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## Simultaneous Valuation: A New Capitalization Technique for Hotel and Other Income Properties

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by Suzanne R. Mellen

In today's complex investment environment, the capitalization of net income into an estimate of value can be considered analogous to the solving of an algebraic equation where the unknown variable "V," or value, is expressed as a factor of the known variables derived from the marketplace. "Simultaneous valuation" is a formula that may be used to calculate a property's value given a variable income stream over a forecast period and given the known return requirements of the debt and equity components. An alternative to the traditional band of investment and discounted cash flow procedure, this equation may also be used in the application of a 10-year discounted cash flow analysis to solve for a property's value.

Simultaneous valuation was specifically developed as a capitalization technique for the valuation of hotel properties; it is also applicable to any income-producing property possessing a variable income stream and other related investment characteristics. Some background on the valuation of hotel properties, however, is necessary to provide insight into the derivation and broader application of the simultaneous valuation formula.

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Appraisers are charged with the task of reflecting the marketplace. The capitalization of a hotel property's net income into an estimate of market value has been difficult in recent years due to the wide spectrum of participants who constitute the universe of typical buyers and sellers. The composition of the marketplace of hotel investors is a direct function of the intense management demands of this form of real estate. The earning potential, and thus value, of a lodging facility is directly related to the competence of its manager, managing agent, or owner/investor.

A brief look at the past decade reveals the changes that have occurred in the profile of market participants. Ten years ago, the hotel industry was experiencing an unprecedented building boom. The traditional roadside property consisting of 50-100 units was rapidly being replaced by the 150-300-room, chain-affiliated hotel or motor inn, as the real estate investment trusts poured funds into the financing of new hotel developments.

Hotel chains and management companies developed staffs of professionals to respond to the rapidly increasing demand for hotel-management expertise. Many managers, savvy in the operation of rooms, food, and beverage, became participants in the real estate market when faced with the opportunity of owning and operating their own facility. Competent operators, recognizing the untapped potential of a hotel property, could expect to obtain mortgage financing at moderate rates to leverage their equity position as they turned around a distressed or previously unsuccessful property. Investment decisions during the early boom period were relatively simple using a multiple of gross or net earnings. The traditional capitalization rate, comprising the weighted average of the debt and equity return requirements, proved to be the best capitalization tool to reflect the actions of typical buyers and sellers in the valuation of a hotel property. The capitalization rate was applied to the stabilized year of operation that theoretically represented a typical year of operation in the property's remaining life. A low rate of inflation, already an economic fact of life, was assumed to be factored into the overall capitalization rate.

The overbuilding of real estate in the early 1970s followed by the 1974/75 recession—a debacle for the real estate industry at large—resulted in dramatic changes in the marketplace. Both lenders and investors found it necessary to become sophisticated in the analysis of real estate investments. Lending institutions, investment banking firms, brokerage houses, and consulting firms established real estate analysis and investment departments equipped with computer capabilities and staffed with a new breed of analyst. These groups now have the expertise to dissect real estate deals before investing their own or their clients' moneys in such income-producing vehicles. Pension funds, offshore investors, and limited partnerships in the real estate marketplace, and high inflation, high interest rates, and a shortage of long-term financing, have created a growing demand for such services.

Meanwhile, the size of typical new hotel developments has increased as a function of rising land and construction costs. In addition, professional hotel management companies often stipulate a minimum number of rooms to optimize a return for their efforts. A larger number of hotel rooms are needed to support the increasing proportion of public space, e.g., food and beverage outlets, meeting rooms, and health club facilities created to cater to the more sophisticated traveler. As a result of these factors, hotel projects now require extensive amounts of capital that can rarely be raised by the traditional hotel owner/operator alone. Both equity investors and lenders must be pursued as a source of funds for hotel acquisition and development.

Today, financial institutions and passive investor groups often require more sophisticated analyses, commonly 10-year discounted cash flow yield calculations, to support their lending and investment decisions. At the same time, the owner/operator continues to utilize a more basic approach when analyzing a hotel deal. Primary concerns are the coverage of debt service and a cash-on-cash return over the initial years of operation.

It appears that today's market for hotel real estate investments comprises both the traditional owner/operator, who continues to survive by virtue of his irreplaceable and highly marketable management expertise, and the passive equity groups, who are investing in hotels as well as other forms of real estate. Appraisers cannot afford to ignore either of these two primary components of the marketplace, for both groups are still active and compete daily for the limited number of viable properties that exist. The investment criteria of the sophisticated equity participant must be regarded simultaneously with the considerations of the owner/operator, who is faced with the immediate impact of paying debt service and generating a return on equity.

### *PREVALENT CAPITALIZATION TECHNIQUES*

Appraisers who specialize in the evaluation of hotel properties continually survey the methods by which hotel investors evaluate hotel deals. The two capitalization techniques used most often in the conversion of a hotel's forecasted net income into an estimate of value are: 1) capitalization of net income to equity at a cash-on-cash dividend rate, and 2) capitalization of net income to equity at an equity yield rate through the use of a 10-year discounted cash flow analysis.

The complexity of the real estate industry today almost necessitates the inclusion of both methods. The traditional owner/operator is frequently faced with the need to provide creative financing for passive investors; such investors are in turn comparing a variety of real estate investments from hotels to office buildings and industrial properties on the basis of discounted cash flow analyses and yield calculations. Both valuation tools are applicable in estimating the market value of a hotel property; however, there is more reliability in the derivation and application of the equity cash-on-cash

rate in the capitalization process, particularly in today's uncertain economic environment.

