

Derivation, Analysis, Selection, and Application
of Discount Rates for Appraisal
of Oil and Gas Properties
for Ad Valorem Tax

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I. Purpose

The purpose of this section of AH566 (Revised) is fourfold:

First, to establish a methodology for the (a) derivation of discount rates from appropriate and available data, (b) analysis of discount rates obtained from market sources, (c) selection of discount rates for use in ad valorem tax appraisal of oil and gas properties, and (d) application of discount rates to the appraisal of specific properties.

Second, to reconcile the relation of some aspects of industry-specific Rule 468 to general application Rule 8.

Third, to reconcile differences in terminology used to describe functions and applications of discount rates.

Fourth, to define appropriate practice for the application of oil and gas industry and financial industry information and methodologies to discount rate analysis.

In the 25 years since the original form of AH566 was published, the evolution of some aspects of the ad valorem tax appraisal of oil and gas properties have not kept pace with changes in (1) the rules and regulations under which both assessors and industry must conduct ad valorem tax appraisal, (2) changes in valuation practices in the petroleum industry, and (3) the advance of the computer as the vehicle for implementing the calculation and data analysis aspects of tax appraisal. It is the intent of this section to bring appraisal practice up to date and to provide a source for the resolution of some of the questions inherent in the appraisal of oil and gas properties. Hereafter reference to oil includes gas except where specifically noted.

The primary changes in appraisal practice since AH566 was first written are (a) the promulgation by the State Board of Equalization of various rules and procedures, particularly Rule 8 and Rule 468, and (b) several court decisions that directly affect not only the form of ad valorem tax appraisal practice but also access to the data necessary to carry out oil property appraisals. The preceding extensive discussions of the content and interpretation of Rules 8 and 468 provide a framework for the implementation of those rules in the appraisal of oil properties. For the purpose of obtaining and applying discount rates to oil and gas property appraisal, it is essential to keep in mind that Rule 468 requires that methods and procedures used by buyers and sellers in the oil and gas marketplace be adopted as the sources of information for the implementation of a Rule 8 Income Approach appraisal.

II. Capitalization of Oil and Gas Income Streams

According to The Appraisal of Real Estate (10th) (see References), real estate appraisal practice recognizes two basic forms of capitalization in the income approach: Direct Capitalization and Yield Capitalization.

"Income producing real estate is typically purchased as an investment, and from the investor's point of view earning power is the critical element affecting property value. An investor who purchases income-producing real estate is essentially trading present dollars for the right to receive future dollars."¹

The income capitalization approach is typically used in market value appraisals of income-producing property."²

"Many rates, or measures of return, can be used in capitalization. All rates of return can be categorized as either income rates (also referred to as cash flow rates) or *yield rates*."³ (emphasis in original) "An income rate is the ratio of one year's income to value; a yield rate is applied to a series of individual incomes to obtain the present value of each."⁴ (emphasis added)

Direct Capitalization

The use of direct capitalization assumes that the income stream is fixed and predictable - that the income in year one is representative of the income to be received in later years. "Direct Capitalization is a method used to convert a single year's income expectancy into an indication of value in one direct step either by dividing the income estimate by an appropriate income rate or by multiplying it by an appropriate income rate or by multiplying it by an appropriate."⁵ The equation for direct capitalization clearly includes the assumption that value is simply a function of Net Operating Income (NOI) for year one or an average of a few years income.

$$\text{Value} = \frac{\text{Net Operating Income}}{\text{Overall Capitalization Rate}}$$

¹ The Appraisal of Real Estate, 10th Edition (hereafter ARE), pg. 409

² ARE, pg. 413.

³ ARE, pg. 414.

⁴ ARE, pg. 414-415.

⁵ ARE, pg. 419.

Overall Capitalization Rates are obtained from a number of sources, two of which are market sales and the band-of-investment. Deriving capitalization rates from market sales requires a 3-4 step process.

1. Obtain income and sales data for a number of comparable sales.
2. Make necessary adjustments between the subject property and the comparables.
3. Divide the NOI of each comparable by its Value to obtain a capitalization rate, or Divide the value by the NOI to obtain an income value factor.
4. Apply the capitalization rate or income value factor to the NOI of the subject property to estimate the value of the subject property.

Deriving capitalization rates from the band-of-investment technique requires a knowledge of the amount or percentage, of debt (M) and equity (1 - M) employed in comparable sales, the mortgage constant (R_m), and the equity capitalization rate (R_e). The overall capitalization rate (R_o) must "satisfy both the mortgage constant requirement of the lender and the pre-tax cash flow requirement of the equity investor."⁶ The formula for the band-of-investment is:

$$R_o = (M \times R_m) + [(1 - M) \times R_e].$$

This technique can be used only when reliable, market-derived data on equity capitalization, available loan terms, and loan to value ratios are available.

Unlike a stream of rents from a building which are fixed for a specified period by lease terms, oil and gas property income streams are, by their nature, highly variable, being derived from production of a commodity with a changeable price and cost structure and subject to additional capital investments. For this reason the direct capitalization method is not used for oil and gas appraisal.

Yield Capitalization

"Yield capitalization is used to convert future benefits into present value by applying an appropriate yield rate. To select an appropriate yield rate for a market value appraisal, an appraiser analyzes market evidence of the yields anticipated by typical investors."⁷

⁶ ARE, pg. 471.

⁷ ARE, pg. 483.

"To perform yield capitalization, an appraiser

- 1) selects a holding period,
- 2) forecasts all future cash flows or cash flow patterns and analyzes the relationship between present and future cash flows,
- 3) chooses an appropriate yield, or discount rate,
- 4) converts future benefits into present value by discounting each annual future benefit or by developing an overall rate that reflects the income pattern, value change, and yield rate."⁸

The discounted cash flow (DCF) is one form of yield capitalization which can be used to estimate present value where "the quantity, variability, timing, and duration of cash flows are specified."⁹ The formula is:

$$PV = \frac{CF_1}{(1+Y)^1} + \frac{CF_2}{(1+Y)^2} + \frac{CF_3}{(1+Y)^3} + \frac{CF_4}{(1+Y)^4} + \dots + \frac{CF_n}{(1+Y)^n}$$

where Y is the appropriate yield, or discount, rate and n is the number of periods in the projection.

