Fair Market Value Transactions, Cost of Capital, and Risk

California Oil and Gas Property Transactions 1983 through 2003

January 29, 2004

prepared for

WESTERN STATES PETROLEUM ASSOCIATION

AND

CALIFORNIA INDEPENDENT PETROLEUM ASSOCIATION

Richard J. Miller & Associates, Inc.

PETROLEUM PROPERTY EVALUATION AND APPRAISAL

January 29, 2004

Board of Directors
Western States Petroleum Association
1415 "L' Street, Ste. 600
Sacramento, CA 95814

Board of Directors
California Independent Petroleum Assn.
1112 "I" Street, Ste. 350
Sacramento, CA 95814

Re: Analysis of Oil and Gas Transactions and Sales1983 through 2003

Dear Sirs:

Pursuant to the request of the Western States Petroleum Association, and the California Independent Association, Richard J. Miller & Associates, Inc. has completed a study of the appropriate price/cost escalation rates and discount (capitalization) rates for the determination of the fair market value of oil and gas properties in California in the current market. The study consists of two parts: an analysis of oil and gas property transactions and sales that occurred in California during calendar years 1983 through 2003; and an analysis of weighted average cost-of-capital of a representative group of companies of the years 1984-2002. The property sales analysis is based primarily upon data submitted to the firm by purchasers of oil and gas properties in the nineteen-year period and to some extent on data obtained from the public record and/or sellers of properties. The analysis of the so-called *"Band of Investment"* approach to the derivation of discount rates is based on publicly available data. The results of both studies are presented in the enclosed report.

Data for this report have been obtained from public and private sources. These data have been accepted and incorporated into this report after determination that they are the appropriate data for this study and on the assumption that the data is accurate. Richard J. Miller & Associates, Inc. reserves the right to modify this study should we become aware that the data presented are inaccurate, incomplete, or misrepresented for any reason. Further, Richard J. Miller & Associates, Inc. makes no warranty, express or implied, regarding the accuracy of the data used or of any conclusions made on those data.

Pursuant to the terms of the current and prior year contracts, and with the established policy of this firm, the data received for this study and the analysis of the individual sales as well as results obtained from that analysis have been and will remain entirely confidential to this firm. There has been and will be no transfer or exposure of data or analysis, except as presented in this report, to any entity or person not a party to the subject transaction. There has been no contact with or influence from third parties or groups representing WSPA, CIPA, or companies or organizations with regard to

the content and conduct of this study except for the directions contained in the contract for service.

Neither Richard J. Miller & Associates, Inc. nor any of its Officers, Directors, Associates or staff have any corporate, personal or fiduciary interest in the parties that provided data, their affiliates or subsidiaries, or in the properties and transactions which are the subject of this analysis. Further, Richard J. Miller & Associates, Inc. does not engage in any business which makes use of the data or invades the confidentiality of the data provided for this study.

It may be of interest to the Board to know that the WSPA/CIPA Property Sales Study, as it is generally known, has been accepted as a source of relevant and useful information by a wide range of industry, government and academic consumers. The WSPA/CIPA study is used and referenced by industry companies and consulting firms as well as the financial institutions that serve the oil and gas industry. This firm receives a considerable amount of responsive discussion from property tax representatives, acquisitions managers, evaluation engineers, and tax and finance experts regarding aspects of the study and with suggestions for expansion and improvement. Many consulting firms and financial institutions use the study to assist them in their own evaluation work. The WSPA study and several professional papers based on the study have been presented in number of forums, including the American Society of Appraisers and Society of Petroleum Evaluation Engineers, and have been published by professional journals as a part of professional meeting proceedings. The study has been referenced by several authors of evaluation papers and publications.

The WSPA/CIPA study is cited as a reference by several government authorities, including the California State Board of Equalization, the Property Tax Division of the Comptroller's Office of the State of Texas, and by the Internal Revenue Service. The study and attributive papers are used as teaching aids in the petroleum engineering departments of several major universities, including USC, Stanford, Colorado School of Mines, Louisiana State University, University of Texas and Texas A & M.

It is the intent of this firm to continue to attempt to improve the WSPA/CIPA study and to render the information presented in the study in the most understandable and useful form possible. We welcome the suggestions of WSPA and CIPA for any further advance toward that goal.

We appreciate this opportunity to be of service to the Western States Petroleum Association and to the California Independent Petroleum Association. Should there be any questions regarding this report, we would be pleased to discuss them with you at your convenience.

RICHARD J. MILLER & ASSOCIATES, INC.

Richard J. Miller, ASA
President

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SUMMARY OF ANALYTICAL RESULTS AND CONCLUSIONS

The purpose of the study presented in this report is to identify and to define the economic parameters used by knowledgeable and informed persons who may be engaged in the operating and buying or selling of oil and gas producing properties for the valuation and appraisal of California oil and gas [1] properties. While the focus of the study is upon the effective discount rates that equate to Fair Market Value, the study also examines other economic parameters and valuation criteria that have influence on the appraisal process

Two methods are used to derive discount rates which can be used as a foundation for oil property appraisal in the marketplace and/or in regulated valuation situations such as ad valorem tax applications. These methods are: (1) derivation of effective market value discount rates from market transactions, and (2) calculation of an appropriate discount rate using the "*Cost-of-Capital*" approach. Both of these discount rates are derived on a Before Income Tax ("*BFIT*") basis. Escalation rates for product prices and operating costs were derived from market sales.

The major objectives of the study, which are emphasized in this report, are:

1. To determine the most appropriate method and source(s) of data for estimating the fair market value discount rate for use in appraisal of oil and gas properties.

2. To define the relation between (a) the Cost-of-Capital and market derived discount rates, and (b) modern financial practice in the oil and gas industry.

3. To rationalize the data obtained from market sales with traditional and contemporary evaluation methods used in modern real estate and oil property appraisal practice.

4. To use the data developed at completion of objectives 1 through 3 to investigate, analyze, and resolve issues and questions regarding the use and application of discount rates and other economic parameters in the appraisal of oil properties in California and elsewhere in the United States and Canada.

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[1] Hereinafter, unless otherwise stated, "*oil properties*" will refer to properties which produce hydrocarbons including crude oil, associated gas, dry gas, condensate and other products.

Summary of Cost-of-Capital Analysis

A group of 43 public oil and gas companies was analyzed to estimate the weighted average Cost-of-Capital ("*WACC*") at year-end 2002 for the Major/Integrated and Independent/Non-Integrated segments of the industry and for the combined segments. The companies provide a representative sample of prospective and actual purchasers of oil properties. The WACC determined in this study is a Before Federal Income Tax ("*BFIT*") value. The results of this part of the study are summarized below.

WEIGHTED AVERAGE COST-OF-CAPITAL (BFIT)
@December 31

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Integrated, %	15.6	15.5	16.1	14.2	16.6	15.1	15.7	14.9	14.9
Independent, %	18.2	14.5	15.9	14.0	16.1	15.8	15.6	15.3	12.5
Combined, %	17.3	14.8	16.0	14.1	16.2	15.6	15.6	15.2	12.9

The determination of a BFIT WACC allows direct comparison of WACC to the discount rates derived from the market sales. This comparison indicates that the annual mean market derived discount rate is consistently greater than the annual WACC.

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Discount Rate, %	25.6	22.4	23.6	20.6	25.5	17.1	ND	ND	ND
WACC, %	17.3	14.8	16.0	14.1	16.2	15.6	15.6	15.2	12.9

Work done in previous studies was expanded in order to determine (a) the extent to which the difference between the WACC and the market derived discount rate can be quantified, and, if the difference can be quantified, then (b) determine the extent to which that quantification can be applied to WACC derived discount rates to simulate market rates of return.

Analysis was done using standard real estate appraisal methods to estimate that portion of the difference between Cost-of-Capital discount rates and market rates. This analysis found that use of the Hoskold Method is of measurable but limited utility in adjusting the Cost-of-Capital derived discount rate.

Summary of Market Sales Analysis

Unless otherwise specifically stated, market sales discount rate data reported in this study is in the form of the risk-inclusive [2] Internal Rate-of-Return of the cash equivalent purchase price on the buyer's BFIT cash flow. Only transactions with Proved reserves, as defined by the purchaser of the property (hereafter "the Buyer"), are considered for this study. In those cases where transactions include Unproved reserves, only the Proved portion of the reserves and the cash flow derived therefrom are used in the analyses provided that the Buyer has specifically apportioned the purchase price and cash flows between or among the Proved and Unproved reserves.

No adjustments of any kind are made to the Buyer's evaluation(s) except through the use of the data supplied by the Buyer as part of the evaluation. No changes, alterations or adjustments were made to the Buyer's evaluations through the imposition of factors not considered by the Buyer.

Based on information obtained for this study, there have been over 700 transfers of interests in oil and gas properties during the period from January 1, 1983 to December 31, 2003 that could be classified as market value transactions. Detailed appraisal information has been obtained and analyzed on 271 of these transactions. [3] This information includes, but is not limited to, the engineering and economic property evaluations and supporting data provided by the buyers of the properties and which was reported to have been used as the basis for the decision to acquire the property. The 271 transactions represent an estimated 80-90% of those transactions that were fair market value and for which the buyer conducted an engineering evaluation.