Although some analysts and appraisers do not choose to apply an all-encompassing equity dividend rate, it can be argued that no one is really able to predict a property's earning potential or appreciation beyond two or three years. In either capitalization process, appraisers are, in essence, solving for the unknown value by developing a relationship between the known variables of a forecasted income stream, and the market-derived debt and equity return requirements. The greater the accuracy in determining each of these variables as they relate to the property in question, the more reliable the appraiser's estimate of value will be. The equity cash-on-cash technique is based on a smaller number of variables than the 10-year discounted cash flow analysis and is, therefore, generally preferred in the valuation of hotels.

### *THE EQUITY COMPONENT*

In today's marketplace, typical equity dividend rates average 12%–13%, and often range from a low of 8%–10% for highly desirable inner-city lodging properties, to 15%–17% for riskier roadside operations. Cash-on-cash returns are the topic of frequent discussion in the marketplace for hotel properties and may best be monitored by discussions with hotel real estate brokers, equity syndicators, and owners.

One prevalent indication of investor expectations today can be found in the numerous limited partnerships that are being formed to raise equity funds for hotel properties. Cumulative preferred returns ranging from 10% to 14% are guaranteed to the limited partners over the term of the partnership. Generally, these equity dividends cannot be covered by a hotel's first-, second-, or even third-year cash flow after debt service. The deficits accrue, however, and are expected to be paid by the forecasted stabilized year of operation.

Of course, this first priority return is not all that the investor expects to receive. The limited partners also share in the upside potential of a property by receiving a pro rata share of the bottom line after preferred returns are distributed. Thus, investors anticipate receiving all the traditional benefits of real estate, which include tax shelter, increasing dividends that result from inflation, and equity buildup that results from property appreciation and debt amortization. The cash-on-cash equity dividend rate inherently reflects the investor's anticipation of these additional future benefits.

### *THE DEBT COMPONENT*

The American Institute Council of Life Insurance Companies is an excellent source for keeping track of the terms of hotel mortgages; a regression formula may be used to update lending terms in relation to current interest

rates. The periodic survey of mortgage interest rates, however, does not reflect the lender's participation that is written into many of today's long-term debt instruments. Appraisers must be careful to periodically survey institutions active in financing hotel projects to determine what additional interest they are charging. Lender kickers of 1% to 3% of total rooms revenue are prevalent today in the financing of hotel properties. This additional debt service can be factored into the valuation of a property by deducting lender participation as an operating expense, before the income capitalization.

### *TRADITIONAL OVERALL CAPITALIZATION RATE*

The traditional approach for deriving an estimate of value has been to divide a property's forecasted stabilized net income, expressed in current dollars, by an overall capitalization rate. This overall rate is typically derived via the band of investment, a weighted average of the equity cash-on-cash return and the debt service constant. Some of the positive attributes of this approach include its relative simplicity and the ease with which it is understood by traditional owner/operators. The problems that have arisen in the use of this approach are due to the rapid rise in inflation that has not been adequately reflected in a stabilized year's net income.

The impact of inflation may be dealt with by forecasting past a two- or three-year buildup period to the stabilized year's net income expressed in inflated dollars. For most hotel investments, this is a necessary step which is used not only to factor in the appreciation of revenues and net income due to inflation, but also to consider the changes in a property's earning potential resulting from a change in ownership and/or management. New lodging facilities, as well as those undergoing refurbishment, substantial renovation, or a change in management, or ones operating in a changing marketplace with increased competition, can be expected to experience a change in earning potential over a forecast period. It is the rule, rather than the exception, to find a potential purchaser investing in a hotel property with changes in mind which will improve a property's ability to generate income.

The traditional overall rate derived via the band of investment may be accurately applied to a constant stabilized income stream over any number of years. Difficulty arises, however, when attempting to apply the overall rate to a variable income stream over a buildup period. In the capitalization of a changing annual net income, appraisers have often erroneously used the overall rate as both a capitalization rate and a discount rate. This calculation entails dividing the stabilized year's net income before debt service by the overall capitalization rate to provide an indication of the property's value as of the stabilized year. The net income before debt service of the intervening buildup year is then discounted back to the present time at the same rate and added to the discounted stabilized year's value. An example of the traditional capitalization techniques illustrates this. The forecast of income

and expense for one stabilized year of operation reflects the anticipated earning potential of the subject 280-room hotel.

**Subject Property — 280-room Hotel  
Forecast of Income and Expense**

*Stabilized Year of Operation*

	73%	Ratio to Total Revenue(%)
Occupancy	73%	
Average Rate	\$67.00	
<i>Revenue</i>		
Rooms	\$4,991,000	59.0
Food	2,000,000	23.6
Beverage	1,100,000	13.0
Telephone	190,000	2.3
Rental and other income	180,000	2.1
Total	\$8,461,000	100.0
<i>Departmental</i>		
<i>Costs and Expenses</i>		
Rooms	\$1,131,000	22.7*
Food and beverage	2,557,000	82.5*
Telephone	224,000	118.0*
Total	3,912,000	46.2
<i>Gross Operating Income</i>	\$4,549,000	53.8
<i>Undistributed Operating Expenses</i>		
Administrative & general	\$ 531,000	6.3
Management fee	255,000	3.0
Marketing	277,000	3.3
Property operations and maintenance	287,000	3.4
Energy	306,000	3.6
Total	1,656,000	19.6
<i>House Profit</i>	\$2,893,000	34.2
<i>Fixed Expenses</i>		
Incentive management fee	\$ 249,000	2.9
Real estate taxes	143,000	1.7
Insurance	48,000	0.6
Reserve for replacement	214,000	2.5
Total	\$ 654,000	7.7
<i>Net Income Before Lender Participation</i>	\$2,239,000	26.5
Mortgage kicker	100,000	1.2
<i>Net Income Before Fixed Debt Service</i>	\$2,139,000	25.3

\* Expressed as a percentage of departmental revenue

The traditional band of investment applied to a stabilized year is presented and proven below, assuming the following investment criteria:

Equity cash-on-cash	11.5%
Mortgage interest rate	14.5%
Mortgage term	20 years
Debt service constant	.1535997
Loan-to-value ratio	70%

Development of overall rate via band of investment:

$$\begin{array}{rcl}
 .30 \times .115 & = & .0345 \\
 .70 \times .1536 & = & .1075 \\
 \hline
 \text{Total} & & .1420 \\
 \text{(Say)} & & .142
 \end{array}$$

Derivation of value estimate:

$$\frac{\text{forecasted stabilized year net income}}{\text{overall capitalization}} = \frac{\$2,139,000}{.142} = \$15,065,000$$

Calculation of annual debt service:

Value estimate	\$15,065,000
Debt at 70%	10,545,000
Equity at 30%	4,520,000
Debt service = \$10,545,000 × .1535997 =	\$1,619,709
(rounded)	\$1,620,000

Annual deduction for debt service:

Net income before debt service	\$2,139,000
less: debt service	<u>1,620,000</u>
Cash flow to equity	\$ 519,000

Proof of 11.5% equity cash-on-cash return:

$$\frac{\text{cash flow to equity}}{\text{equity investment}} = \frac{\$ 519,000}{4,520,000} = 11.5\%$$

The application of the same derived rate, as both the overall capitalization rate and discount rate, to a stable income stream expressed in current dollars over a period of years is illustrated on the following page.

Derivation of value estimate via capitalization and discounting procedure:

Year	Forecasted Net Income		Discount Rate at 14.2%		Discounted Cash Flow
1	\$ 2,139,000	×	.87566	=	\$ 1,873,000
2	2,139,000	×	.76677	=	1,640,000
3	2,139,000	×	.67143	=	1,436,000
Stabilized	15,065,000*	×	.67143	=	10,115,000
				Total	\$15,064,000
			Property value (rounded)		\$15,065,000

\*\$2,139,000/.142 = \$15,065,000

Calculation of annual debt service:

Value estimate	\$15,065,000
Debt at 70%	10,545,000
Equity at 30%	4,520,000

$$\text{Debt service} = \$10,545,000 \times .1535997 = \$1,620,000$$

Annual deduction of debt service:

	Year 1	Year 2	Year 3	Stabilized
Net income before debt service	\$2,139,000	\$2,139,000	\$2,139,000	\$2,139,000
less: debt service	<u>1,620,000</u>	<u>1,620,000</u>	<u>1,620,000</u>	<u>1,620,000</u>
Net income to equity	\$ 519,000	\$ 519,000	\$ 519,000	\$ 519,000

Proof of 11.5% return on equity over forecast period:

Year	Net Income to Equity		Discount Rate Rate @ 11.5%		Discounted Cash Flow
1	\$ 519,000	×	.896861	=	\$ 467,000
2	519,000	×	.804360	=	418,000
3	519,000	×	.721399	=	375,000
Stabilized	4,520,000*	×	.721399	=	\$3,260,000
				Total	\$4,520,000
			Value of equity component		\$4,520,000

\*\$519,000/.115 = \$4,520,000

This procedure also illustrates that an equity cash-on-cash dividend rate is equivalent to an equity yield rate if the reversionary benefits are considered in the cash-on-cash rate used to capitalize the last forecasted year into perpetuity. Equity investors factor into their cash-on-cash requirements the



anticipated future benefits of increasing annual dividends as well as equity buildup resulting from property appreciation and debt amortization.

The equity yield rate equates all of the future benefits accruing to the equity position from the original investments. In the preceding example, therefore, the 11.5% equity dividend rate also proves to be the equity yield, or discount rate, where the past year's net income after debt service—capitalized into perpetuity—considered the full future benefits of the investment. Investors looking for an 11.5% cash-on-cash return over a number of buildup years are, in effect, expecting to yield 11.5% on their investment over the forecast period. Over the longer term of actual ownership, the yield to the equity position is expected to be higher than the cash-on-cash return.

Although an overall rate derived by the band of investment is applicable in the capitalization of a constant stable income stream, it does not lend itself to the capitalization of a variable income stream. This phenomenon is illustrated by the following forecast of income and expense, which was prepared for the 280-room subject property to reflect a three-year buildup to the fourth stabilized year of operation. The stabilized year is intended to represent a typical year of operation over the hotel's remaining life cycle. The forecast is expressed in inflated dollars for each year.