The discounted cash flow method of yield capitalization is the most appropriate method for use in the appraisal of oil and gas properties both from an examination of the form of typical cash flows and from the demonstrated use of discounted cash flow by knowledgeable buyers and sellers. The use of discounted cash flow for ad valorem tax appraisal is a demonstration of the application of Rule 468 to augment Rule 8. Where Rule 8(g)(1&2) seems to leave open the choice of Direct or Yield capitalization, the Rule 468 requirement to use methods prevalent in the marketplace leads to the choice of the discounted cash flow approach.

Reversion

The reversion is the return to the investor of the original amount of the investment, and is often a major portion of the total benefits to be received from an investment in an income-producing property. Reversion can occur either at the end of the cash flow through a sale of the property or from a portion of the cash flow prior to the end of the property life.

⁸ ARE, pg. 483.

⁹ ARE, pg. 485.

Oil and gas deposits are, by their nature, wasting assets. There is a fixed volume; only a portion of the volume can be produced and sold; and the production of part of the volume reduces the amount remaining to be produced. New oil is not created during the production process. When all producible oil has been recovered, the asset will have been diminished to zero and will have no residual or reversionary value. This will be true even though changes in economic and technological conditions may act to defer the point of final diminishment.

The wasting asset aspect of oil and gas as an income source is recognized in the petroleum industry approach to valuation which relies (1) on yield capitalization and (2) on return of capital from the income stream prior to the diminishment of the asset. The use of yield capitalization approach is recognized for any income source that is not fixed and reliable, which includes oil and gas income streams. The requirement for return of capital from the income stream is demonstrated by the use of the Payout method as a common criteria for oil and gas investment decision making. In the Payout approach, the time required for recovery of invested capital from the income stream is calculated and then used to judge the acceptability of an investment. The term anticipated for Payout varies but historically averages 3-5 years. All income after payout is considered a return above payout and can be equated to a return on investment. The combination of payout and yield on post-payout income is a total yield rate.

Return on and Return of Capital

The Appraisal of Real Estate notes: "In applying the income capitalization approach, an appraiser assumes that the investor's ultimate objective is a total return that exceeds the amount invested. Therefore, the investor's expected return consists of (1) full recovery of the amount invested (i.e., the return of capital), and (2) a profit or reward (i.e., a return on capital)."¹⁰

Capitalization may apply to a rate of return of capital, to a rate of return on capital, or both. "The *return of capital* refers to the recovery of investment capital; the term *return on capital* refers to the additional amount received as compensation for use of the investor's capital until it is recaptured."¹¹

"In direct capitalization, no mathematical distinction is made between the return on capital and the return of capital."¹² However, "In yield capitalization the distinction between return on and return of capital is always definite and precise."¹³

¹⁰ ARE, pg. 414.

¹¹ ARE, pg. 416.

¹² ARE (9th Ed.), pg. 414.

¹³ ARE, pg. 417.

"Investment capital may be recaptured through annual income or it may be recaptured all or in part through resale of the property at the termination of the investment."¹⁴ "If, on the other hand..... the investor does not expect to recapture all the original investment at time of resale, some of the income stream must be used for repayment of capital. In this case the true rate of return on capital will be somewhat less than the indicated income rate (i.e., the equity capitalization rate in direct capitalization). The difference between the rate of return on capital and the indicated capitalization rate will be the rate of return of capital."¹⁵

Investment Terminology

A Yield Rate is defined as: "...a rate of return on capital; it is usually expressed as a compound annual percentage rate."¹⁶ Also referred to as an interest rate, risk rate, internal rate of return, discount rate, and "return on" rates.

"An interest rate is a yield rate for debt capital."¹⁷ It does not provide for the recovery of capital.

"A discount rate is a yield rate used to convert future payments into present value."¹⁸

"Internal rate of return (IRR), refers to the yield rate that is earned or expected for a given capital investment over the period of ownership."¹⁹ The IRR is expressed as an annual percentage rate, like interest, and may also be defined as a yield rate used to discount the future benefits of the investment to present value.

Overall yield rate (Y_o) is a rate of return on the total capital invested and is associated with an investment in the entire property.

An equity yield rate (Y_e) is a rate of return on equity capital.

A mortgage yield rate. (Y_m) is the rate of return on capital invested as a loan and is usually equal to the interest rate but may include origination fees, penalties, etc.

¹⁴ ARE, pg. 416.

¹⁵ ARE, pg. 416.

¹⁶ ARE, pg. 415.

¹⁷ ARE, pg. 426.

¹⁸ ARE, pg. 426.

¹⁹ ARE, pg. 415.

The yield rate can be partitioned into a rate of return on income operations (Y_{inc}) and rate of return on the reversion (Y_{rev}).

III. Derivation of Discount Rates

Market Derived Rates - Obtaining fair market value discount rates from oil property sales.

Rule 8(g)(1) describes, in general terms, a methodology for obtaining discount rates from actual sales of properties for use in fair market value appraisals of similar types of properties for ad valorem tax. While Rule 8(g) might be interpreted as referring to direct capitalization, the language applies equally well to yield capitalization. In applying Rule 8(g) to oil and gas property appraisal, the established practice of assessors and industry analysts has been to recognize that the discounted cash flow process can be used to extract market yield rates from actual sales of oil properties by calculation of the rate of return that equates the present value of the future income stream to the cash equivalent purchase price of the property.

Sources of Data:

The California Revenue and Taxation Code contains one or more sections that provide to assessors the power to obtain specific information regarding the purchase and sale of oil and gas properties. Many assessors accumulate this information, including acquisition appraisals and evaluations, through the use of the Change in Ownership filing wherein data is provided under penalty of perjury. This ability to obtain data is buttressed by *Gulf v. Roberts*.²⁰ Additional data is available to assessors in the form of surveys of buyers and sellers, and of appraisers of properties regarding expected rates of return for oil property investments. Since this large volume of data regarding fair market value acquisitions of oil properties is available and since assessment requires a fair market value appraisal, the primary source for discount rate (yield rate) data should be the information provided by buyers in the marketplace.