The 271 transactions are reduced to a Working Database of 243 fair market value transactions by excluding those transactions having a discount rate greater than 42% BFIT. This Working Database is the foundation for all the analyses done in this study. Of the 243 transactions in the Working Database, 18 occurred in the 1998-2003 period. Data from a number of other sales that occurred in the 2000-2003 period were obtained, but they were not included in the study because they were not received in time and/or analysis was not complete in time.

1. For this study, the fair market value discount rate is determined by comparing of the cash equivalent purchase price to the future BFIT income stream for the property as projected by the Buyer. Only the cash flow from Proved reserves is used in this analysis.

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[2] The term "*risk-inclusive*," as used in this report, refers to the capture of any perceived risk attributed to the property and/or the operation thereof in the discount rate rather than through the use of specific risk adjustment factors applied to the production projection, cash flow, and/or other component of the income stream. In those transactions where the Buyer made use of identifiable specific risk-adjustment factors to reduce the production projection or cash flow, those same factors were used to remove the adjustment to render the projection and cash flow "*risk-inclusive*."

[3] A large number of the 700+ transfers that are considered to be market transactions are relatively small (>$100,000) and were concluded between the parties with no formal evaluation of the property. The sales for which data was obtained are those that did include an engineering evaluation of the property by the buyer.

The discount rate is determined at the Date of Transfer [4] of the property as reported by the Buyer unless another date is specified or is obviously appropriate. For statistical analysis purposes, a Working Database was created using only those sales with effective discount rates between 0% and 42%. The mean fair market value discount rate for the acquisition of all types of oil properties over the twenty year period (1983-2003 inclusive) is 23.9%. The following table presents arithmetic mean and median discount rates for three representative periods.

MEAN FAIR MARKET VALUE DISCOUNT RATE (0-42%)
BEFORE FEDERAL INCOME TAX

	1983-89	1990-2003	Combined
No. of Sales	140	103	243
Mean, %	24.5	23.1	23.9
Median, %	22.9	21.9	22.5

2. Examination of market sales data through the use of single and multiple regression analysis indicates that the only readily identifiable market parameter that can be used to estimate fair market value discount rates is the percentage of Proved Developed Reserves (PDP) in the total volume of Proved reserves attributed to a property. This relation is referred to as "*%PDP*" in further discussion.

   A. Numerous parameters were tested using single regression (correlation) methods. Several were found to have some relation to discount rate, particularly as the database was narrowed to reduce systematic variation, but the %PDP was found to have a much stronger relation than any other factor. The correlation coefficient of the %PDP relation generally exceeded that of any other variable by 2-3 times.

   B. When multiple regression of %PDP in combination with other factors was done, virtually all the relation is defined by %PDP with only modest to insignificant contribution by other variables. When %PDP is removed as a variable by reducing the database to only 100%PDP properties, there are no other variables that indicate any significant influence on the discount rate.

[4] The Date of Transfer is a specific date reported on the Change in Ownership form. This is the date at which the Buyer became the beneficiary of the income from the property. While a transaction may be agreed upon at an earlier date and may be "closed" at a later date, the Date of Transfer is the point at which the Buyer may begin to recoup his investment and earn a return. In some rare circumstances, use of the Date of Transfer, rather than the starting date of the evaluation, may require adjustment of the capital investment schedule in the evaluation.

3. There is a relatively strong relationship between the discount rate and the percentage of PDP reserves, which can be used to select discount rates for oil property appraisal. The statistical analysis done for this study indicated that the marketplace would discount %PDP cash flows at 22% ± 3% and would discount 100%PUD (0%PDP) properties at about 29-30%.

4. Sales of properties with 100% Proved Developed Producing (PDP) reserves account for 160 sales or 66.67% of all sales in the Working Database. Analysis of market derived discount rates for 100% PDP properties indicates an average discount rate of 23.2% with a standard deviation of 6.3 percentage points.

Statement of Compliance

This report presents the results of a study of market value transactions that have occurred in California over the period from 1983 through 2003. The purpose of the study and the framework for the report structure was defined by WSPA in 1985 to be a general market value analysis that was not to be oriented to adhere to any specific rules, regulations or evaluation criteria. The direction was to (a) identify market value transactions, (b) obtain the requisite data and (c) extract and/or derive representative evaluation parameters including, but not limited to, discount rates and price/cost escalation rates. The introduction of the Cost-of-Capital analysis in 1988 expanded the study by adding an entirely different but related line of inquiry. The use of the study reports and, in some limited circumstances, the supporting documentation for various purposes in different legal and/or regulatory jurisdictions has often raised questions about the applicability of the WSPA Study to (a) the evaluation purpose in question, and/or (b) the regulations and requirements of the jurisdiction in which the evaluation is being considered. While experience since 1985 has generally shown that the WSPA Study and the annual reports satisfy all extant criteria, this Statement of Compliance is intended to address certain issues.

Fair Market Value of Transactions

The WSPA Study attempts to define those evaluation criteria and/or market parameters that could be used by an appraiser to estimate the market value of an oil and gas producing property. In the WSPA Study, the derived parameters are extracted only from sales transactions that satisfy the most commonly accepted definitions of "*Fair Market Value*." This is done by (a) obtaining as much authoritative data as is possible regarding each transaction, (b) reviewing the transaction information to attempt to determine the extent to which (i) the buyer and seller were knowledgeable of the property and its uses, (ii) the motivation of both parties, (iii) any circumstances that might have influenced the actions of either party, and (iv) the degree to which the transaction could be considered to be representative of the market for oil and gas properties in the context of the location of the property and the timing of the transaction. For most transactions, particularly where there may be questions regarding the conditions or circumstances of the transaction, the buyer and seller were interviewed to resolve those questions. Particular attention is given to those transactions where the property does not appear to have been acquired for the purpose of continuing oil production but for another purpose. This situation is common in urban/suburban areas where mineral rights are acquired for the purpose of clearing surface real estate for development for homes, schools and/or commercial uses.

Generally Accepted Appraisal Practice

For the most part, there is no distinction between the market value criteria described in the many legal definitions of fair market value and the conception of market value as it may be construed in general appraisal practice. A review of the standard applications of "fair market value" in appraisal practice for purchase and sale of property, eminent domain, estate tax and other uses indicates that the procedures used in the WSPA Study to identify and evaluate transactions comply with the standards that are imposed by the Federal Government for land acquisitions, by the Internal Revenue Service for tax analysis, and the several other authorities that promulgate standards for the appraisal of properties.

California State Board of Equalization ("*SBE*")

The WSPA Study complies with the requirements of SBE with regard to the derivation of parameters for use in evaluating income producing properties. Specifically:

(a) The discount rates derived from market sales comply with the requirements of SBE Rule 8(g)(1). The transactions from which discount rates are derived are determined to be market value under definitions of fair market value applicable to California law. [5]

(b) The Cost-of-Capital discount rates calculated as part of the WSPA Study comply with the requirements of SBE Rule 8(g)(2). The source data is taken from the published financial information of companies that can be considered to be potential purchasers of California oil properties.

(c) The evaluations that are used as the source of Rule 8(g)(1)discount rates are, to the extent possible, in compliance with SBE Rule 8(c). Discount rates are derived from pre-income tax cash flows with no allowance for or deduction of depletion, depreciation, amortization, income taxes or debt interest. [6]

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[5] See Appendix A, Part 1, pg. A-1

[6] SBE Rule 8(c) does not allow deduction of property tax or other taxes based on the value to be determined. Many evaluations deduct estimated property taxes as an operating cost. SBE procedures do not recommend adding these deductions back into the cash flow prior to deriving a discount rate. The WSPA Study adheres to that restriction but also does a separate calculation to determine the effect of the deduction of those anticipated taxes on the effective discount rate.

Texas Property Tax Code

Texas property tax regulations require that property be evaluated at Fair Market Value. The data presented in the WSPA report is derived from market value transactions that comply with this requirement. Further, the data derived in the WSPA Study are generic as to application and location of property. Studies of the WSPA discount rate data show that there is no bias introduced in the evaluation of properties in Texas or any other jurisdiction through the use of data derived from California transactions.

Industry Standards

There are no specific oil industry standards for the derivation of discount rates from market sales, primarily because there are very few sources of such data. The WSPA Study database includes transactions that conform to the commonly accepted industry definition of fair market value, to the generally accepted SPE definitions of Proved reserves classes and to the commonly accepted industry and financial analysis procedures for estimating the rate-of-return on investments.

Application of Analytical Results to Fair Market Value Appraisal

The primary derivatives of the WSPA Study are market value discount rates that are obtained from an analysis of actual market transactions. Cost-of-Capital discount rates are calculated from an industry sample of companies using standard financial methods. The market derived discount rates provide a measure of the returns anticipated by buyers of properties in the marketplace while the Cost-of-Capital results provide a comparison point and a benchmark for the market sales data.