**Subject Property—280-room Hotel**  
**Forecast of Income and Expense**  
*(expressed in inflation dollars)*

	Year 1		Year 2		Year 3		Stabilized	
	62%	% of Gross	68%	% of Gross	72%	% of Gross	75%	% of Gross
	\$56.00		\$60.00		\$65.00		\$70.00	
<i>Revenue</i>								
Rooms	\$3,548,000	57.1	\$4,170,000	58.0	\$4,783,000	58.8	\$5,366,000	59.2
Food	1,538,000	24.7	1,736,000	24.2	1,934,000	23.8	2,129,000	23.5
Beverages	846,000	13.6	955,000	13.3	1,064,000	13.0	1,171,000	12.9
Telephone	145,000	2.3	165,000	2.3	185,000	2.3	205,000	2.3
Other income	142,000	2.3	158,000	2.2	175,000	2.1	192,000	2.1
<b>Total</b>	<b>6,219,000</b>	<b>100.0</b>	<b>7,184,000</b>	<b>100.0</b>	<b>8,141,000</b>	<b>100.00</b>	<b>9,063,000</b>	<b>100.0</b>
<i>Departmental Costs and Expenses</i>								
Rooms	890,000	25.1*	991,000	23.8*	1,092,000	22.8*	1,194,000	22.3*
Food & beverage	2,046,000	85.8*	2,258,000	83.9*	2,474,000	82.5*	2,693,000	81.6*
Telephone	181,000	124.8*	198,000	120.0*	215,000	116.2*	234,000	114.2*
<b>Total</b>	<b>3,117,000</b>	<b>50.1</b>	<b>3,447,000</b>	<b>48.0</b>	<b>3,781,000</b>	<b>46.4</b>	<b>4,121,000</b>	<b>45.5*</b>
<i>Gross Operating Income</i>	3,102,000	49.9	3,737,000	52.0	4,360,000	53.6	4,942,000	54.5
<i>Undistributed Operating Expenses</i>								
Administrative & general Management fee	435,000	7.0	473,000	6.6	513,000	6.3	555,000	6.1
Marketing	187,000	3.0	216,000	3.0	244,000	3.0	272,000	3.0
Property Operations and maintenance	223,000	3.6	243,000	3.4	265,000	3.3	287,000	3.2
Energy	231,000	3.7	254,000	3.5	278,000	3.4	302,000	3.3
Total	256,000	4.1	276,000	3.8	297,000	3.6	319,000	3.5
<b>Total</b>	<b>1,332,000</b>	<b>21.4</b>	<b>1,462,000</b>	<b>20.3</b>	<b>1,597,000</b>	<b>19.6</b>	<b>1,735,000</b>	<b>19.1</b>
<i>House Profit</i>	1,770,000	28.5	2,275,000	31.7	2,763,000	34.0	3,207,000	35.4
<i>Fixed Expenses</i>								
Incentive management fee	177,000	2.9	228,000	3.2	276,000	3.4	321,000	3.5
Real estate taxes	120,000	1.9	128,000	1.8	137,000	1.7	147,000	1.6
Insurance	40,000	0.6	43,000	0.6	46,000	0.6	49,000	0.6
Reserve for replacement	155,000	2.5	180,000	2.5	204,000	2.5	227,000	2.5
<b>Total</b>	<b>492,000</b>	<b>7.9</b>	<b>579,000</b>	<b>8.1</b>	<b>663,000</b>	<b>9.2</b>	<b>744,000</b>	<b>8.2</b>
<i>Net Income</i>	1,278,000	20.6	1,696,000	23.6	2,100,000	25.8	2,463,000	27.2
Mortgage kicker	71,000	1.1	83,000	1.2	96,000	1.2	107,000	1.2
<i>Net Income Before Debt Service</i>	\$1,207,000	19.5	\$1,613,000	22.4	\$2,004,000	24.6	\$2,356,000	26.0

\* Expressed as a percentage of departmental income

Calculation of annual debt service:

Value estimate	\$14,780,000
Debt at 70%	10,346,000
Equity at 30%	4,434,000

$$\text{Debt service} = \$10,346,000 \times .153599 = \$1,589,000$$

Annual deduction of debt service:

	Year 1	Year 2	Year 3	Stabilized
Net income before debt service	\$1,207,000	\$1,613,000	\$2,004,000	\$2,356,000
less: debt service	<u>1,589,000</u>	<u>1,589,000</u>	<u>1,589,000</u>	<u>1,589,000</u>
Net income to equity	\$ (382,000)	\$ 24,000	\$ 415,000	\$ 767,000

Discounting of net income to equity at the equity dividend rate:

Year	Net Income to Equity		Present Worth of \$1 @ 11.5%		Discounted Cash Flow
1	\$ (382,000)	×	.89686	=	\$ (343,000)
2	24,000	×	.80436	=	19,000
3	415,000	×	.72140	=	299,000
Stabilized	6,669,570*	×	.72140	=	<u>4,811,000</u>
					\$4,786,000

$$\$4,786,000 \neq \$4,434,000$$

\*\$6,669,570 = \$767,000/.115

The sum of the discounted net income to equity, totaling \$4,786,000, is proven to not equal the original equity investment of \$4,434,000. The actual yield to the equity investment over the forecast period calculates, via Hewlett-Packard 38C, to be 15%, not the anticipated 11.5% cash-on-cash return. In this case, the property's value is underestimated due to the mathematical inaccuracy of applying the weighted average overall rate in the capitalization process. In the alternate case, where the equity dividend rate is higher than the debt service factor, the miscalculation results in an overstated property value and an understated equity yield.

**SIMULTANEOUS VALUATION FORMULA**

It is apparent that a new technique is needed to accurately capitalize a variable forecasted income stream in the utilization of a cash-on-cash equity dividend rate. Given the known investment criteria of debt and equity components and the forecast of a variable income stream over a buildup period,

two algebraic equations have been derived to set forth the mathematic relationships between the known and the unknown variables.

The following symbols are used:

NI	=	net income available for debt service
V	=	value
M	=	loan-to-value ratio
R <sub>e</sub>	=	equity dividend rate
f	=	annual debt service constant
d <sub>e</sub>	=	annual equity dividend
1/S <sup>n</sup>	=	present worth of \$1 factor (discount factor) at the equity dividend rate
S	=	1 + i/12 where i equals the interest or equity dividend rate (R <sub>e</sub> = i)
n	=	projection period in years

### *Simultaneous Equation 1*

The annual cash flow to equity (equity dividend) is expressed as the net income forecast less annual debt service payments:

$$\begin{aligned} NI^1 - (f \times M \times V) &= d_e^1 \\ NI^2 - (f \times M \times V) &= d_e^2 \dots \\ [NI^n - (f \times M \times V)]R_e &= d_e^n \end{aligned}$$

### *Simultaneous Equation 2*

The value of the equity component is expressed as the discounted annual cash flows:

$$(d_e^1 \times 1/S^1) + (d_e^2 \times 1/S^2) + \dots + (d_e^n \times 1/S^{(n-1)}) = (1 - M)V$$

### *The Applied Formula*

Like terms are combined to express the sum of the discounted cash flow as the value of the equity component after debt service:

$$\begin{aligned} ((NI^1 - (f \times M \times V)) 1/S^1) + ((NI^2 - (f \times M \times V)) 1/S^2) + \dots \\ + (((NI^n - (f \times M \times V))/R_e) 1/S^{(n-1)}) = (1 - M)V \end{aligned}$$

This combined algebraic equation, called the simultaneous valuation formula, may be used to solve a property's value given a forecasted variable income stream and the known return requirements of the debt and equity components. The application of the formula to the variable income stream in the preceding example is illustrated on the following page.