Procedure:

A recommended procedure for deriving discount rates from actual sales is as follows:

- A. Determine that the transaction was fair market value.
- B. Define the actual purchase price; convert to cash equivalent as necessary.
- C. Confirm the structure of the transaction with both parties.
- D. Review the details of the entire evaluation provided by the buyer. Reconstruct the cash flow as necessary to define all the components.

²⁰ 147 C.A. 3d 770; 195 Cal. Rptr. 393 (5th DCA, 10/4/83).

- E. Make adjustments to the cash flow as necessary to (1) accommodate any differences between the cash flow used for the market acquisition and the special requirements of a Rule 8 cash flow, and (2) to account for risk adjustments made to the cash flow by the buyer (appraiser).
- F. Calculate the discount rate that equates the present value of the future cash flow to the cash equivalent purchase price.
- G. Review the derived discount rate and analysis with the buyer to be sure that critical information was not overlooked.
- H. Test the derived discount rate for reasonableness.

Discussion:

Each transaction used for discount rate derivation purposes must reasonably fit the definition of a fair market value purchase and sale as defined by state law and relevant court opinions (Step A). The assessor should review all aspects of the transaction with both buyer and seller to ascertain that FMV conditions were met. It should be recognized that no transaction exactly meets all the conditions attributed to fair market value but a reasonable fit should be possible.

The purchase price must be defined and equated to cash equivalence (Step B). The appraiser should be certain that any conditions either on the purchase price or contained in the terms of sale, and which can be quantified, are considered as part of the purchase price. This may require that some terms be converted to cash equivalent. Such conditions might include but are not limited to:

- (1) Future payments contingent upon changes in oil price or other circumstances.
- (2) Specific assumed financial liabilities.
- (3) Expected abandonment costs or other liabilities deducted from the purchase price.
- (4) Partial payment in stock or other consideration.

The structure of the transaction (Step C) should be reviewed with both buyer and seller for confirmation, particularly where formal terms of sale were not prepared or provided.

The economic evaluation data provided by the buyer should be carefully reviewed to insure a full understanding of all the components (Step D). A simple analysis of only the ending cash flow is not sufficient as this may overlook important information and, possibly, errors in the data presented. In some cases this may require that the cash flow be reconstructed or expanded to include greater detail than the cash flow provided by the buyer, however, this reconstruction and/or expansion should not incorporate any data that was not provided by the buyer. Alteration of the cash

flow to incorporate extraneous data could render the cash flow a non-market analysis and cause any derived discount rate to be suspect and invalid.

(Step E1) Property tax rules impose certain conditions on the content of the income stream that can be used for ad valorem tax appraisal. Rule 8(c) states that . . . "Gross outgo does not include amortization, depreciation, or depletion charges, debt retirement, interest on funds invested in the property, or rents and royalties payable by the assessee for use of the property. Property taxes, corporate net income taxes, and corporation franchise taxes measured by net income are also excluded from gross outgo." In other words, an appraisal done for ad valorem tax assessment purposes cannot include deductions for a number of costs which are often considered and are taken as cost deductions by market appraisers.

As an example:

A Rule 8 cash flow done for assessment purposes for Property X might differ from a fair market value appraisal done for the same Property X by a buyer of that property. It is common for buyers to make an estimate of ad valorem on the acquired property and to deduct the estimated tax as a cost in calculating future cash flow. The assessor is not allowed to do this. All other things being the same, the assessor's cash flow would exceed that of the market evaluator by the amount of tax deducted. In deriving a discount rate from the buyer's cash flow, the assessor must add back the property tax deduction made by the buyer in order to calculate a discount rate that corresponds to Rule 8 requirements. Similar adjustments are necessary if the buyer deducted debt repayment and/or interest as a cost, took advantage of special income tax deductions to improve the economics of a proposed acquisition or project, or made any other deductions that are not allowed to assessors under Rule 8.

(Step E2) Some "knowledgeable and unformed persons", when appraising an oil property adjust portions of the cash flow to account for the perceived risk of recovery of reserves, or the likelihood of obtaining a production projection or income stream. The risk is specific to the property. As shown by industry surveys and other studies, this approach usually takes the form of multiplying the future production schedule (or other income stream component) by a risk factor and then discounting the resulting income stream at a competitive rate of return for similar investments. However, it is more common to accumulate the perceived risk in the discount rate. If a buyer constructed his income stream to include risk adjustments, the assessor should (1) obtain the un-risked income stream or (2) back-calculate the un-risked stream using the buyer's risk factor(s) and (3) derive a risk-inclusive discount rate. A mixture of risk-inclusive discount rates and rates which do not include property specific risk will render discount rate analysis and selection difficult.

The derivation of the capitalization rate is accomplished by calculating the discount rate (Step F) that reduces the future cash flow to a present value that is equal to the cash equivalent purchase price. This can be done by several methods using an electronic calculator or computer spreadsheet program.

1. Iteration - Make a series of estimates of discount rates and calculate the present value of the cash flow at each rate until the discounted cash flow equals the purchase price.
2. Graphical - Calculate the present value of the cash flow at a range of discount rates. Plot the profile of present values as a function of the discount rates. Enter the graph at the purchase price and read the discount rate at the point that the present worth profile crosses the purchase price line.
3. Internal Rate of Return - Many spreadsheet programs will calculate IRR (where all cash inflows and outflows are analyzed) to find the discount rate at which the present value of all net investment returns exactly equals the capital outlay for the investment. The IRR considers all positive and negative cash flows from the inception of the investment to its termination and reflects the indicated return on investment in addition to the return of investment.

The income stream and discount rate analysis should be reviewed (Step F) with the buyer or other source of data to be sure that information was not overlooked and to make certain that the property value and/or discount rate do not include other considerations that are not a function of the property value. Acquisitions of oil producing properties by an integrated company may reflect value as a source of crude for downstream operations. The company may accept a low rate of return on the property if it anticipates making up the difference at the refinery level.

Derived discount rates must be reviewed for reasonableness. It may not always be possible to fully understand a transaction or to divine buyer's/seller's motivations; however, some tests should be made. Oil properties are not risk free and do not have the characteristics of corporate bonds and/or equities. Discount rates derived from actual sales should reflect the risk of such investments as demonstrated by the accumulated body of knowledge for property sales and the numerous industry studies and surveys on the subject.