The Cost-of-Capital and the market sales discount rates serve somewhat different purposes within the evaluation process. The Cost-of-Capital serves a financial purpose by defining the minimum return that a company must earn in order to maintain the market value of the company. Individuals and other non-corporate entities are not exempt from this logic. Financial management texts and papers, as well as established practice, identify the Cost-of-Capital as a minimum rate-of-return. The WACC or a variation thereof is used as the foundation discount rate for comparison of projects for corporate capital budgeting/investment. In many cases, increments are added to the WACC to account for perceived risk in the investment and/or as a required increment of return.

The market derived rates encompass all the perceived issues and conditions that are related to the property being valued, including the anticipated risk. This relation is demonstrated by the data derived in the WSPA Study, which indicate that:

1. Over 90% of the discount rates derived from market transactions (1983-2003) exceed the mean Cost-of-Capital (16% BFIT) over a concurrent period (1985-2002).

2. The annual mean market-derived discount rate consistently exceeds the calculated annual WACC by several percentage points in every year.

The data provided by the WSPA Study, along with research from other sources, provides the rationale for the relationship between Cost-of-Capital and derived discount rates. The market derived rates are shown to be risk-related and represent the returns that buyers anticipate from acquired properties. These discount rates show no definable relation to the date of the transaction, prevailing interest rates or equity returns, the physical characteristics of the property, or the economic parameters used in the evaluation. The calculated WACC is, by construction, limited to being a return-on-investment that is derived from highly-liquid assets, which are based on multiple income streams. Each of these considerations acts to cause the WACC to be a lower return, in general, than the return anticipated for actual transactions.

Application of the Cost-of-Capital

In order to be useful in the appraisal of a specific property, the WACC must be calculated from a representative sample of potential buyers (and sellers) of oil and gas properties. This WACC should be calculated as a pre-tax value in order to avoid the effects of issues which are taxpayer-specific. The limitations of the WACC as a specific property discount rate must be recognized, and appropriate adjustments made, for return-of-investment, liquidity, multiple income streams. These adjustments are difficult to quantify, however, methods, procedures and data have been developed in business valuation and real estate appraisal to do so. The process of adjustment of the corporate pre-tax WACC to a property specific discount also requires that the WACC be adjusted for the risk related to a specific property.

The result of these adjustments should be a discount rate appropriate to a producing property with lower risk (100% Proved Developed Producing) reserves. Third party studies and analysis of the WSPA Cost-of-Capital data suggests that discount rates in the 19-21% BFIT range would be obtained with proper adjustments. The WSPA data from actual sales finds that this is the representative range for properties with 100% PDP reserves.

Application of the Sales Derived Discount Rate

The adjusted WACC provides a baseline discount rate; the market sales data provides the means for general risk adjustment. The WSPA Study has found that there is a relation between the derived discount rate and the percentage of PDP reserves attributed to the property in the evaluation. This analysis indicates that properties with 100% PDP reserves would have considerably lower discount rates than would properties with 100%PUD reserves (or 0%PDP) reserves. While the relation is not statistically robust, it is the only measurable relation that can be developed from the sales data, and it has a rational foundation in the risk-reward trade-off mechanism, which is generic in all investment models.

The combination of WACC and market sales data provides a rational and objective methodology for the selection of discount rates for the appraisal of specific oil and gas properties. The appraiser can start from a standard textbook WACC calculation. The procedure for this task is presented in detail in numerous publications including real estate texts and manuals developed by taxing authorities to obtain a Cost-of-Capital that is representative of the minimum required return anticipated by prospective purchasers of oil properties. The WACC is then adjusted to account for (1) return-of-investment, (2) illiquidity and (3) income diversity to align the discount rate with a minimum risk level appropriate to 100%PDP properties. The appraiser then determines the relative volumes of PDP and other classes of reserves in the evaluation and assigns an appropriate risk increment based on Figure 8 or another well-researched source. The selection of the risk-related rate is a judgement issue, not a matter of picking a number off a graph or table. The %PDP relation provides only a guideline to the range of discount rates. There may be other issues that influence the choice of discount rate from within the range.

DISCUSSION OF STUDY

General

The Discussion section of this report, along with the Exhibits and Appendices, presents the results of a study of market economic and evaluation parameters comprised of three parts.

First, the Cost-of-Capital Study is a review and analysis of the financial information reported by potential buyers and sellers of oil properties. This part of the study is conducted using a representative group of oil and gas companies, (a) to determine the Before Federal Income Tax ("*BFIT*") Cost-of-Capital for companies in the 1984-2002 period, and (b) to compare and reconcile the BFIT Cost-of-Capital to the BFIT discount rates derived from property sales.

Second, the Property Sales Study is a review and analysis of actual sales of oil and gas properties that have occurred during the nineteen-year period from 1983 through 2001 in order to determine the economic and financial criteria used by knowledgeable and informed purchasers of oil properties in evaluating such properties for acquisition. Particular attention is given to the effective discount rate which equates to the fair market value of the properties on a BFIT basis.

Third, in the Reconciliation section, an analysis of the assembled database of actual market transactions and Cost-of-Capital information is done in order to (a) establish the basis on which knowledgeable and informed purchasers of oil and gas properties make the decision to offer and pay a market value price for a property, and (b) derive a set of parameters which can be applied to similar properties to estimate the market value of those properties. This section of the Study also includes (1) a discussion of the relation between the WACC derived discount rate and the discount rate obtained from analysis of actual market sales for the purpose of attempting to quantify that difference, and (2) an analysis of the return-of-investment component of the Cost-of-Capital.

It is not intended that the data and analysis results presented in this report be construed to be specific recommendations for future use in the appraisal of oil and gas properties. However, generally accepted appraisal practice and specific appraisal regulations, including California State Board of Equalization ("*SBE*") Rule 8 and Rule 468, rely on (1) discount rates and other data obtained from the marketplace, and/or (2) discount rates derived from a Cost-of-Capital approach as the source(s) for discount rates and other economic parameters for use in appraisal of oil properties. Therefore, the current and historical data derived by the study and presented in this report form a proper basis from which to select such parameters for use in fair market value and ad valorem tax appraisals. Exceptions to the general application of this data may be caused by specific rules and regulations applicable to the intended use. The application of this derived data to ad valorem tax appraisal under California State Board of Equalization Rules 8 and 468, as interpreted by Assessors' Handbooks 502 and 566, is discussed in Appendix E to this report.

Organization of the Report

The report is organized in five sections. The Cost-of-Capital section studies the derivation of the BFIT Cost-of-Capital discount rate from the financial reports of active buyers and/or prospective purchasers of oil and gas properties, along with analysis of relevant capital markets and interest rates. As part of this section of the study, the traditional real estate *Band-of-Investment* approach was examined for application to oil properties. Additional analysis is focused on rigorous application of financial methods to Cost-of-Capital analysis. These methods include a review of Pure-Play discount rate derivation, the expansion of cost-of-equity analysis to account for Market Capitalization Effect, and an examination of the Fama-French Three Factor Model. The Market Capitalization Effect was coupled with the Pure-Play approach to construct a conceptual bridge between market sales and Cost-of-Capital results.

The Economic-Financial Context is a new section which (1) presents a synopsis of current and historical economic and financial data, and (2) seeks to relate the Cost-of-Capital and sales data derived in the WSPA Study to that broader market.

The Property Sales Study investigates the derivation of (1) price/cost escalation rates and (2) effective fair market value discount rates from actual acquisitions and sales of oil and gas properties. Discussion of the statistical analysis of the discount rate database to determine (a) the components of the discount rate, and (b) the relationship of the discount rate to various physical and economic characteristics of the properties has been significantly expanded.

The Reconciliation section of the report is now considered to be the most important area of study, as the market sales data and Cost-of-Capital analysis have achieved both consistency and acceptability as data sources. The focus of this analysis is to attempt to identify and quantify the relationship between Cost-of-Capital and the Market Sales results. This section also includes a brief discussion of the comparison of the results obtained in this study to the results of other similar studies.

The Application section discusses the application of the data derived in this study to the appraisal of oil and gas properties for ad valorem tax and other purposes.

COST-OF-CAPITAL STUDY

Purpose of the Cost-of-Capital Study

The selection of a discount rate for use in the appraising oil producing properties using the Income Approach has often been a point of some difficulty. The preferred source for discount rates is, and should be, the marketplace for producing properties. This preference is suggested in appraisal literature and is stated in regulations such as California SBE Rule 8(g), which accords primacy to market derived rates. [7] In California, the regulatory requirement for full disclosure of property transactions [8] provides assessors with a body of market data for use in deriving evaluation parameters. However, reliable market sales data is difficult to obtain even with full disclosure. The limitation on the availability of market data has led to the use of weighted average Cost-of-Capital as the basis for deriving a "*capitalization rate*" for use in the Income Approach to property valuation.

In this study, the Cost-of-Capital is defined to serve two similar but distinct roles. First, the Cost-of-Capital assumes the role of "*opportunity cost*" and performs as the lower risk alternative to individual property investment. Second, academic and empirical research indicates that Cost-of-Capital is the foundation for investment decision methodologies used by individual and corporate investors where the Cost-of-Capital performs as the base rate for a minimum required return.

