain, as well as any expense reimbursements that the tenants are obligated to pay. For example, in most "net" leases, the tenant must reimburse the landlord for the tenant's proportionate share of real estate taxes, property insurance, common area maintenance, and, in some cases, a management fee.

Any vacancy on the property and any rented space for which the lease is expiring must also be accounted for. The analyst must make an assumption, based on current market conditions, about whether the vacant space or soon-to-be-vacant space is expected to be leased for any portion of the year. Any vacant space that is projected to be leased during the year must be referenced to market rent.

The analyst must also anticipate the renewal or termination of the tenants' leases. When a lease is expected to expire, the analyst must model the existing tenant either to stay or to vacate the space and release it at market terms and conditions. In many DCF analyses, a factor is included to account for the probability of a tenant staying or moving.

At lease expiration, the landlord must search out a new tenant and strike a new deal. Generally, the new rent will be a function of market rent; there may be some rental concessions, such as rent abatement (free rent), above-standard build-out (remodeling of the space), cash payments, and moving expenses. In addition, a period of no rent usually exists from the move-out date of the old tenant to the move-in date of the new tenant. In some markets, it may take a year or more to attract a new tenant. This lag time, or specific vacancy, must be accounted for.

Analysis of Expenses for First Year

To be able to generate income and receive rental checks each month, the owner of the property may be obligated by the leases to pay for such items as real estate tax and insurance, utilities, repairs and maintenance, structural reserves, leasing commissions, snow removal, and parking lot maintenance. The analyst must be aware of which operating expenses are germane to the subject property.

These operating expenses must be subtracted from gross income to yield the cash flow which the owner expects to receive the first year. This cash flow must pay the debt service and be enough to satisfy the investment criteria of the owner.

Analysis for Remaining Years

The method of analysis for the remaining years is similar to the first year described above. The analyst must identify the anticipated rental stream from the leases and the newly leased space and the decrease in the rental stream from vacancies. Operating expenses must be identified and subtracted from income to yield cash flow. In addition, the analyst must make certain assumptions regarding inflation, that is, increases in market rent and expenses. The anticipated Consumer Price Index (a very popular inflation adjustment for operating expenses) can be used to track these increases or the analyst can make specific assumptions regarding rents and real estate values in the specific market.

At the end of this analytical process, the analyst has a series of annual cash flows for the ten years of the analysis, or the return *on* the owner's investment.

Reversion Value

The return *of* the owner's investment is modeled by the reversion, also known as the reversionary interest. For modeling purposes, the return *of* the investment is the projected sale of the property at the end of the holding period. The revenue generated by the sale is also included as cash flow in the last year (tenth year) of the analysis. The anticipated sale price is a function of the

capitalization of the income in the year after the sale. For example, for a sale today of a stabilized income-producing property, the sale price would be the next twelve months' net income capitalized into perpetuity. Likewise, for a sale at the end of the tenth year, the anticipated sale price would be the eleventh year's income capitalized into perpetuity. At this point, the analyst has a series of anticipated cash flows *and* a reversion value at the end of the holding period.

Discounting Process

An appropriate discount rate is applied to express this series of numbers and assumptions as a current market value and relate these anticipated cash flows to investor expectations. A discount rate is the rate of return required to discount future income to its present value.

The rationale for discounting cash flows to yield net present value is based on the concept of the time value of money. Asked to choose between a dollar today or a dollar a year from now, a prudent individual would take the dollar today. A dollar today can be invested for the next year and gain interest (as a measure of investment return). Assuming a 5 percent safe investment rate, the equivalent of the dollar today is $1.05 a year from now and $1.1025 two years from now, compounded. However, a dollar a year from now is worth only $0.9524 today, assuming a 5 percent investment rate. That is, $0.9524 invested today for a year at a 5 percent rate will be worth $1.00 a year from now. Likewise, a dollar earned two years from now is worth only $0.9070 today. The dollar two years from now is discounted by 5 percent annually to yield the present value.

In the DCF analysis, an appropriate discount rate is applied to each year's cash flow estimated by the methods described above. These discounted cash flows are added together to yield present value, also known as net present value. The owners of the property is entitled to receive that cash flow over the anticipated ownership or holding period. The discount rate is the owner's (or buyer's) required rate of return for the right to receive those cash flows into the future. The buyer's purchase price represents the relationship between cash flow and required rate of return, that is, the annual cash flows and reversion are the buyer's return *of* and *on* the sale price, respectively, at the discount rate or required rate of return.