Assignment of the known variables:

$NI^1$	=	\$1,207,000
$NI^2$	=	\$1,613,000
$NI^3$	=	\$2,004,000
$NI^4$	=	\$2,356,000
$M$	=	70%
$R_e$	=	11.5%
$f$	=	.1536

Discount factors derived from compound interest tables at an equity dividend rate of 11.5%:

$1/S^1$	=	.89686
$1/S^2$	=	.80436
$1/S^3$	=	.72140
$1/S^{(4-1)n}$	=	.72140

### *Simultaneous Valuation Formula*

$$((NI^1 - (f \times M \times V)) 1/S^1) + ((NI^2 - (f \times M \times V)) 1/S^2) + \dots + (((NI^n - (f \times M \times V))/R_e) 1/S^{(n-1)}) = (1-M)V$$

Insertion of the known variables:

$$\begin{aligned} & ((\$1,207,000 - (.1536 \times .70 \times V)) \times .89686) + \\ & ((\$1,613,000 - (.1536 \times .70 \times V)) \times .80436) + \\ & ((\$2,004,000 - (.1536 \times .70 \times V)) \times .72140) + \\ & ((\$2,356,000 - (.1536 \times .70 \times V))/.115) \times .72140 = (1-.70)V \end{aligned}$$

Solving the equation:

$$\begin{aligned} & ((\$1,207,000 - .10752V) \times .89686) + \\ & ((\$1,613,000 - .10752V) \times .80436) + \\ & ((\$2,004,000 - .10752V) \times .72140) + \\ & ((\$2,356,000 - .10752V)/.115) \times .72140 = .30V \end{aligned}$$

$$\begin{aligned} & (\$1,083,000 - .09643V) + (\$1,297,000 - .08648V) + \\ & (\$1,446,000 - .07756V) + \\ & ((\$20,487,000 - .93496V) \times .72140) = .30V \end{aligned}$$

$$\begin{aligned} & (\$1,083,000 - .09643V) + (\$1,297,000 - .08648V) + \\ & (\$1,446,000 - .07756V) + ((\$14,779,000 - .67448V) = .30V \end{aligned}$$

$$\$18,605,000 - .93495V = .30V$$

$$\$18,605,000 = .93495V + .30V = 1.23495V$$

$$V = \$18,605,000/1.23495 = \$15,065,000$$

$$\text{Total property value} = \$15,065,000$$

The value is proven by calculating the yield or cash-on-cash return to equity over the forecast period.

Calculation of annual debt service:

Value estimate:	\$15,065,000
Debt at 70%	10,545,000
Equity at 30%	4,520,000

$$\text{Debt service} = \$10,545,000 \times .1536 = \$1,620,000$$

Annual deduction of debt service:

	Year 1	Year 2	Year 3	Stabilized
Net income before fixed debt service	\$1,207,000	\$1,613,000	\$2,004,000	\$2,356,000
less: debt service	<u>1,620,000</u>	<u>1,620,000</u>	<u>1,620,000</u>	<u>1,620,000</u>
Net income to equity	\$ (413,000)	\$ (7,000)	\$ 384,000	\$ 736,000

Discounting of net income to equity at the equity dividend rate:

Year	Net Income to Equity		Discount Rate @ 11.5%	=	Discounted Cash Flow
1	\$ (413,000)	×	.89686	=	\$ (370,000)
2	(7,000)	×	.80436	=	(6,000)
3	384,000	×	.72140	=	277,000
Stabilized	6,400,000*	×	.72140	=	\$4,617,000
	Total				\$4,518,000
	Value of the equity component (rounded)				\$4,520,000

$$* \$6,400,000 = \$736,000 / .115$$

The yield to the equity component calculates to be 11.5% over the forecast period.

### DISCOUNTED CASH FLOW ANALYSIS

The second valuation method that is sometimes employed in the valuation of hotel investments is a 10-year discounted cash flow analysis, an offshoot of Ellwood; all of the before-tax components of a real estate investment, i.e., annual income dividends, property appreciation, and debt amortization, are directly considered. Given a property's value or purchase price, the yield to equity and yield to a lender may be calculated by forecasting a hotel's earning potential over an assumed 10-year holding period. Alternatively, given the equity and lender-yield requirements, an appraiser can estimate a property's value by discounting forecasted net income to each component, at the required rate, up to the date of appraisal. The yield to, or

value of, each of the participants' position in a hotel investment, e.g., general or limited partners, participating lenders, etc., which often constitute today's more complicated investment packages, can also be analyzed by the same approach.

Some appraisers argue that a 10-year forecast of income and expense is not applicable to hotel properties because projecting income and appreciation far into the future is an uncertain task. This technique has evolved primarily as a tool for the valuation of leased properties; it requires appraisers to consider the turnover of leases and terms of new market rentals when evaluating the earning potential of an office building, shopping center, or industrial property in an inflationary economy. Over the past few years, however, more and more analysts and investors have begun to rely on 10-year discounted cash flow analyses when evaluating real estate investment alternatives and developing real estate portfolios that include hotels. Projected yields over an assumed 10-year holding period have been refined to the point where they are being used as the basis for investment decisions, given comparable assumptions, such as inflation rates, calculation of appreciation, and net reversion to the investor at the end of the holding period.