The Cost-of-Capital is a financial function, not an appraisal function. The discount rate derived from the Cost-of-Capital is not necessarily the same as the discount rate that would be applied to the income stream from a oil producing property in order to determine value. There are three primary differences. First, the Cost-of-Capital assumes *recapture* or return of the original investment through *reversion* and, therefore, contains no component for return-of-investment. In contrast, an oil property is produced to depletion of the reserves and/or the economic limit of production. In either circumstance, the property has no reversion value; therefore, the required return must contain both a return-of-investment and a return-on-investment component. Second, the Cost-of-Capital is a generalized return based on the expectation of income from a portfolio of investments rather than from individual property income streams and, therefore, the Cost-of-Capital does not include the risk inherent in the reliance for a return on a unique income stream from a single property. Third, the Cost-of-Capital is derived from the expectation of returns on debt and equity assets, which have considerably greater market liquidity then do oil properties.

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[7] California Administrative Code, Title 18, § 8

[8] California law requires that whenever a real property interest is transferred, the recipient or "Buyer" must file a Change of Ownership Statement with the assessor of the county in which the property is located. This statement requires a substantial amount of information about the transfer including, in the case of oil and gas properties, the buyer's engineering and economic evaluation of the property and supporting documentation.

Concept of Cost-of-Capital

The Cost-of-Capital and the Weighted Average Cost-of-Capital (WACC) are concepts common in financial management and are discussed in detail in numerous books, [9] journals and regulatory manuals.[10, 11, 12] In general terms, the Cost-of-Capital is the cost to an individual, company, or other business entity of obtaining the capital necessary for new investment and for the maintenance of corporate growth. The "*cost*" is generally calculated as the "*return*" or interest rate associated with the particular form of capital obtained and the capital structure of the firm. It is the rate-of-return that must be earned on all investments in order to maintain the value of the company as represented by the stock price. If the rate-of-return on investment and, by extension, the return-on-equity declines, the stock price could be expected to decline. The same principle applies to individuals and unincorporated entities. For simplicity, this study assumes a corporate investor.

In traditional financial management, the Cost-of-Capital serves three primary functions. First, it is a measure of the required return on an investment. Second, it is a measure of the risk of some investments and of the risk to the investors in the company. Third, it is a component of the discount rate. While these distinctions are very narrow, each characterization offers a different perspective on the Cost-of-Capital and its application in oil property valuation.

When viewed as a measure of required return, the Cost-of-Capital becomes the minimum acceptable rate-of-return on invested capital. Since the Cost-of-Capital is, by definition, the rate-of-return expected by equity investors and by debt holders of a company, the investments made with that capital must return a rate sufficient to satisfy those investors. If a company has numerous investment options such as drilling new wells, starting enhanced recovery projects, or building a new processing plant, it must ensure that each investment will provide a return sufficient to satisfy all capital providers. While certain projects may be allowed a lower return, there are usually offsetting intangible benefits such as environmental compliance or an indirect benefit to another project. However, such investments are necessarily limited in number; otherwise, the composite return from all projects would be diluted. The company cannot make a practice of investing at less than Cost-of-Capital returns. If it does, investors will find other places to put their money that are perceived to be more reliable.

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[9] The reference text for this report is Brealey, Richard A. and Myers, Stewart C., "*Principles of Corporate Finance*," Fourth Edition, 1991 McGraw-Hill

[10] "*Texas Property: Tax Manual for Discounting Oil and Gas Income*," Comptroller of Public Accounts, Austin, TX, 1999

[11] **"***Assessors' Handbook, Section 501 - Advanced Appraisal*," California State Board of Equalization, December 1998, Sacramento, CA

[12] "*Assessors' Handbook, Section 566 - Assessment of Petroleum Properties*," California State Board of Equalization, August 1996 (Amended 1999), Sacramento, CA

The Cost-of-Capital can also be viewed as a measure of risk. While the difference may be hard to discern, companies in high risk industries such as oil and gas production and development could be expected to have higher Cost-of-Capital due to a higher perceived risk of attaining the required return. This would be particularly true for small production companies with limited capitalization. The perceived risk is measured in the return required for equity investments and the interest rate on debt.

The Cost-of-Capital is a component of the discount rate used for valuing potential investments. While it may be the largest component, it is not the only component. When used to estimate the value of the income stream from an investment, the discount rate must include components for (1) return-of-investment, and (2) the risk of the specific project/investment relative to the opportunity Cost-of-Capital. The result is a discount rate which may be different for each project or income source.

Corporate Capital vs. Specific Project Financing

Traditional Cost-of-Capital methods are based on corporate capitalization rather than the financing that may be attributed to a specific project or acquisition. As noted below, less than 10% of all property acquisitions in the WSPA database were financed. Over 90% of the transactions were concluded using corporate equity in the form of cash for 100% of the purchase price. [13] This equity comes primarily from retained earnings. Corporate financial management would, over time, require that internal funding be optimized between debt and equity so that all corporate investments that are not specifically financed can be viewed as drawing on a mix of debt and equity (the corporate capital structure) rather than equity alone. While not all purchasers of oil properties are publically traded corporations, the corporate model is still valid and is theoretically sound.

The Traditional or Real Estate Band-of-Investment

The Cost-of-Capital, as used in this Study, is not the same as the *Band of Investment,* which is the common term in real estate appraisal. The Band of Investment is a term (1) associated with direct capitalization of income streams, and (2) refers primarily to the cost of debt and equity returns related to specific property mortgage financing. In oil property appraisal, income is variable, not constant, so that yield capitalization rather than direct capitalization is the appropriate method. Yield capitalization rates are obtained through methods which are based on yield returns over a prospective period consistent with the term of the investment. These methods are captured in the Cost-of-Capital approach as discussed in this study.

The Band of Investment ("*BOI*") approach to discount rate derivation is discussed in real estate appraisal as part of the Direct Capitalization methodology. Differing forms of the Band of Investment exist. The most common form is based on Mortgage and Equity components. According

[13] The California Change of Ownership form requires that the buyer indicate the form and structure of the financing, if any, used for the acquisition.

to the Appraisal of Real Estate:

> "*Because most properties are purchased with debt and equity capital, the overall capitalization rate must satisfy the market return requirements of both investment positions. Lenders must anticipate receiving a competitive interest rate commensurate with the perceived risk of the investment or they will not make funds available. Lenders also require that the loan principal be repaid through periodic amortization payments. Similarly, equity investors must anticipate receiving a competitive equity cash return commensurate with the perceived risk or they will invest their funds elsewhere*."[14]

The application of the Mortgage-Equity process to oil properties is not simple or direct. Real estate mortgage financing is often for long periods (20-30 years) primarily because the asset value is not expected to decline. Oil properties, however, are depleting assets so that oil loans tend to be made for short periods (5-7 years) or for half the reserve life, whichever comes first. Discount rates derived from oil property income streams are yield rates and have no expectation of reversion. In traditional real estate appraisal, the BOI is a direct capitalization rate which assumes (1) a long-term mortgage, and (2) reversion of the property as part of the equity return. The equity cash flow will continue after the loan is paid off.

Appendix F to this report includes[15] a list of 25 transactions that had some form of financing other than all cash.[16] These 25 transactions account for less than 10% of the 271 transactions in the WSPA database. Short-term corporate borrowing, whether from institutional credit facilities and/or short term capital markets such as commercial paper, were considered to be for corporate convenience and were not included as indicators of either mortgage or equity components of a BOI. These data suggest that very few oil property transactions are financed using mortgage or similar debt. The vast majority of oil property acquisitions, in terms of both size and number, are financed with 100% equity.

Due to the relatively small number and percentage of transactions which are not 100% equity financed, the results of the specific sales analysis should not be construed to supersede the WACC results but do provide interesting insight and should be considered along with the WACC results discussed below.

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[14] *"The Appraisal of Real Estate*," 10th Edition, Appraisal Institute, Chicago, IL. 1992, pg. 470.

[15] *"Fair Market Value Transactions, Cost of Capital, and Risk: California Oil and Gas Property Transactions 1983 through 1998*," Richard J. Miller & Associates, Inc., January, 1999.

[16] Financing, as used in this analysis, is a broad term that includes any payment other than cash. The forms of "*financing*" include bank loans, transfers of stock and production payments of one form or another. In most cases, but not all, there was also some cash.

Analysis Methods and Procedures

Determination of the WACC for a single company or a group of companies requires analysis and consideration of the three basic components of the total WACC.

- Capital Structure
- Cost-of-Debt
- Cost-of-Equity

Capital Structure

Capital is generally obtained in three forms: debt, preferred stock and common stock. Some companies use all three forms while others use only one or two. Regardless of construction, each form is a component of the capital structure, and each component has a cost. The retained earnings of a corporation are the property of the equity holder and are equity for analysis purposes. The composition of the "*capital structure*" of the company must be determined as of the date of the analysis. For this study, the proportions of the market value of debt and equity are used as the capital structure.