Derivation of the Discount Rate

Estimating the appropriate discount rate is probably the most intimidating factor in DCF analysis. It is also a major source of dispute in assessment hearings because the appraiser's judgment when deriving the rate may seem subjective. However, a derivation well-grounded in theory and well-documented does not have to be either intimidating or a source of dispute.

The discount rate is a measure of investment risk for a property similar to the subject property. Discount rates are derived from market information, which can come from sales of similar properties (if the investment criteria and assumptions about these properties are known), from investor surveys and published sources, and from competing alternative investments. A discount rate can also be mathematically derived using the capitalization rate as a starting point.

Sales

Deriving a discount rate from a review of comparable sales is difficult because data on the assumptions used by the buyer are hard to obtain. Capitalization rates can be derived from the relationship between the sale price and anticipated stabilized net operating income, but a discount rate cannot be derived this way.

A discount rate can be derived from a sale if the buyer's sales analysis assumptions of that property are fully understood. The analyst can make a subjective judgment regarding the applicability of the rate from the assumptions the buyer's appraiser is using on the subject property.

Published Surveys

Some real estate companies (for example, Cushmann and Wakefield, Real Estate Research Corp., and the Appraisal Institute) publish results from national surveys of potential purchasers to ascertain investment criteria and market expectations for certain property types. In some larger markets, real estate appraisal and consulting companies and assessment offices survey their local markets and publish newsletters that contain investor expectations and criteria.

Competing Investments

A final method for estimating discount rates is to review available data on competing investments. Income-producing real estate competes among the gamut of available products for the investor's dollar. For any investment, the higher the risk, the greater the required return. This holds true in the securities and bond market and in the real estate market as well.

The hierarchy of competing investments begins with those with "safe" rates (usually government-supported investment vehicles such as Treasury bills and Treasury bonds) and moves through corporate bonds to riskier investments such as real estate. These investment classes compete with each other for the pool of investor funds. By offering varying interest rates based on risk of investment, each investment vehicle attracts funds based on the risk adversity of the individual investor.

This hierarchy extends into the real estate market, too. Well-located properties occupied by first-class, nationally known tenants are associated with less investment risk than poorly maintained or partially vacant buildings. The

inferior properties will have a greater risk rate, or discount rate, associated with their cash flow.

Discount Rate Calculations

Development of an appropriate discount rate for a DCF analysis starts with the capitalization rate developed for a stabilized-year analysis. Again, this capitalization rate can be derived from comparable sales, a mortgage-equity analysis, or investor surveys. After an appropriate capitalization rate is identified, it is adjusted for anticipated value appreciation or depreciation over the holding period (this does not refer to accounting "depreciation" but to the change in value, increase or decrease, from current value). This change in value is usually due to a change in the income stream the property generates, but could be due to changes in underlying land values as well.

Generally, high equity yield rates indicate more risk, less appreciation, and less income stability or growth. Lower rates indicate less risk, more appreciation, and better income stability or growth.

The formula for this yield capitalization rate is:

$$Y_o = R_o + (X_o A),$$

where: Y_o is the equity yield rate, R_o is the overall capitalization rate, X_o is the expected percentage change in the value of the property over the projected period, and A is the analyzer that converts the total change in value to an annual percentage.

For an example of these calculations, assume an indicated capitalization rate of 10 percent, an estimated 34 percent anticipated appreciation over the ten-year holding period, and a sinking fund rate based on a "safe rate" (Hoskold premise) of 4.5 percent. Therefore, the assumptions are that Y_o is unknown (to be solved), R_o is a 10 percent capitalization rate, X_o is 34 percent appreciation estimated over the holding period, based on a comparison between the value today estimated by using comparable sales and the estimated reversion value calculated at the end of the tenth year, and A is the sinking fund (analyzer) based on an ordinary-level annuity (Hoskold premise) of a safe rate indicated at 4.5 percent calculated using the HP-12c calculator: $n = 10$, $i = 4.5$ percent, $FV = -1$, and solving for Payment (PMT). Thus,

$$\begin{aligned} Y_o &= 0.10 + (0.34 \times 0.0814) \\ Y_o &= 0.10 + 0.0277 \\ Y_o &= 0.1277, \text{ or } 12.8\% \end{aligned}$$

The indicated discount rate from this example would be 12.8 percent.