The discount rate derived from actual sales of oil properties is a yield rate. As noted earlier, oil properties have no reversion value; return of capital must be achieved out of cash flow. If, for example, the derived discount rate is 25% then the 25% rate includes a return on the investment equivalent to the risk incurred and a return of the original investment. It may not be prudent to attempt to split the return into its parts as this would require speculation which may not be supportable. However, the composition can be viewed in several ways. The standard Payout approach accumulates the return of capital out of the first few years of income, and considers all additional income as return on investment. The yield for the first few years is zero while reversion occurs and then goes up to a rate consistent with the risk incurred. If the reversion were spread over the life of the stream, one could envision a sinking fund effect where interest is earned on the accumulating funds (a step-child of the Hoskold approach)²¹ and where the return on investment is

²¹ ARE, pg. 492.

increased as more income is available in the first few years. It is apparent that any number of reversion schemes could be constructed, but industry leans toward Payout and the standard approach is to describe the combined return of-and-on investment as the rate of return which implicitly assumes recovery of investment out of cash flow.

Cost-of-Capital Discount Rates - Obtaining fair market value discount rates from an analysis of the returns anticipated by debt and/or equity investors.

Rule 8(g)(2) describes, in general terms, a method for obtaining capitalization (discount) rates from the marketplace for investment capital by "...deriving a weighted average of the capitalization rates for debt and for equity capital.... (the band-of-investment method)..." The parenthetical phrase is not necessarily controlling but is important. The band-of-investment is one of the methods that is discussed in relation to Direct Capitalization and can cause some confusion among evaluators when applied to derivation of discount rates for oil and gas property appraisal.

First, due to the wasting nature of the asset and the variability of the income stream, oil properties are usually valued by Yield Capitalization not by Direct Capitalization. Second, the band-of-investment method includes some presumptions that may not be applicable to oil property valuation.

Regarding the band-of-investment The Appraisal of Real Estate says:

"Because most properties are purchased with debt and equity capital, the overall capitalization rate must satisfy the market return requirements of both investment positions."... "The capitalization rate for debt is called the *mortgage constant* (R_m). It is the ratio of the annual debt service to the principal amount of the mortgage loan." and "... is a function of the interest rate, the frequency of amortization, and the term of the loan." The equity capitalization rate (R_e) "... is the ratio of the annual pre-tax cash flow to the amount of equity investment." In the band-of-investment construction R_e is a return of and on investment since it is a ratio of cash flow to the equity investment and part of the cash flow is presumed to be a return of capital. However, for appraisal purposes "...a property's equity capitalization rate is the anticipated return to the investor, usually for the first year of the holding period."²²

Further: "The overall capitalization rate must satisfy both the mortgage constant requirement of the lender and the pre-tax cash flow requirement of the equity investor. It is a composite rate, weighted in proportion to the total property investment represented by debt and equity. The overall capitalization rate is a weighted average of the mortgage constant (R_m) and the equity dividend rate (R_e). The loan-to-value ratio (M) represents the loan or debt portion of the property investment; the equity ratio is expressed as $(1 - M)$."²³

²² ARE, pg. 470.

²³ ARE, pg. 471.

Rule 8(g)(2) echoes this requirement by stating.... The appraiser shall weight the rates for debt and equity capital by the respective amounts of such capital he deems most likely to be employed by prospective purchasers." (emphasis added)

In real estate appraisal: "Typical mortgage terms... may be obtained by surveying lenders active in the market area. Equity capitalization rates are derived from comparable sales..." "When the mortgage constant and equity capitalization rates are known, an overall rate may be derived with the band-of- investment, or weighted average, technique. using these formulas."²⁴

	Mortgage Component	$M \times R_m$
plus	Equity Component	$(1 - M) \times R_e$
	equals	R_o

As an illustration: Available loan ratio is 75%, 13.5% interest, and 25-year amortization period.

$$R_m = 0.1399$$

Equity Rate 20% (derived from comparable sales)

$$R_o = (0.75)(0.1399) + (1 - 0.75)(0.20)$$

$$= 0.154925 = 15.4925\%$$

The Appraisal of Real Estate comments on this method: "Although this technique is frequently used to derive overall capitalization rates, appraisers should be careful when using it for this purpose. The technique is particularly applicable in real estate markets where sufficient market data are available and it can be demonstrated that the equity capitalization rate is the primary investment criterion used by buyers and sellers. A capitalization rate used to estimate market value should be justified and supported by market data...."²⁵

The reference to "real estate markets" is important when attempting to transfer the band-of-investment method to oil property appraisal. SBE Rule 8(g)(2) requires that the weights for each rate be those "most likely to be employed by prospective purchasers." Further, SBE Rule 468(c)(1) requires that "values be determined using factual market data.... ordinarily considered by knowledgeable and informed persons engaged in the operation, buying and selling of oil, gas, and other mineral-producing properties and the production therefrom." This latter restriction applies to financing arrangements as much as to any other factor thereby requiring the use by the appraiser of "factual market data."

In order to use the simple band-of-investment method, the appraiser must demonstrate that "knowledgeable and informed persons" value oil properties by direct capitalization.

²⁴ ARE, pg. 471.

²⁵ ARE, pg. 471.

Where direct capitalization is not the demonstrated approach, a form of band-of-investment could be used if sufficient market data were available in the form of mortgage constant (R_m), loan to value ratio (M), and equity rate (R_e). Where one or more components is not available and/or where historical data demonstrate that mortgage financing is not "most likely to be used by prospective purchasers"²⁶ the method defaults to a simple measure of equity return, R_e . However, R_e is to be determined from comparable sales. Estimation of R_e from comparable sales of oil properties requires a determination of R_m , M , and R_o from which R_e can be calculated. If $M = 0$ then R_m also equals zero and $R_e = R_o$. As noted above, in direct capitalization R_o includes return on and return of capital.