Historically, the acquisition of producing properties in California has been done with equity capital. Data from California oil property sales indicate that the vast majority of oil and gas properties are purchased by the payment of cash to the seller where funds are apparently taken from the pool of investment capital available to the buyer. As noted above, of the 271 sales in the WSPA database for the 1983 through 2003 period, only 25 sales indicate any form of payment to the seller other than 100% equity cash. The other forms of payment include cash plus the proceeds of specific loans; but also include cash plus stock, stock warrants, exchanges of other properties and conditional payments subject to changes in oil price.

Based on this information, it is apparent that knowledgeable and informed buyers of oil and gas properties are most likely to use equity capital for acquisition as opposed to mortgage debt financing. It would, therefore, be reasonable to assign the equity Cost-of-Capital as a discount rate for oil property appraisal. However, for this study, it is assumed that acquisitions are only one activity of the buyer and that appropriate use of capital by the buyer, whether corporate or individual, would attempt to optimize leveraging opportunities in a financially responsible manner. For this reason, the Cost-of-Capital is calculated as a weighted average Cost-of-Capital derived from debt and equity. Therefore, the corporate capital structure of publicly traded oil and gas companies is used as a surrogate for all potential purchasers of oil and gas properties.

Cost-of-Debt

The Cost-of-Debt is calculated as the weighted average of the cost for each debt instrument issued by the company and outstanding at the time of the analysis. The cost for publically issued debt is the yield to maturity on bonds and notes. The cost of institutional debt, such as bank loans, is the prevailing interest rate. The aggregate weighted cost-of-debt for the company is calculated using the dollar amount outstanding times the interest rate or YTM for each increment of debt.

Cost-of-Equity

The cost of all forms of equity must be determined along with the composition of the equity portion. For this study, the cost-of-equity on the analysis date for each company is calculated using an average of the (1) total return (dividend payment plus equity growth) obtained from the Value Line Investment Survey, and (2) a cost-of-equity calculated from the Capital Asset Pricing Model (see Appendix B). For those companies not reported by Value Line, only the Capital Asset Pricing Model ("*CAPM*") result is used. As part of the analysis for this study, the results obtained using only Value Line companies were compared to the results from the larger group. No significant difference was found among the two groups. The cost-of-equity estimated from both the Value Line survey and the CAPM calculation is an After Federal Income Tax (AFIT) value which must be converted to a Before Federal Income Tax (BFIT) value. The BFIT Cost-of-Capital is calculated as the After Tax cost-of-equity divided by a factor of (1 minus T) where T is the *statutory* Federal Tax Rate. [17]

[17] This study uses only the Federal rate. There is some debate as to whether the California state income tax should also be included. The inclusion of the state corporate rate is appropriate when attempting to conform to California markets, and, considering that California has invoked a unitary tax rule in the past, there is an argument for applying the California rate to derive a BFIT Cost-of-Capital even though the vast majority of income for the companies in the sample is earned outside California.

There is also debate as to whether the effective tax rate should be used rather than the statutory tax rate. The statutory rate is always used in professional discussion, textbooks, etc. for several reasons. The primary reason is that effective tax rate is after the fact, a historical rate, whereas CAPM and other methods of calculating cost of equity are used to derive forward rates where the only known rate is the statutory rate. Further, the effective tax rate results from company-specific decision processes and accounting practices, which may or may not be repeated or replicated in the future either through choice or changes in tax law.

Derivation of Weighted Average Cost-of-Capital

The BFIT WACC is determined from the combination of capital structure, BFIT cost-of-debt and BFIT cost-of-equity. For year-end 2002, an analysis was done of the WACC for a group of 43 oil and gas companies including 7 major integrated companies and 36 non-integrated producing companies using year-end financial data (Exhibit I). The current study was done in a manner similar to prior WACC studies for calendar years 1984 through 2001. The composition of the study group(s) was derived from the list of companies reported by the Value Line Investment Survey with several additions selected from reports issued by Standard & Poor's. The selection of the additional companies was based on (1) availability of data such as dividends, earnings and calculated beta factors, (2) activity of the company in acquisitions, and (3) California location. The number of companies included in the data set has been reduced from prior years due to mergers, acquisitions, and business failures.[18]

Most of the companies in the study are publicly traded on the New York Stock Exchange (NYSE). Several of the companies included in the study group were active in property acquisitions. All the companies were considered to be on-going concerns. The companies are considered representative of the prospective property purchasers in the market, even though they may not necessarily be active purchasers in 2002 or 2003. The costs-of-capital and the required rates-of-return for these firms essentially define the competitive market for investment capital and for investors for public and non-public companies. If there is any differential between public and non-public companies, the Cost-of-Capital and required rates-of-return for non-public companies would be expected to be higher than for public companies because they lack the risk reduction that comes from public review, regulatory control and liquidity.

The following paragraphs present a brief discussion of the results of the WACC analysis done for this study. Additional discussion of the methods and procedures used is found in Appendix B to this report and in referenced Exhibits. It must be kept in mind that the BFIT Cost-of-Capital is artificial and does not exist in real financial analysis. It is calculated here only to provide an alternative for, and a comparison to, market-sales-derived BFIT discount rates. Results of analysis for year-end 2002 are summarized in below.

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[18] The composition of the study group of companies and the analysis of financial data is made more complicated for year-end 2002 because of the large number of mergers and corporate acquisitions entered into in recent years, resulting in the creation of new entities that may not be recognized from prior years. These include Exxon Mobil and BP Amoco (plus ARCO), but also Kerr McGee/ Oryx, Santa Fe/Snyder/Maynard, Seagull/Ocean and the combination of several companies into Range Resources, Remington Oil & Gas and Pioneer Natural Resources. In 1999, Devon Energy acquired Santa Fe/Snyder/Maynard and was added to the study group. In 2000-2001 Devon acquired Mitchell Energy. Enron has been removed from the list. Several companies including Callon Petroleum, Calpine Corp., Equity Oil, Questar Corp., Houston Exploration, and XTO Energy have been added to the list.

WEIGHTED AVERAGE COST-OF-CAPITAL (BFIT)
@ December 31

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Integrated, %	15.6	15.5	16.1	14.2	16.6	15.1	15.7	14.9	14.9
Independent, %	18.2	14.5	15.9	14.0	16.1	15.8	15.6	15.3	12.5
Combined, %	17.3	14.8	16.0	14.1	16.2	15.6	15.6	15.2	12.9

The WACC calculated in this study is the current or marginal Cost-of-Capital, not a simple historical Cost-of-Capital. As a marginal value, the WACC is more closely related to the minimum return standard applied to individual evaluations by buyers and is, therefore, more closely related to the market discount rate than a historical WACC. This is true even though the companies that are used in the WACC analysis are not necessarily the same as those occurring in the market sales database as Buyers or Sellers. Further, the results obtained from the standard Cost-of-Capital analysis are considered to be conservative. The companies used for the sample groups are primarily large, stable, publicly traded companies with relatively long performance histories. The Value Line estimates in particular are based on thorough research of accumulated company and industry performance. These results are seen as having relatively less risk than other companies with smaller capitalization and greater risk. There is a significant amount of research from securities analysis, indicating that the risk associated with small capitalization as compared to large capitalization is expressed in expected and/or actual returns.

In the study for this year, an AFIT WACC is also calculated in order to provide a comparison to historical market return and to the reports of several companies regarding returns. The average AFIT WACC for all 43 companies is 9.3% as compared to the 12.9% BFIT WACC. It should be noted that, for most companies, internal discount rate guidelines are defined in AFIT terms, not BFIT terms.

Pure-Play Analysis for Cost-of-Capital Estimation

The WACC analysis reported for this study is a traditional calculation of an average WACC for each of the companies in the study group. As noted earlier, this WACC is not necessarily, and is rarely likely to be, the rate that would be used to value a specific property.

A 1997 study by Ibbotson Associates for WSPA [19] suggests an approach to estimating a WACC that more closely fits the requirements of specific property appraisal. In this work, Ibbotson calculated WACC for a "*Pure-Play*" oil and gas production company, where 100% of revenue would come from producing operations. The Pure-Play company simulates the return from a producing property, but the return is estimated from capital market methods and data. The result obtained by Ibbotson was a BFIT WACC of 20.15% for a pure-play oil producing company. This result is

[19] "*WACC for Pure-Play Oil and Gas Extraction and Refining Entities*," Ibbotson Associates, presented by Roger G. Ibbotson, President and Chairman, at Ventura, CA, January 15, 1997.

significant in providing some indication of a minimum discount rate that could be applied to low risk properties. While Ibbotson made adjustments for liquidity, there is no consideration or adjustment for the risk inherent in the income stream or reserves.