DCF Spreadsheets

A DCF analysis is generally presented on letter-size (8½-by-11-inch) paper in landscape mode (that is, sideways). The left column is a series of descriptive phrases such as "gross potential income," "vacancy and collection loss," "operating expenses," and "net operating income." The remaining columns represent the years covered by the cash flow analysis and are generally headed by the year date. To the uninitiated, the page appears to be a confusing mass of numbers. However, this array of numbers which represents the anticipated cash flow and, thus, the indicated value of the subject property (table 1).

The success and quality of a DCF analysis are not necessarily a result of achieving a certain value figure. The measure of a good analysis is also found in the presentation:

- Is the spreadsheet readable? Are the numbers large enough to be read without eye strain? Would the document be more readable if it were presented on legal-size (8½-by-14-inch) paper or with a different font? Are the columns wide enough for the chosen font size? Is there enough white space between columns?
- Are key headings in bold type or a different font size or style?
- Are the headings logically displayed?
- Is the property address or legal description noted on the spreadsheet?
- Is the author's name or initials and the date of creation noted on the spreadsheet?
- Is the spreadsheet file noted for future reference or updating?
- How are the basic assumptions listed and discussed? Is there an accompanying document, either in narrative or tabular form, which details items such as market rent, rent roll, or a tenant listing; lease expiration assumptions; free rent; inflation assumptions; discount rate and capitalization rate derivation; and reversion assumptions?

A spreadsheet is only a series of numbers on a page; a discounted cash flow analysis is a spreadsheet with appropriate supporting documentation.

Reviewing a DCF Spreadsheet

Regardless of the computer software used to generate a DCF spreadsheet, mechanical errors can be made in many areas: spreadsheet design, cell formulas, omissions, and misapplication of the software.

To review a spreadsheet, the assessor needs a calculator, a pencil, and some common sense. As mentioned, all DCF spreadsheets should come with supporting documentation for review. A spreadsheet by itself generally is not sufficient for the reader to comprehend the meaning of the valuation. However, even without a

Table 1
DCF Analysis: 123 Main Street

		1	2	3	4	5	6	7	8	9	10	Reversion
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Income												
Rent From Tenant #1		$31,000	$31,000	$31,000	$48,250	$100,500	$104,040	$106,120	$108,240	$110,400	$112,610	$114,860
Rent From Tenant #2		121,170	121,170	121,170	121,170	133,290	133,290	133,290	133,290	133,290	145,400	145,400
Vacant Space		46,510	93,020	93,020	93,020	93,020	93,020	107,710	107,710	107,710	107,710	107,710
Total Rental Income		$198,680	$245,190	$245,190	$262,440	$326,810	$330,350	$347,120	$349,240	$351,400	$365,720	$367,970
R.E. Tax Reimbursement		32,420	43,200	44,900	46,700	48,600	50,500	52,500	54,600	56,800	59,100	61,500
Insurance Reimbursement		2,710	3,600	3,700	3,800	4,000	4,200	4,400	4,600	4,800	5,000	5,200
Total Potential Income		233,810	291,990	293,790	312,940	379,410	385,050	404,020	408,440	413,000	429,820	434,670
Less: Vacancy & Collection	10.0%	23,400	29,200	29,400	31,300	37,900	38,500	40,400	40,800	41,300	43,000	43,500
Effective Gross Income		$210,410	$262,790	$264,390	$281,640	$341,510	$346,550	$363,620	$367,640	$371,700	$386,820	$391,170
Operating Expenses												
Real Estate Taxes		$41,560	$43,200	$44,900	$46,700	$48,600	$50,500	$52,500	$54,600	$56,800	$59,100	$61,500
Insurance		3,480	3,600	3,700	3,800	4,000	4,200	4,400	4,600	4,800	5,000	5,200
Management Fee	5.0%	10,500	13,100	13,200	14,100	17,100	17,300	18,200	18,400	18,600	19,300	19,600
Repairs/Structural Reserve	2.0%	4,200	5,300	5,300	5,600	6,800	6,900	7,300	7,400	7,400	7,700	7,800
Rent to Landlord		17,590	17,590	17,590	135,650	175,000	175,000	175,000	175,000	177,620	182,070	185,710
Total Expenses		$77,330	$82,790	$84,690	$205,850	$251,500	$253,900	$257,400	$260,000	$265,220	$273,170	$279,810
Net Operating Income		$133,080	$180,000	$179,700	$75,790	$90,010	$92,650	$106,220	$107,640	$106,480	$113,650	$111,360
Reversion	10.0%										$1,114,000	
Cash Flow		$133,080	$180,000	$179,700	$75,790	$90,010	$92,650	$106,220	$107,640	$106,480	$1,227,650	
Net Present Value	13.5%	$980,000										
CPI Multiplier		4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
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chart or narrative of assumptions, the reviewer can make some headway in determining the validity of the mechanical aspects of the spreadsheet.