Rule 8(g) anticipates that market sales data might not always be available for derivation of discount rates and that, when there are periods of few sales of oil properties, an alternative method may be necessary. The acquisition and operation of many oil properties requires some sophistication in finance - many operators are multinational corporations. The cost of investment capital for these firms can be used as a base for estimating "capitalization" or discount rates for oil property appraisal. When all investors must compete for investment funds, the cost-of-capital of public companies engaged in the business of acquiring, developing, and producing oil and gas can serve as a surrogate source for band-of-investment capitalization rates. While investments by corporations are made largely from retained earnings, which is equity capital, the company will also seek to minimize its capital costs by taking advantage of the tax deductibility of debt interest to finance part of its operations with debt. Corporate debt is rarely project-specific and is based on the credit-worthiness of the corporation. The combination of retained earnings, new equity capital, and corporate debt can be thought of as a "capital pool" made up of relatively stable portions of debt and equity. Were this not the case, all corporate investments would be at the equity rate. The corporate cost-of-capital is known in financial terms as the weighted average cost-of-capital (WACC):

$$\text{WACC} = (\% \text{ Debt})(\text{Cost of Debt}) + (\% \text{ Equity})(\text{Cost of Equity})$$

This formulation is similar to the band-of-investment form used in direct capitalization, however, the similarity hides some differences which must be understood and addressed.

Numerous authorities and virtually every college finance textbook describe and discuss the WACC: these descriptions bear investigation. One well-regarded authority states: "The cost of capital (sometimes called the expected or required rate of return or the discount rate) can be viewed from three different perspectives. On the asset side of a firm's balance sheet, it is the discount rate which should be used to reduce the future value of cash flows to be derived from the assets to a present value. On the liability side, it is the economic cost to the firm of attracting and retaining capital in a competitive environment where investors (capital providers) carefully analyze and compare all return-generating opportunities. To the investor, it is the return one expects and requires

²⁶ Information regarding the financing of oil property acquisitions is acquired by most county assessors as part of the change in ownership filing. Past and current financing practice should be considered as the best indicator of the amount of debt and equity capital ". . . most likely to be employed by prospective purchasers."

from one's investment in a firm's debt or equity. While each of these perspectives might view the cost of capital differently, they are all viewing the same number.²⁷ (emphasis in original)

While all three perspectives are of interest in real estate and oil property appraisal, the vantage point of the investor is most useful. In real estate appraisal, "The capitalization rate selected for valuation may be an income rate or a yield rate but it should represent the annual rate of return necessary to attract investment capital. Because rates of return are *prospective*, market perceptions of risk.... are important considerations. The capitalization rates chosen should simulate market expectations."²⁸ (emphasis added)

In using the WACC as a surrogate to estimate capitalization rates under Rule 8(g)(2) for oil property appraisal, several differences between the band-of-investment method and the WACC must be recognized.

The band-of-investment formula is modified for WACC as follows and becomes a yield capitalization approach based on the total capital of the firm. Total Capital is the market value of debt and equity at the time of evaluation.

$$WACC = Y_c = (M_D \times Y_m) + (M_e \times Y_e)$$

$$\begin{array}{lclcl} M_D & = & \% \text{ Debt} & = & \text{Total Long Term Debt/Total Capital} \\ M_e & = & \% \text{ Equity} & = & \text{Total Market Value of Equity/Total Capital} \end{array}$$

The use of long-term debt (more than one year maturity) is necessary in order to match the term of the debt to the anticipated life of the oil production and/or the income stream being appraised. The Debt portion of WACC consists of two broad components each of which provide a yield to the respective investors:

- Publicly traded debt such as bonds, notes, and debentures (Y_{PUB}).
- Institutional debt from banks and other private lenders (Y_{INST}).

$$Y_m = Y_{PUB} + Y_{INST}$$

Publicly traded debt (Y_{PUB}) has a face rate and an issue price, but as the price may change the interest rate stays the same so that the yield to the investor (lender) can change depending on when the investment is made. The yield is measured as yield-to-maturity (YTM). YTM is the discount rate that equates all future income from debt to the price of the debt at a given time. If the purchase price of debt is different from the issue price, the YTM can be greater or less than the face interest rate of debt. In that case, YTM could be considered a composite of Y_{inc} and Y_{rev} where:

²⁷ Stocks, Bonds, Bills and Inflation, 1995 Yearbook; Ibbotson Associates, Chicago, Ill, pg. 139.

²⁸ ARE, pg. 426.

$$Y_{PUB} = (Y_{inc} + Y_{rev})_{PUB}$$

Since YTM is a total return rate, it is not necessary to attempt to define $Y_{inc} + Y_{rev}$ but it could be done. As a yield rate, YTM does not include return of capital. Reversion occurs (a) at maturity when the debt is repaid to the investor or rolled over to new debt or (b) when the investor sells the bonds to another investor. If the bonds or notes are sold at a price greater than that paid by the investor, an additional gain is made on the reversion.

Institutional debt pays an interest rate (Y_{INST}) (which may be variable) but which is a true interest with no income due to reversion. There may be repayment of principal on this debt which could result in a changing loan to value ratio (M in direct capitalization); however, two issues must be considered. First, institutional debt is usually a small fraction of total debt and an even smaller part of total capital. Second, efficient capital management by the firm would optimize the capital mix of the firm by taking advantage of the tax deductibility of interest and maintaining a debt-equity mix of about 30-35% debt and 65-70% equity. If this is done, the change in the institutional portion of M_D is modest. Any change would be difficult to assess and measure.

The debt side of WACC could be constructed as:

$$\begin{aligned} Y_c &= [(M_{INST}) \times Y_{INST}] + [M_{PUB} \times (Y_{rev} + Y_{inc})] \\ &= (M_{INST} \times Y_{INST}) + (M_{PUB} \times Y_{PUB}) \\ &= M_D \times Y_m \end{aligned}$$

The equity side is not quite so complex. Several methods are available in financial literature for the determination of the cost of equity. The general equation is:

$$M_e \times Y_e$$

The equity investment is the purchase of common or preferred stock. In the oil industry, preferred stock is rare so an assumption of 100% common stock is acceptable. The returns to equity holders from investment are true yield rates. Reversion occurs when the stock is sold. There may be a gain or loss on the reversion, however, ignoring the tax aspects of capital gains, it can be reasonably assumed that all investors presume reversion with a gain. Equity returns consist of income in the form of dividends (Y_{inc}), paid at a certain rate on a regular basis, and capital appreciation (Y_{inc}):

Equity return = Dividend yield plus capital appreciation (price growth)

$$Y_e = Y_{inc} + Y_{rev}$$

The dividend yields of common stocks are measured and reported, and future yields are projected by Value Line and Standard & Poor's among others. This is a true yield rate based on expected payments relative to the price of the stock. Capital appreciation or growth in the price of

the stock is also estimated and reported by many of the same services.²⁹ The price growth is a form of income based on the stock price change, over the reversion of the original investment. The anticipated growth is amortized over a holding period to create a yield to the investor.