Weighted Average Cost of Capital: Modified

The BFIT and AFIT WACC discussed above is calculated using the standard textbook approach where the three basic components are the cost-of-debt, the cost-of-equity, and the proportion of each in the capital structure. Of these three, the cost-of-equity has always been at once the more difficult and most controversial components. As noted above, the Capital Asset Pricing Model is the primary source for estimating expected return-on-equity, with a lineage going back to the early 1960's.[20] Continuing research into the methods of estimating cost of equity has resulted in two major and relatively new approaches which augment the CAPM. These are the *Market Capitalization Effect* and the *Three Factor Model*.

Market Capitalization Effect

The Market Capitalization Effect refers to the observation that anticipated and/or actual return-on-equity is inversely related to the market capitalization ("*market cap*") of companies. [21] In this concept, market capitalization is a surrogate for one form of investment risk. (See page 50 for a more complete discussion of Market Capitalization Effect)

The sample group of 43 companies used in this study have a total market capitalization at December 31, 2002 of $443,528 billion and range from ExxonMobil at $229,274 billion to Royale Energy at $23.622 million. The average market cap of the 43 companies is $10,315 million.

The Market Capitalization Effect contributes a premium [22] ranging from -0.32% up to 9.16%, which is additive to the equity return calculated by the CAPM. Based on an average market cap of $80.938 billion, the integrated companies in the sample set would qualify for an average premium on the CAPM of -0.32 percentage points, while companies within the larger group of non-integrated companies would have the CAPM return increased by of 0.42 to 9.16 percentage points. These adjustments to the cost of equity would produce a material change in the calculated WACC, particularly when equity forms the largest portion of total capital. The available data does not allow a completely rigorous application of the Market Capitalization Effect to the Cost-of-Capital for this study, however, as shown in Exhibit II, for many oil and gas companies, the adjustment recognized for the Market Capitalization Effect would result in a measurable increase in WACC. Based on the

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[20] In 1990, one of the authors of the CAPM, Dr. William Sharpe, received the Nobel Prize in Economics for his contribution to financial analysis.

[21] The market capitalization of a company at a point in time is the current market value (price) of the equity (stock) shares issued by the company times the number of shares outstanding.

[22] "*Cost of Capital Quarterly - 2003 Yearbook*," Ibbotson Associates, Chicago, IL, 2003

average capitalization of $1.827 billion of the Non-Integrated/Independent segment of the study group, the market cap premium would be 0.66%, which would result in an increase in average AFIT COE from 10.058% to 10.718%. When corrected to BFIT, this represents an increase from 15.47% to about 16.49%. The capital structure is about 62.3% equity, which results in a 0.26 percentage point increase in BFIT WACC to 12.72%.

Three Factor Model

The Three Factor Model is an expansion of the CAPM based on research by Fama and French[23] at The University of Chicago and by other researchers[24, 25] into the function of the beta component of CAPM. This research suggests that refinements can be made to CAPM to account for valuation factors not measured by beta. There has been voluminous study of this issue, which is far from being resolved. However, financial analysis using the Three Factor Model is being done, and Ibbotson, among others, publishes Three Factor Model data along with standard CAPM data.

Three Factor Model data are currently published only by SIC code, not for individual companies. For this study, SIC Code 131, which corresponds most closely to the Non-Integrated/Independent group of companies in the Cost-of-Capital analysis, was researched to obtain Three Factor Model estimates of Cost-of-Equity.

SIC Code 131 - Crude Petroleum and Natural Gas: This group includes 96 companies, such as Anadarko Petroleum Corporation and Berry Petroleum and most of the companies in the Non-Integrated/Independent group above. For this group, the Median cost-of-equity using the Three Factor Model is 9.52% AFIT. When adjusted to BFIT, the cost-of-equity for this SIC code would be 14.65% which is 0.82 percentage points less than the 15.47% basic CAPM BFIT cost-of-equity for the Non-Integrated (Independent) group of companies.[26] Substituting the Three Factor cost-of-equity in the Cost-of-Capital analysis results in a WACC of 11.58% for year-end 2002. [27]

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[23] Fama, Eugene F. and French, Kenneth R., "*The Cross-Section of Expected Stock Returns*," Journal of Finance, Vol. 47, 1992, pp. 427-465

[24] Kothari, S.P., Shanken, Jay and Sloan, Richard G., "*Another Look at the Cross-Section of Expected Stock Returns*," Working Paper, December 1992

[25] Black, Fischer, "*Beta and Return*," Journal of Portfolio Management, Fall 1993, pp.8-18.

[26] Data from "*The Cost of Capital Center*," Internet site operated by Ibbotson Associates, Inc., Chicago, Il [www.valuation.ibbotson.com]

[27] WACC = ((0.6223)(14.65)) + ((0.377)(6.509)) = 11.58%

THE ECONOMIC AND FINANCIAL CONTEXT OF THE WSPA STUDY

The WSPA Study presents the results of two separate, but directly related, analyses of market data; the discount rates derived from actual transactions and the estimated Cost-of-Capital for those corporations that would be considered potential purchasers and sellers of oil and gas properties. The two discount rate sources represent processes that are related in both theory and practice. Numerous studies, along with standard financial references, demonstrate that WACC and/or variations of WACC are used as the foundation for capital budgeting decisions, including those involving property acquisitions. The observation in this and other studies that discount rates from actual transactions continually exceed the Cost-of-Capital should be expected. Both elements are also related to the broader economic-financial context of the oil and gas industry.

WACC as Opportunity Cost

In financial management, the discount rate performs a traditional and comprehensive role. As noted by Brealey & Myers [28]: *"To calculate present value, we discount expected future payoffs by the rate of return offered by comparable investment alternatives. This rate of return is often referred to as the* ***discount rate, hurdle rate****, or* ***opportunity cost of capital****. It is called the* opportunity cost *because it is the return forgone by investing in the project rather than investing in securities."* [Emphasis in original]

In the context of the WSPA Study, the rate of return offered by "*...comparable investment alternatives...*" is the return derived from actual market transactions. As will be shown below, this return has been consistently found to be in the 19-22% range for the lowest risk (100%PDP) properties. However, market derived returns on oil properties are not always available, and, even where available, a second source of data is often desired. The WACC is commonly used to provide an estimate of "*opportunity cost*" as a starting point. The WACC has also been referred to as a "*minimum required return*" for capital budgeting purposes. The WACC is described as "*The expected return on a portfolio of all the company's securities...*" [29] When used as an opportunity cost, the WACC must represent the minimum return because, as noted by Brealey & Myers, it is the "*...return forgone by investing in the project rather than investing in securities*." Since the WACC is the expected return on the company's securities, any funds invested in a project must earn at least the WACC or the company would have been better off to buy its own stocks and bonds. Broadening the WACC by calculating an average WACC for an industry group of companies does not change the MRR aspect of WACC, but simply substitutes an industry return for an individual company return.

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[28] Brealey, Richard A. and Myers, Stewart C., "Principles of Corporate Finance," Fourth Edition, 1991, McGraw-Hill, pg. 13

[29] Ibid, pg. 408

Where WACC is used as the basis for capital budgeting, it is not unusual for evaluators to add an increment to WACC to provide the opportunity for an enhanced return that justifies investment of corporate capital. This increment is often called a "*hurdle rate*." While this term is the same as that used by Brealey and Myers, it has specific meaning in industry and serves a purpose. Brealey & Myers also note that the WACC "*... is used in capital budgeting decisions to find the net present value of projects that would not change the business risk of the firm*."[30] Note the reference to the firm. "*Unfortunately, the* [WACC] *formula applies to the firm as a whole, not necessarily to any specific project*."[31]

Further,

"*The first thing to notice about the weighted-average formula is that all* [the] *variables in it refer to the firm as a whole. As a result the formula gives the right discount rate only for projects that are just like the firm undertaking them. The formula works for the "average" project. It is incorrect for projects that are safer or riskier than the average of the firm's existing assets. It is incorrect for projects whose acceptance would lead to an increase or decrease in the firm's debt ratio*.

The idea behind the weighted-average formula is simple and intuitively appealing. If the new project is profitable enough to pay the (after-tax) interest on the debt used to finance it, and also to generate a superior expected rate of return on the equity invested in it, then it must be a good project. What is a "superior" equity return? One that exceeds r_E*, the expected rate of return required by investors in the firm's shares."* [32]

The WACC is clearly a threshold since a project with an anticipated return less than WACC would diminish the value and increase the business risk of the firm. On the other hand, the addition of an increment above WACC as a "*hurdle rate*" is intended to provide the enhanced equity return. For use in valuing oil properties for market value, the alternative to WACC as an Opportunity Cost could be BFIT ROE.

Historical Industry Performance as a Measure of Opportunity Cost

Neither oil property acquisitions nor the underlying appraisals and the management decisions that result in acquisitions (or decisions not to acquire) occur in a vacuum. The reliance of industry and regulatory authorities on the WACC is a clear recognition that oil property valuation is not a unique methodology but has an indisputable financial basis. For that reason, it is useful to review the broader economy and the financial performance of the oil industry over the past 40+ years.

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[30] Ibid, pg. 408

[31] Ibid, pg. 465

[32] Ibid, pg. 465

This analysis examines the return-on-equity[33] ("*ROE*") of oil industry companies as the measure of most closely related to actual market data. Three principal data sources are used.