Yield rates, like cash-on-cash dividend rates, fall within a range reflecting investor return requirements. It may be argued, therefore, that the 10-year discounted cash flow analysis, for all its positive and negative attributes, has now been refined to the point where it alone can serve as a reflection of marketplace expectations. Forecasted equity yields on today's hotel investments range from a low of 16%–18% for the most superior operations to a high of 24%–26% for those properties associated with high risk.

One of the major components of a 10-year discounted cash flow analysis is the projected rate of inflation; this should not be a problem as long as comparable rates are used for marginal real estate investments. Factors, such as aberrations in the marketplace resulting from imbalances of supply and demand, which influence the earning potential of a particular kind of property, must be considered above the selection of an inflation rate.

A hotel's net income can be projected over a 10-year holding period by preparing a forecast of income and expense in inflated dollars up through a stabilized year of operations, as is done in the overall capitalization method. A longer forecast can be made if specific market conditions can be predicted with any accuracy. Such factors might contribute large additions to a market area's room supply that could decrease occupancies for several years to come or the opening of a convention center in the future that might increase hotel occupancies. A two- to three-year buildup to a stabilized year, however, is applicable for most properties. The net income from the stabilized year forward is projected by applying the overall inflation rate to the stabilized or typical year's net income. This assumption considers that the revenues and expenses of a property will simultaneously increase at the same rate as inflation, and that net income, as a percentage of gross revenues, will

remain constant from the stabilized year forward.

Appraisers and owner/operators of hotel properties are aware that a hotel will most likely not generate the same net income as a percentage of gross from year to year, due to the historically cyclical nature of both real estate and the hotel industry. It is fair, however, to assume that a stabilized year's net income will reflect the average annual net income of a property over the 10-year holding period. In this regard, it is important for an appraiser to stabilize at a typical, not an optimal, year of performance. A hotel may well reach a high occupancy and an above-market average rate in years of ebullient demand and/or shortage in supply; however, that performance will most likely be offset by years when occupancies are down and average rates soften due to poor economic conditions and/or new additions to supply.

The application of an inflation rate to the stabilized year's net income is relatively realistic in light of the little change that has occurred in the earning potential of hotel properties over the past decade. A comparison of the national averages of hotel operating ratios reveals that net income before debt service has experienced little change over the past 10 years. Increases that have occurred in some expense categories, such as energy costs and property operations and maintenance, have been offset by decreases in room, food, and beverage departmental expenses, as a percentage of departmental revenue.

Short-term aberrations that exist during particularly good years for the hotel industry at large, such as 1978 and 1979, and poor years, such as 1974 and 1975, tend to average out over a 10-year period. A 10-year projection of income and expense for a hotel property can be fine-tuned to reflect any unusual income and/or expenses that may be forecast over the holding period. These might include increased property operations and maintenance, due to a declining physical plant, or increased labor costs, due to the anticipated renegotiation of a labor contract. Hotels on the whole, however, can generally be expected to offset most cost increases with simultaneous increases in rate.

It is also critical that an analyst make an adequate deduction (generally 2%–5% of gross revenues) to provide for the replacement of furniture, fixtures, and equipment over the holding period. By applying the inflation rate to a property's stabilized-year net income, it is assumed that the property is not at a declining point in its life cycle and that the hotel will be continually refurbished to sustain its market position and earning potential over the projection period.

A property's reversionary value at the end of year 10 is generally calculated by capitalizing a projected 11th-year's net income with an overall going-out rate that is intended to reflect what a potential purchaser would be willing to pay for the property as of that point in time. The overall rate that is employed should bear some relationship to the going-in rate, which is that rate that equates the stabilized year's net income to the property's appraised



value as of the date of appraisal. A going-out rate one to two percentage points higher than the going-in rate is generally used to reflect the increasing age of the property and the risk in projecting so far into the future. A larger differential may be made if there is some reason to believe that the property will be entering a declining stage in its life cycle that should be reflected in the hotel's reversionary sales proceeds.

Overall going-in rates are calculated by dividing a typical stabilized year's net income by the appraised value or purchase price; for most hotel properties, this income level is not reached for several years. A simple method that may be employed in calculating the going-in rate for a hotel is to discount the stabilized year's net income back to the date of appraisal by the inflation rate; the resulting net income is then divided by the appraised value or purchase price. The overall "going-in" rate equates the property's stabilized net income in current dollars to its value. Some iterative calculations may be required to fine-tune the basis for the going-out rate, because the going-in rate cannot be calculated until the property's value is known. If a 10-year discounted cash flow analysis is being employed to estimate the property's value, then the value cannot be estimated by the yield valuation method until a "going-out" rate is chosen.

#### ***APPLICATION OF THE SIMULTANEOUS VALUATION FORMULA TO A 10-YEAR DISCOUNTED CASH FLOW ANALYSIS***

The same unknown variables include a variable income stream forecast and the return requirements of the debt and equity components and form the basis of a 10-year discounted cash flow analysis and valuation based on investor yield requirements. Although the typical terms and loan-to-value ratio of currently available debt can be determined, the annual debt service and resultant net income to equity cannot be calculated without knowing the property's total value, the very unknown that we are attempting to estimate. One method by which the property's value can be determined is to forecast the net income available for debt service and to calculate, through an iterative process, the amount of the mortgage that the net income is capable of supporting at market rates and at a specified loan-to-value ratio. This tedious process can be circumvented by solving for a property's value through the use of the simultaneous valuation formula.

The formula previously set forth need only be altered slightly to reflect the property's net sale proceeds at the end of the 10th year.