An increasing market price of the stock increases the market value of corporate capital which in turn allows increased debt. If the debt/equity ratio is properly managed, however, M_D and M_e would remain relatively constant except in unusual circumstances. In this way, the yield rates for debt and equity can be used in the development of a band-of-investment capitalization or discount rate which complies with Rule 8(g)(2) and with Rule 468(c)(1).

A standard method of estimating return on equity (yield) is the Capital Asset Pricing Model (CAPM). While more complex forms exist, the basic formula is:

$$COE = K_s = R_f + (\beta \times R_p)$$

The financial notation should not be confused with the real estate terms used above. The data for CAPM analysis is readily available:

R_f = Current safe, riskless rate of interest. Current YTM on long-term (20-30 yr.) Treasury Bonds (daily Wall Street Journal).

β = Beta; a measure of the volatility of a specific equity (stock) compared to the equity market as a whole (or a representative sample). Usually a 5-year regression of the movement in the price of a stock relative to a sample of the market such as the S & P 500 stocks. Reported periodically by S & P, Value Line, etc.

R_p = Equity Risk Premium, the historical relation between the riskless rate and corporate equity returns, where (Ibbotson):

$$R_p \left[\left(\frac{1 + R_m}{1 + R_e} \right) - 1 \right]$$

R_m = Historical total returns ($Y_{inc} + Y_{rev}$) on Treasury bills (Ibbotson).

R_e = Historical total returns on corporate equities (Ibbotson).

²⁹ Value Line Investment Services, for example, offers a 5-year projection of dividend yield and price growth which can readily be combined to a total equity return.

Using CAPM allows continual analysis of any publicly traded company so that a larger database of information can be built. CAPM is a total equity yield rate that includes both income and reversion yields. It does not however include a return of the investment which occurs as reversion at sale.

Reversion of the original investment is accomplished through sale or redemption of bonds and notes and by sale of stock. In both cases there is some risk of loss of part of the principal investment but the loss is minimized by the liquidity of both forms of investments in the stock and bond markets. The equity holder runs a greater risk of loss and therefore requires and obtains (usually) a higher return.

The use of data from publicly traced companies for WACC analysis is a matter of necessity since data for private companies and individuals is rarely available. In competitive capital markets all investors, public and private, seek the best returns so that results from public firms may be considered representative of the marketplace.

The WACC, as a form of band-of-investment, serves two purposes in the appraisal of oil properties

1. It serves as a minimum or base return that must be earned on the investments of the company. The investor fit the company, if he held a mix of company debt and equity similar to that of the capital structure of the company, would by definition expect a return on his investment equal to or greater than WACC. If the firm does not make investments to provide at least the expected return, investors will be disappointed and go elsewhere. In order to account for the risk of not achieving the WACC rate, the firm requires higher returns on those investments with greater perceived risk.
2. The WACC serves as a comparative investment against which to gauge the returns expected from an individual oil property investment (acquisition). If an investor can earn a return equal to WACC by investing fit the debt and equity of publicly traded companies, then he would logically require a higher rate of return for investment fit an oil property which has much greater risk than the WACC equivalent investment. Carrying this analysis a bit farther; where it is shown that oil property acquisition and sales (from which actual market rates are obtained) are done entirely with equity financing, then the comparative return should be the return on capital that could be anticipated by an investment fit equity, not debt and equity or debt alone.

Comparing Market and Cost-of-Capital Rates

Discount rates derived from WACC analysis cannot be applied directly to appraisal of individual oil properties. There must first be adjustments to account for inherent differences between WACC returns and the returns expected front a specific property. The differences are several and important.

- First - Corporations are not considered to be wasting assets - at least not in the sense of oil and gas reserves. Corporations expand, add product lines, develop new properties. Reversion of capital invested in corporate bonds or stock is obtained by sale in the respective markets. By contrast, oil properties are wasting assets where reversion must be obtained from cash flow.

- Second - The rate-of-return derived from actual sales (Y_o) represents the return anticipated from specific property investments with no reversion except from cash flow. The return derived from WACC analysis represents the return from a portfolio of debt and equity issued by public companies where reversion is presumed but not provided.³⁰ The market derived Y_o therefore includes two elements missing from the WACC Reversion and Risk.

- Third - The WACC is the discount rate used to value the company not the individual assets of the company. The WACC may very well be used as a benchmark or minimum rate against which to compare investments, but each investment has risk that may not be the same as the composite risk of the firm.

- Fourth - Individual oil property investments carry more risk than investment in a corporation. An oil property is an investment dependent on one income stream. On the other hand, the Y_e and Y_m components of WACC represent returns from a wide portfolio of investments so that risk of loss due to failure of one asset is minimized by the income available from all other assets.

- Fifth - Individual oil property investments carry additional risk relative to bond and/or equity investments or a mix of both in three distinct areas: Liquidity risk, Term risk, Response to market change. Oil properties are bought and sold but transactions require weeks and months. Stocks and bonds can be sold with a phone call. Oil properties require a long period of time to recover the initial investment from cash flow; expected Payout in industry is 3-5 years for most investments. Stocks and bonds can be sold to recover original investment in very short time periods. The economic response of oil property returns to changes in the economy or marketplace is difficult to gauge except over a period of weeks or months while stocks and bonds can be continually monitored and decisions can be made immediately to buy or sell.

As noted above, the difference between WACC and individual property returns consists of two elements: Reversion and Risk. An investor expects a return commensurate with the risk taken in the investment. The WACC can serve as a base rate for discounting, but must be increased to account for the additional risk inherent in investment in a single oil property.