- For the period 1989 through 2003, quarterly data is taken from the "*Corporate Scoreboard*," published in Business Week magazine. This source calculates AFIT return-on-equity for all industrials and for various segments of industry including a Fuels group that includes an Oil and Gas sub-group. Over time the composition of the group has changed due to mergers and other events, but there has been considerable consistency of reported results over the period of interest. The most recent data is for the 3rd Quarter[34] of 2003 for 20 companies.

- Data for 1968 through 1990 is taken from an American Petroleum Institute ("*API*") report.[35] This source provides an annual AFIT return-on-equity for a group of companies comprised primarily of integrated and large independent producing companies.

- Additional data for 1968 through 1988 is taken from reports published by The Chase Manhattan Bank ("*Chase*").[36] This source reports annual return-on-equity for essentially the same group of companies as is used by API.

Comparison of the data from the three sources indicates that the results are consistent and can be integrated over the entire period of 40 years. As shown in the table below, the API data has an arithmetic Mean of 12.9% and a Median of 12.5%; the Chase data has a Mean of 13.5% and Median of 12.4%. The annual data from API and Chase are plotted along with the Business Week data in Figure 1; the quarterly Business Week data for 1989-2003 are shown in more detail in Figure 2.

AFIT RETURN-ON-EQUITY
OIL AND GAS INDUSTRY

	Period	Mean, %	Median, %
Business Week	1989-2003	12.4	11.9
API	1968-1990	12.9	12.5
Chase	1968-1987	13.5	12.4

[33] *Return-on-Equity*, as defined in standard texts and as used in the three data sources, is Net Income After Taxes and Extraordinary Items divided by Stockholders' Equity.

[34] Business Week, November 17, 2003, McGraw-Hill, pg. 83

[35] Discussion Paper No. 017R, "*Financial Trends of Leading U.S. Oil Companies: 1968-1990*," American Petroleum Institute, October 1991, Washington, D.C.

[36] "*Financial Analysis of a Group of Petroleum Companies*," The Chase Manhattan Bank, N.A., New York, New York, for each year 1961 through 1988

The Business Week data plotted in Figure 2 includes three data groups: All Industrials, Fuels Group, and the Coal, Oil and Gas ("*COG*")sub-group. The three data sets provide an interesting contrast over certain periods where the oil group tends to coincide with the Industrials, but there are other periods of wide divergence. While there are significant variations in the returns over the period that are related to conditions in the oil industry and/or the economy as a whole, there is also a central tendency that seems to be in the 13.4% range. As noted in the table above, the mean for the Business Week group is 12.4%, but it is also apparent that returns have varied from as low as 4% to 27% in just the past 6 years. Over the period of 1996-2003, the mean ROE for all Industrials is 13.8% (median = 15.50%), while the mean and median for the COG group is 13.7% and 14.0% respectively. The volatility in the Oil and Gas group over the entire 40 years period can be traced largely to changes in oil price, along with changes in the general economy that may or may not be related to energy costs. For the purpose of this study, the longer period of 1968-2003 is considered to be more useful than the shorter periods.

The significance of this data is that it suggests that equity holders in oil and gas companies could reasonably expect long-term after tax returns of 12-14%, based on historical performance over the past 40 years. Considering that the market sales data indicates that virtually all property acquisitions are based on equity capital only, it is then reasonable to consider the 12-14% AFIT range to be the minimum expected return for property investments.

However, certain further considerations are necessary. First, historical performance is not a guarantee of performance in the future. Second, the ROE provided by API, Chase and Business Week are after-tax (AFIT) returns, which must be converted to pre-tax returns for use in evaluating properties. Third, the return-on-equity from common stock equity investments represents returns from highly liquid assets based on income streams from a large number of sources. Fourth, the return-on-equity provides no return-of-equity component.

Historical performance should not be presumed to continue. However, a rational Cost-of-Capital analysis that is consistent with historical performance can provide a connection between past performance and future expectations. It is in this context that the longer historical period has greater value than a shorter period that may be influenced by near-term events such as current oil price fluctuations. In that regard, the nearly seamless continuity of the 1968-2003 period would appear to make the 13.4% Mean ROE a good baseline.

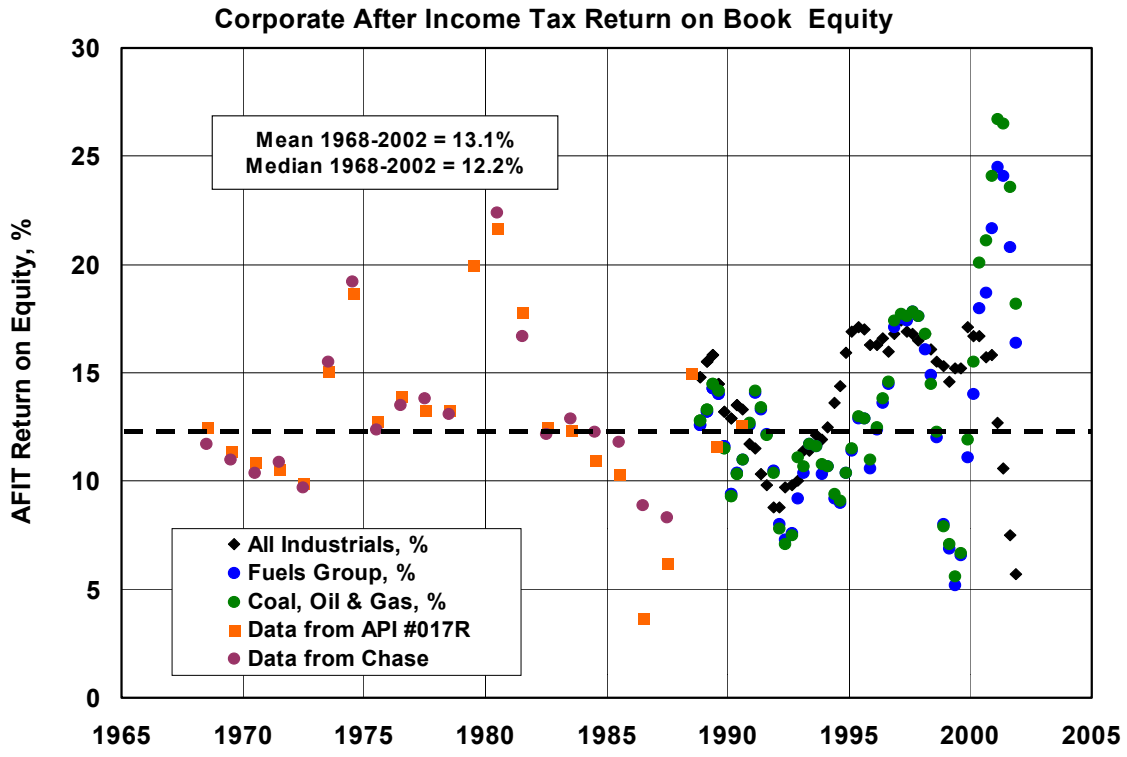

FIGURE 1

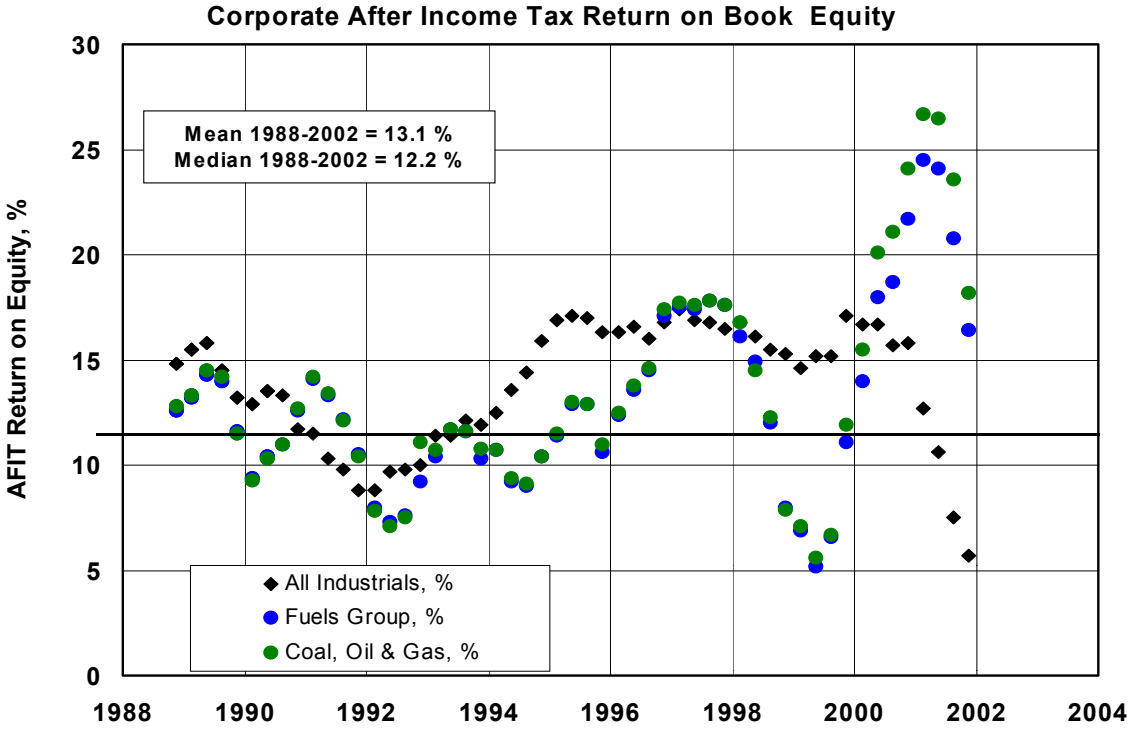

FIGURE 2

The conversion of an AFIT ROE to a BFIT ROE can be done by the simple expedient of dividing the ROE by (1-T), where T is the statutory marginal tax rate. Using the current 35% Federal rate, the mean ROE would become 20.6% before income tax.[37] The issues of liquidity, diversity of income streams and the absence of a return-of-investment component are resolved for ROE in the same manner as for WACC. The addition of a Hoskold or other factor would raise the Mean ROE to the middle 20% range.