The following symbols are used:

NI = net income available for debt service after lender participation (11th-year net income before lender participation)

V = value

- M = loan-to-value ratio  
 f = annual debt service constant  
 d<sub>e</sub> = annual equity dividend  
 d<sub>r</sub> = reversionary equity value  
 b = brokerage and legal cost percentage  
 P\* = fraction of loan paid off in projection period  
 f<sub>p</sub> = annual constant which would be required to amortize the entire loan within projection period p  
 R<sub>r</sub> = overall "going-out" rate applied to net income to calculate total property reversion (sales price at end of projection period)  
 n = projection period in years  
 1/S<sup>n</sup> = present worth of \$1 factor at equity yield rate

\*P = (f-i)/(f<sub>p</sub>); where i = interest rate of mortgage

**Simultaneous Equation 1 — Calculation of Annual Cash Flow to Equity (Equity Dividend & Reversion)**

$$\begin{aligned}
 NI^1 - (f \times M \times V) &= d_e^1 \\
 NI^2 - (f \times M \times V) &= d_e^2 \dots \\
 NI^{10} - (f \times M \times V) &= d_e^{10} \\
 (NI^{11}/R_r) - (b(NI^{11}/R_r)) - ((1-P) \times M \times V) &= d_r
 \end{aligned}$$

**Simultaneous Equation 2 — Calculation of Equity as Sum of Discounted Cash Flows**

$$(d_e^1 \times 1/S^1) + (d_e^2 \times 1/S^2) + \dots + (d_e^{10} \times 1/S^{10}) + (d_r \times 1/S^{10}) = (1-M)V$$

**Simultaneous Valuation Formula (10-year DCF)**

$$\begin{aligned}
 &((NI^1 - (f \times M \times V))/S^1) + ((NI^2 - (f \times M \times V))/S^2) + \dots + \\
 &((NI^{10} - (f \times M \times V))/S^{10}) + \\
 &((NI^{11}/R_r) - (b(NI^{11}/R_r)) - ((1-P) \times M \times V))/S^{10} = (1-M)V
 \end{aligned}$$

The subject property's forecasted net income before debt service for a period of 11 years forms the basis for an illustration of the simultaneous valuation formula. An inflation rate of 7% is applied to the hotel's net income from the stabilized fourth year forward.

Subject Property — 280-room Hotel  
 Eleven-year Projection of  
 Net Income Before Debt Service  
 (thousands)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
<i>Occupancy %</i>	62%	68%	72%	75%	75%	75%	75%	75%	75%	75%	75%
<i>Average rate</i>	<u>\$56.00</u>	<u>\$60.00</u>	<u>\$65.00</u>	<u>\$70.00</u>	<u>\$74.90</u>	<u>\$80.14</u>	<u>\$85.75</u>	<u>\$91.76</u>	<u>\$98.18</u>	<u>\$105.05</u>	<u>\$112.40</u>
<i>Room Revenue</i>	\$3,548	\$4,170	\$4,783	\$5,366	\$5,741	\$6,143	\$6,573	\$7,033	\$7,525	\$8,052	\$8,616
<i>Gross Operating Profit</i>	1,770	2,275	2,763	3,207	3,431	3,672	3,929	4,204	4,498	4,813	5,150
<i>Net Income</i>	1,455	1,924	2,376	2,784	2,979	3,187	3,411	3,649	3,905	4,178	4,470
less: incentive management fee	<u>177</u>	<u>228</u>	<u>276</u>	<u>321</u>	<u>343</u>	<u>367</u>	<u>393</u>	<u>420</u>	<u>450</u>	<u>481</u>	<u>515</u>
<i>Net Income Before Lender Participation</i>		1,278	1,696	2,100	2,463	2,636	2,820	3,018	3,229	3,455	3,697
less: mortgage kicker	<u>71</u>	<u>83</u>	<u>96</u>	<u>107</u>	<u>115</u>	<u>123</u>	<u>131</u>	<u>141</u>	<u>151</u>	<u>161</u>	<u>172</u>
<i>Net Income Before Debt Service</i>	\$1,207	\$1,613	\$2,004	\$2,356	\$2,521	\$2,697	\$2,886	\$3,088	\$3,304	\$3,536	\$3,783

The application of the simultaneous valuation formula to the forecasted income stream is illustrated below.

Assignment of the known variables:

NI <sup>1</sup>	=	\$1,207,000	1/S <sup>1</sup>	=	.81954
NI <sup>2</sup>	=	\$1,613,000	1/S <sup>2</sup>	=	.67164
NI <sup>3</sup>	=	\$2,004,000	1/S <sup>3</sup>	=	.55044
NI <sup>4</sup>	=	\$2,356,000	1/S <sup>4</sup>	=	.45110
NI <sup>5</sup>	=	\$2,521,000	1/S <sup>5</sup>	=	.36969
NI <sup>6</sup>	=	\$2,697,000	1/S <sup>6</sup>	=	.30298
NI <sup>7</sup>	=	\$2,886,000	1/S <sup>7</sup>	=	.24830
NI <sup>8</sup>	=	\$3,088,000	1/S <sup>8</sup>	=	.20349
NI <sup>9</sup>	=	\$3,304,000	1/S <sup>9</sup>	=	.16677
NI <sup>10</sup>	=	\$3,536,000	1/S <sup>10</sup>	=	.13668
NI <sup>11*</sup>	=	\$3,956,000			

\* Net income before lender participation

M	=	70%
f	=	.1536
d <sub>e</sub>	=	22%
b	=	5%
f <sub>p</sub>	=	.18994
R <sub>r</sub>	=	14%

Intermediary calculations:

$$P = (.1536 - .145)/(.1899 - .145) = .19134$$

$$(f \times M \times V) = .10752V$$

Simultaneous valuation formula:

$$((NI^1 - (f \times M \times V))1/S^1) + ((NI^2 - (f \times M \times V))1/S^2) + \dots$$

$$((NI^{10} - (f \times M \times V))1/S^{10}) +$$

$$(((NI^{11}/R_r) - (b(NI^{11}/R_r)) - ((1-P) \times M \times V))1/S^{10}) = (1-M)V$$