³⁰ Data from private companies would be expected to indicate competitive but higher returns.

WACC plus Return of Capital plus RISK FROM:

SINGLE INCOME STREAM
LACK OF LIQUIDITY
TERM RISK

The risk related to the income stream is the risk of not achieving the expected income according to schedule which is a direct function of the production and price risk of operating oil properties. Return of capital from the income stream requires that the discount rate be increased or that the initial investment be reduced. As an example, assume two identical income streams one of which (A) has reversion of 100% of investment at the end, and a second (B) with no reversion. If an investor in A and an investor in B both want to recover their initial investment and achieve the same return *on* investment then B must use a higher discount rate or reduce his initial investment.

Discreet quantification of these additional risk components is difficult. However, data from the public debt and equity markets is readily available and the history of sales of oil and gas properties is relatively well developed. WACC can be calculated for individual companies or groups of companies on almost a daily basis. Several studies and surveys of derived and/or required discount rates for acquisition of specific oil properties show remarkable consistency, particularly for lower risk properties. Comparison of the results of WACC analysis, for a group of representative companies that are prospective purchasers of California oil properties, to the discount rates derived from the actual acquisition of such properties, taken over the same period of time, might show sufficient relationship to allow an empirical derivation of a "Property Risk Premium" that could be added to the Prospective Purchaser WACC to obtain a discount rate applicable to individual oil properties. Such a relationship (or premium) could be derived by regression of the difference between annual WACC and annual mean discount rate for relatively low risk Proved Developed Producing properties where the DCR is risk-inclusive.³¹

A second analysis could be done by determining the return on capital of each sale after deducting the investment capital from the cash flow. The standard industry approach is to deduct the investment capital first to determine Payout, but an approach more compatible with real estate appraisal would be to deduct recovery of capital proportionally from the income stream over time. This should provide a consistent approach.

³¹ Comparison of historical market derived rates with WACC analysis indicates a clear and relatively consistent difference of 7-8 percentage points for all sales and 5-6 percentage points when only Proved Developed Producing (PDP) properties are considered. The difference is a composite of risk and return of investment but the parts may be difficult to separate. Some insight may be gained from surveys of evaluators and appraisers of oil properties for acquisition and other purposes. These surveys (SPEE) historically indicate an expected cost of funds plus return of 18-20% BFIT which is 4-5% points above WACC for the same period. The same surveys indicate a risk adjustment for PDP of 5% which when applied to the base discount rate of (example) 19% indicate a total rate of 20%. Here risk can be allocated 1% and return of capital the remaining 4-5%.

The issue is avoided however by simply using market derived discount rates from sales of properties of similar risk to the subject property.

Testing Derived Discount Rates

Discount rates derived under Rule 8(g)(1) or (g)(2) must be tested to be sure that they are reasonable and applicable for use in ad valorem tax appraisal. Testing can be done by (a) comparing market derived and cost-of-capital rates to each other, and (b) by comparison of rates derived from either method to expected rates of return from other investments.

The derivation of discount rates for application to appraisal of individual oil properties should not result in significantly different rates from either of the two Rule 8 methods. Properly used, the two methods should produce similar results. If market derived rates for low risk (PDP) properties are consistently 19-21% then cost-of-capital rates, properly derived, should also produce rates of 19-21%. The two methods should be expected to give similar results, otherwise there would be differences in property values based solely on the source of the discount rate. It should not be expected that, in years where market sales are few, the discount rate would drop several percentage points to a lower rate. Both methods are meant to measure the same result.

A comparison of discount rates for individual oil properties to the rates expected from other investments should be based on intelligent investment and common sense. Oil properties are not the equivalent of treasury or corporate bonds. There is no fixed interest rate, no redemption value, no comparable liquidity, and no priority in bankruptcy as there is with corporate bonds. Oil properties are closer in risk to corporate equities but lack the liquidity and the diversified risk afforded by the portfolio effect of a corporation or a mutual fund. In all cases, the oil property is required to recover investment from cash flow while stocks and bonds recover investment from reversion.

IV. Analysis of Derived Discount Rates

Discount rates derived from either the market sales or cost-of-capital methods are related to the financial and economic environment of the petroleum industry and to the larger national and international economy. They should not be used in a vacuum. Discount rates should be analyzed and tested (1) to ensure that the derived discount rates are reliable indicators of market value, and (2) to provide a systematic means of selecting discount rates for application to property appraisal.

Reliability Analysis - Standard statistical techniques of analysis for Mean, Median, Standard Deviation, and Confidence limits are the best methods of testing the reliability of market sales derived and cost-of-capital discount rates. The cost-of-capital data is a function of a highly competitive and publicly reported industry. Third party analysis should be available for use in comparison to calculated results. Discount rates extracted from market sales are not commonly reported and may be limited to small samples. However, if correctly derived, such data can be statistically analyzed to determine reliability. Small samples for any one year or other time period

can be broadened if analysis shows that results are consistent over longer time periods. Results from either method should be compared to results of other studies and surveys of petroleum industry as a measure of reliability.

Application Analysis - Discount rates derived from market sales and/or cost of capital must be applied to ad valorem appraisals in a consistent and systematic manner. Such application cannot be arbitrary but must be based on a demonstrated and reliable relation between discount rates and one or more characteristics of the property and/or income stream being appraised. Relationships between variables in appraisal are established through statistical methods using Regression or Correlation Analysis. Regression analysis can be complex but, in its simplest form, a correlation is tested between variable A and variable B to determine if and how much B is affected by a change in A. An analysis of market derived discount rates as a function of date of sale, which shows little or no correlation between date of sale and discount rate, indicates that discount rates can be considered consistent over time. This result would allow use of a broader number of sales for application to current appraisals.

Similar analysis could test the relation of discount rates to oil price, property size, dollar value of transaction, reserves volume, or the defined reserve risk. Tested variables could then be categorized by the significance of any correlation to discount rate and used accordingly. Variables which demonstrate little or no correlation to discount rate are not appropriate for use in selecting discount rates.