The following points can be used to identify areas in a DCF spreadsheet that may need further clarification. These items do not necessarily signify an invalid analysis, just areas that need further discussion or explanation.

Income—Does the gross income generally increase from right to left over time? Are the increases in line with the expectations from the property being analyzed? If there are decreases or sizable increases in income over time, are they justified?

The gross income line correlates all tenant information. Tenant vacancies, rollovers to market rent, lease renewal assumptions, expense reimbursements, and magnitude of income are all reported in gross income. The pattern of gross income over time should be logical.

Vacancy and Collection Loss—There is always risk that the income projections in the tenant rent roll will not come true. This is due to unexpected vacancies, renewals not happening as planned, and slow rent collections. The vacancy loss amount does *not* have to be the same number in each year. If the local economy is fair to poor and shows a 20 percent vacancy rate, but is expected to improve to 10 percent by the fifth year of the analysis, a variation in vacancy can be shown.

However, this vacancy rate is the *property's* vacancy rate, not the market's vacancy rate. If the local market has a 20 percent vacancy rate, it does not necessarily mean that a property's vacancy should also be 20 percent. The vacancy rate should be property specific and depend on the assumptions in gross income. Be aware of double accounting for vacancy between a general vacancy and collection loss line and specific vacancy for each tenant at the termination of leases.

Reimbursement of Pass-Through Items—The reviewer of a DCF spreadsheet must be aware of the lease structure for individual tenants. Depending on local custom and practice, leases may be structured to permit the owner/landlord to be reimbursed for such expenses as real estate taxes and property insurance. The reviewer needs to know whether taxes and insurance, for instance, are passed through to tenants in a ratio proportionate to their leased space or if there is a base year over which the landlord is permitted to pass-through expenses. In any event, the spreadsheet should have separate lines for pass-through items, which, in turn, should have a corresponding expense category below.

Operating Expenses—As with income, operating expenses are generally considered to be subject to inflation. A more sophisticated analysis would attempt to match inflation rates for specific categories of expenses. For example, it may be appropriate to differentiate, and fairly easy to research, different prospective increases in real estate taxes, property insurance, costs for repairs and maintenance, and salaries or personnel costs. Overall, as with income, expenses should increase as the spreadsheet moves to the right.

Appropriate expenses should also be matched with the income attained from the leases. Expenses of lease termination or commencement, such as rent abatements, tenant build-out, and leasing commissions, should match with the rollover to market rent in the income lines as well as with the vacancies associated with turnover.

Capital Expenses—Capital expenses, such as a reserve for replacement, structural repairs, and roofs, must be considered as operating expenses for valuation purposes. The accounting industry treats these items differently for income tax or depreciation purposes. Appraisers must consider these items as deductions from cash flow in the years in which they are projected to occur. Prospective purchasers do this in their analyses; the valuation industry must follow suit.

Discounting—Some spreadsheet models show the discount rates for each year, which are then summed to yield net present value. In these models, the reviewer should try to duplicate the indicated discount rate for several of the years, using a calculator or a published financial table. In spreadsheets designed using an internal calculation of the discount rate against the cash flow line, the resulting value can also be duplicated using a financial calculator or a financial table.

Conclusions and Summary

When producing or reviewing a DCF spreadsheet and supporting material, the analyst must decide whether the material presented is logical, supported, and internally consistent. The cash flow analysis is not merely a mechanical, mathematical exercise. It must have a connection to the real estate market and it must make sense.

Knowledge of cash flow analysis is essential to the everyday valuation activities of anyone in the assessment community who deals with income-producing commercial property. More and more, property owners are submitting DCF analyses to the assessor and the courts in administrative and judicial hearings. The assessor must be able to review and analyze these in detail. Without an understanding of these types of analyses, the assessor and the property owner would have a difficult time discussing property values on common ground.

Reference

International Association of Assessing Officers. 1990. *Property appraisal and assessment administration.* Chicago: International Association of Assessing Officers.

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