Insertion of the known variables:

$$((\$1,207,000 - .10752V) \times .81954) +$$

$$((\$1,613,000 - .10752V) \times .67164) +$$

$$((\$2,004,000 - .10752V) \times .55044) +$$

$$((\$2,356,000 - .10752V) \times .45110) +$$

$$((\$2,521,000 - .10752V) \times .36969) +$$

$$\begin{aligned}
& ((\$2,697,000 - .10752V) \times .30298) + \\
& ((\$2,886,000 - .10752V) \times .24830) + \\
& ((\$3,088,000 - .10752V) \times .20349) + \\
& ((\$3,304,000 - .10752V) \times .16677) + \\
& ((\$3,536,000 - .10752V) \times .13668) + \\
& (((3,956,000/.14) - (.05(3,783,000/.14)) - ((1 - .19134) \times .70 \times V)) \times .13668) = \\
& (1 - .70)V
\end{aligned}$$

Solving the equation:

$$\begin{aligned}
& (989,000 \times .08812V) + (1,083,000 \times .07221V) + \\
& (1,103,000 \times .05918) + (1,063,000 \times .04850V) + \\
& (932,000 \times .03975V) + (817,000 \times .03258V) + \\
& (717,000 \times .02670V) + (628,000 \times .02188V) + \\
& (551,000 \times .01793V) + (483,000 \times .01470V) + \\
& (((28,257,000 - 1,413,000) - .56606V) \times .13668) = .30V
\end{aligned}$$

Combining like terms:

$$\begin{aligned}
12,035,000 - .49892V &= .30V \\
12,035,000 &= .79892V \\
V &= 12,035,000 / .7982 = 15,064,087 \\
\text{Total property value} &= \$15,065,000
\end{aligned}$$

The value is proven by calculating the yield to equity over the forecast period.

Calculation of annual debt service:

Total property value (rounded)	\$15,065,000
Debt @ 70%	10,546,000
Debt @ 30%	4,520,000

$$\text{Debt service} = .1536 \times \$10,546,000 = \$1,620,000$$

Annual deductions for debt service are presented in the following chart.

Subject Property — 280-room Hotel  
 Ten-year Projection of Net Income  
 (thousands)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<i>Net Income Before Lender Participation</i>		\$1,278	\$1,696	\$2,100	\$2,463	\$2,636	\$2,820	\$3,018	\$3,229	\$3,455
less: mortgage kicker	<u>71</u>	<u>83</u>	<u>96</u>	<u>107</u>	<u>115</u>	<u>123</u>	<u>131</u>	<u>141</u>	<u>151</u>	<u>161</u>
<i>Net Income Before Debt Service</i>	1,207	1,613	2,004	2,356	2,521	2,697	2,886	3,008	3,304	3,536
less: debt service	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>	<u>1,620</u>
<i>Net Income To Equity</i>	(413)	(7)	384	736	901	1,078	1,266	1,468	1,685	1,916

Calculation of equity reversion at the end of the 10th year:

$$\text{Sales proceeds} = \frac{\text{11th-year net income}}{\text{going-out overall capitalization rate}} = \frac{\$3,956,000}{.14} = \$28,257,000$$

Property sales proceeds	\$28,257,000
less: brokerage and legal commissions at 5%	<u>1,413,000</u>
Net sales proceeds	26,844,000
less: outstanding mortgage balance	<u>8,531,000</u>
Net proceeds to equity	\$18,313,000

Discounting of net income to equity at the equity yield rate:

Year	Net Income to Equity		Discount Factor @ 22%		Discounted Cash Flow
1	\$ (413,000)	×	.81954	=	\$ (338,000)
2	(7,000)	×	.67164	=	(4,000)
3	384,000	×	.55044	=	212,000
4	736,000	×	.45110	=	332,000
5	901,000	×	.36969	=	333,000
6	1,078,000	×	.30298	=	326,000
7	1,266,000	×	.24830	=	314,000
8	1,468,000	×	.20349	=	299,000
9	1,685,000	×	.16677	=	281,000
10	1,916,000	×	.13668	=	262,000
Reversion	18,313,000	×	.13668	=	<u>2,503,000</u>
			Total		\$4,520,000

Value of equity component at equity yield rate of 22% \$4,520,000

### A PRACTICAL APPLICATION OF THE FORMULA

Given a specified loan-to-value ratio, the simultaneous valuation formula may be used to directly solve for a property's value without undergoing iterative trial and error calculations. Application of the simultaneous valuation formula may appear cumbersome, particularly as it pertains to a 10-year discounted cash flow analysis. The formula, however, is readily adapted to computer application. It may be programmed by eliminating the unknown variable "V" from the equation. Care must be taken in solving the equation to properly multiply the various factors in the correct order of algebraic computation. Once adapted to a mini-computer, the simultaneous valuation formula proves to be an invaluable tool that quickly and accurately solves for a property's value, given a property's forecast of net income and specified investment criteria.

Calculation of the simultaneous valuation formula may be based on 1) the equity dividend rate, applied to a forecasted income stream up through a stabilized year of operation, and 2) the equity yield rate, applied to a projected income stream over an assumed 10-year holding period. Either rate may be appropriate to reflect the actions and anticipations of hotel investors. The increasing complexity of the marketplace often necessitates the calculation and correlation of both of these indicators of investor-return requirements.

The preferred approach for the valuation of hotels is to capitalize a forecasted income stream up through a stabilized year, using the simultaneous valuation formula based on a required equity cash-on-cash return (dividend rate). The resultant value estimate then serves as the basis to calculate the anticipated yield to equity over a 10-year period through the use of a discounted cash flow analysis. Thus, the appraiser indicates what a property is projected to yield over 10 years, based on the property's appraised value. The yield to lender, managing agent, and/or partnership interests over the projection period can also be calculated in an analysis of the various components of a hotel investment.