V. Selection of Fair Market Value Discount Rates for Oil and Gas Property Appraisal

Discount rates used for the appraisal of oil properties must be selected using a procedure that:

1. Is soundly based on statistically valid analysis of discount rates and significant variables,
2. Is in compliance with Rule 468 as a method used in the market place by "knowledgeable and unformed persons engaged in... buying and selling..." oil properties.
3. Recognizes the risk inherent in the derivation of income and returns from oil properties as compared to other investments.
4. Recognizes the relative risk among oil properties where differing classes of reserves and other measures of the likelihood of obtaining an expected production and/or income stream are apparent.

Each of the above factors and each step of the selection process should conform to generally acceptable appraisal practice and, within the confines of current SBE Rule 8, to appraisal practices in the petroleum industry in accordance with Rule 468. Analysis of discount rates from actual sales

should provide sufficient data for discount rate selection particularly when supported by cost-of-capital analysis. While the judgement of the appraiser is important to this process, this judgement should not be expanded to result in selection of discount rates which are not supported by data obtained through Rule 8(g) and Rule 468. Where derived results may be in question, reference should be made to surveys and other industry data such as the Society of Petroleum Evaluation Engineers (SPEE) annual survey of discount rates and risk factors.

Any method or procedure used for the selection of discount rates should be developed in such a way that assessors and taxpayers have confidence in the reliability of the method. Reliability and confidence are gained by:

- a. Thorough testing and analysis of the method and the underlying data.
- b. Thorough discussion and examination of results and methodology with data providers and taxpayers.
- c. Review and critique of the method by qualified appraisers and industry analysis through exposure to peer groups and publication in recognized appraisal and industry trade journals.
- d. Demonstrated reproducibility of selection results by analysis with similar databases.

Assessors should avoid the use of discount rate selection methods that require the use of unique criteria or criteria which do not have an established definition. Terms and criteria such as "quality" and "low/high risk" have no meaning unless they can be defined by reference to petroleum industry and appraisal practice terminology.

VI. Application of Fair Market Value Discount Rates

Discount rates selected for application to individual oil and gas properties for ad valorem tax appraisal must comply with Rule 8 and Rule 468 and must be applied in a consistent and reproducible manner.

Ad valorem tax assessment requires that each property or parcel be appraised at fair market value on the lien date. Attainment of fair market value requires that the economic parameters applied to the property appraisal represent current market conditions. The discount rate is one of the most important of these parameters. The discount rate is a rate of return that must be competitive with the rate of return that could be earned in other investments.

“The rate of return used to convert income into property value should represent the annual rate of return necessary to attract investment capital. This rate is influenced by many factors, including the degree of apparent risk, market attitudes toward future inflation, the prospective rates of return for alternative investments, the rates of return earned by comparable properties in the past, the supply of and demand for mortgage funds, and the availability of tax shelters. Because the rates

of return used in the income capitalization approach represent *prospective rates*, not historical rates, the market's perception of risk and changes in purchasing power are particularly important.

The suitability of a particular rate of return cannot be proven with market evidence, but the rate selected should be consistent with the available data. Rate selection requires appraisal judgment and knowledge about prevailing market attitudes and economic indicators."³²

In the absence of evidence to the contrary, discount rates should be applied consistently to properties of equivalent risk.

"An appraiser must consider the element of risk in applying the income capitalization approach. The anticipation of receiving future benefits creates value, but the possibility of losing future benefits detracts from value. Higher rewards are required in return for accepting higher risk. This belief is fundamental to the real estate market and the valuation of income-producing properties. It is generally accepted that all investments are predicated on the expectation of receiving a return on capital that represents the time value of money with an appropriate adjustment for perceived risk. The minimum rate of return for invested capital is sometimes referred to as the safe, or riskless, rate. Theoretically the difference between the total return on capital and the safe rate may be considered a premium to compensate the investor for risk, the burden of management, and the illiquidity of invested capital."³³

In the petroleum producing industry, risk is measured, in large part, as the likelihood of obtaining the expected production or income stream. Given the nature of oil production systems and the market for petroleum products, oil properties must be considered to have greater risk than debt or equity investments in capital markets. Many oil properties and their income streams may be very large and may appear to be a stable source of income similar to real estate investments, however, the size may indicate a considerable "burden of management" that is not required of real estate assets. When combined with the illiquidity of oil properties, in terms of conversion to cash, any similarity to debt, equity, or surface real estate investments disappears.

Investors in the marketplace recognize these risks and compensate by using higher discount rates. Assessors and appraisers "... must recognize investors' tendencies in analyzing market evidence, projecting future benefits, and applying capitalization procedures. The appraiser must be satisfied that the income or yield rate used in capitalization is consistent with market evidence and reflects the level of risk associated with receiving the anticipated benefits."³⁴

³² ARE, pg. 417.

³³ ARE, pg. 417.

³⁴ ARE, pg. 417.

Terms and Relations - Yield Rates³⁵

Y_o = Rate of return on an investment in the entire property. Y_o equals the discount rate or IRR derived from a discounted cash flow analysis of the actual sale of an oil property where fair market value cash equivalent purchase price and cash flow are known.

Y_m = A rate of return on capital invested as a loan on real property. Mortgage interest rate plus points and any other charges that increase lenders yield.

Y_e = Rate of return on capital in the equity position of real property.

Y_{rev} = Rate of return on capital as it applies to that portion of an investment in real property attributable to the cash flow(s) from the reversion. Used to separately value the cash flow from a reversion. It explicitly excludes any cash flow attributable to operations (NOI's).

Y_{inc} = Rate of return on capital as it applies to that portion of an investment in real property attributable to cash flows from operations. It explicitly excludes any cash flow attributable to the reversion.

M = The Ratio between a mortgage loan and the value of the property pledged as security

Y_o = $(M \times Y_m) + (1 - M)Y_e$
only if the loan is interest only and there is no change in income or value.

$$Y_m < Y_o < Y_e$$

Y_e should always exceed Y_o which in turn should always exceed Y_m .

If there is no mortgage (the property is purchased entirely with equity capital) then:

$$Y_o = Y_e$$

³⁵ Rates and Ratios Used in the Income Capitalization Approach; Fisher, Clifford E., Jr. MAI; Appraisal Institute; Chicago, Ill., (1995).

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