Finally, there is the issue of risk where the risk of an individual oil producing property is compared to that of a publically traded oil and gas company. It is interesting to note that the 20.6% BFIT rate obtained above is consistent with the observed market derived discount rates for low risk (100% PDP) oil and gas properties.

Derived WACC as a Sample of the Market

The WACC derived as part of this study is based on financial analysis of 43 publically traded integrated and non-integrated oil and gas companies. The WSPA sample group consists of many of the same companies as are in the Chase, API and Business Week sample groups. Comparison of the calculated forward WACC for the WSPA Group with the historical results obtained by BW, Chase and API indicates a relatively close fit between the historical Mean ROE of 13.4% and the calculated AFIT Cost of Equity of 9.3% going forward from year-end 2002. While it is apparent that WACC for 2002 is exceptionally low this is largely due to a prime rate of less than 5% for institutional debt borrowers. Based on this comparison of (a) data sources and (b) calculated vs. historical results, it is concluded that the WACC value calculated for this study is representative of the anticipated return-on-equity and Cost-of-Capital for the oil industry.

The Debt and Equity Markets

The WACC consists of anticipated costs for both debt and equity. Use of the WACC as a discount rate source presumes that a corporation or other entity employing the WACC methodology would make investments using a balance of debt and equity. This corporate capital composition has been shown to be about 70% equity and 30% debt in the oil and gas industry. The available data indicates that property acquisitions are financed by equity with very little debt. However, the WACC that is calculated for this study is based on the corporate capital mix of debt and equity, which is viewed as being the ultimate source of funds for the acquisition.

[37] The 35% rate has not been the statutory marginal tax rate over the entire 1968-2003 period, and a rigorous procedure would make specific corrections for each year. However, it is presumed that the AFIT return-on-equity from periods prior to the introduction of the 35% rate would reflect the tax rates then in effect and, if adjusted to BFIT at those rates, would be consistent with more recent returns.

It is not unusual, however, for evaluators to relate the discount rate to debt rather than equity. This is probably because debt rates, as in bank lending rates, prime rate and other debt measures, are a function of common experience and the data is easily obtained. Equity return concepts are not so well known and data is not easily obtained.

A review of the historical trends of debt and equity returns demonstrates the inadequacy of debt alone to serve as a surrogate for actual returns from transactions. As discussed previously, the BFIT WACC occupies a range of 13-16% over the 16-year period that WACC has been calculated for this study. Over that same period, interest rates on all forms of debt have declined. The bank prime lending rate, for example, has declined from a peak of 13% in 1983 to around 2-3% in 2003 and 30-year Treasury bonds had dropped from 15% to less than 6%, before issuance stopped in early 2002. Corporate bond returns have followed a similar pattern. In contrast, equity yields from both large and small company stocks have tended with fluctuations, to increase over the same period. While many other factors would contributed to the general increase in total returns from stocks, declining interest rates would, over time, result in less income being paid out for debt service and, thus, more income available for equity holders.

BFIT versus AFIT

One of the more esoteric arguments in the derivation of Cost-of-Capital discount rates is the form of the adjustment from the after-tax returns quoted in Business Week and other sources to the pre-tax or BFIT returns necessary for particular uses such as ad valorem tax and estate tax appraisal. The textbook approach, and the approach recommended by most non-academic sources, is to use the marginal statutory tax rate. However, some evaluators have advocated the use of the effective tax rate on the theory that the effective tax rate is the rate that companies actually pay.

There are several reasons why the use of the marginal rate is correct. First, the effective tax rate is calculated as the total U.S. Income Tax paid divided by the Net Income Before Tax. It is not uncommon for the effective tax rate to differ from the statutory tax rate for a given reporting period. For example, at year-end 2001, the effective tax rate for the WSPA group of companies was 38.8% and 29.3% for integrated and non-integrated companies respectively. A review of the financial statements of those companies reveals that each one calculated income tax at the marginal corporate rate (35%), but then also made adjustments to those taxes for tax credits, foreign taxes and all the other credit and other adjustments that the tax code allows. Further, the taxpayer has substantial latitude regarding the use of such tax adjustments, so it is not unusual to have an above-marginal effective tax rate one year and a sub-marginal effective rate the next.

Second, the effective tax rate is highly individualized to the company due to the possible mix of credits and exemptions that may apply.

Third, the effective tax rate is historical and applies to a specific reporting period. The WACC is a forward rate-of-return. The only application of the effective tax rate that would be valid would be if the taxpayer anticipated that all the conditions, including the tax law itself, that occurred to create the effective tax rate would continue to occur in the same form in the future.

PROPERTY SALES STUDY

The purpose of the property sales study is to review and analyze actual sales of oil and gas properties in the marketplace and attempt to determine: (1) the effective fair market value discount rate used in the marketplace to equate the value of the property to the anticipated future income stream from the property and to the risk inherent in the property, and (2) the projection parameters used in the marketplace for product prices, operating costs and capital investment.

Construction of the Sales Database

The database used for the property sales study consists of transactions in which ownership in oil[38] producing properties in California was transferred from one entity to another during the years 1983 through 2003. Details of the identification of transfers of property,[39] and subsequent collection of sales data and procedural methods, are presented in Appendix C to this report. Market sales data is obtained from buyers and sellers of properties. The preferred source of data is the Change in Ownership Statement ("COS") or similar form which, by California law, must be provided to the tax assessor in the county in which the acquired property is located. Supplemental information is often obtained through communication with the buyer and/or seller. Primary attention was focused on obtaining data on property sales that occurred in 1998 through 2003.

Characteristics of the Sales Database

The transactions that compose the WSPA database of sales can be characterized as follows:

1. All transactions are considered to be fair market value under one or more definitions of fair market value.
2. The large majority of the transactions are for individual producing properties. Multiple property transactions are included where evaluation of the individual properties was done and where the properties are closely related.
3. Only California properties are included.
4. Only those transactions that are based on Proved reserves are used in the database. As of 2003, only five transactions were included in the database that had any UnProved reserves, and in those cases the UnProved reserves account for less than 10% of total reserves. For those transactions in which the buyer/evaluator allocated value to Proved and UnProved reserves, the Proved portion only was assimilated into the database.
5. The vast majority of the transactions received by, or reported to, the WSPA database are for the acquisition of mineral rights leases or ownership interests in mineral rights.

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[38] Hereinafter, unless otherwise stated, "*oil properties*" will refer to properties that produce hydrocarbons including crude oil, associated gas, dry gas, condensate and other products.

[39] The primary sources of initial data regarding transfers of properties are the individual filings of Division of Oil and Gas "*Report of Property and Well Transfer*" and reports of property sales provided by sellers.

Transactions involving fee simple interests account for fewer than 5 sales. In those transactions where (a) the surface rights or (b) other ownership interests in surplus equipment or facilities and fixtures may be involved, these are valued separately from the mineral rights and are accounted for separately in the transaction.

State of the Market

Market Value property transactions in the 1990-2003 period have generally fallen into four classes:

1. The consolidation of properties by major companies primarily through corporate combinations, joint ventures, stock purchase, merger or acquisition of smaller companies. This activity is of interest as it may affect the market in the future, but it provides only limited and inconsistent information as to the market value of individual oil properties. These transactions often result in ancillary transactions due to spin-off of specific properties.

2. The sale of small(er) properties by major oil companies to small(er) operators.

3. The sale of properties among small operators.

The latter two categories provide useful data for this study since they generally involve discrete properties. However, unlike the 1980's and early 1990's, there are not a large number of transactions in these two groups.

The fourth category of sales consists primarily of small transactions involving 1-10 wells among small operators based on agreed dollar amounts, acceptance of liability, or an intention to use the property for some other purpose than oil production. These types of transactions rarely include any economic evaluation and are thus not particularly useful for this study.

In contrast to acquisitions of producing properties that were made in the 1980's, these recent transactions seem to incorporate several significant considerations. First, major oil companies, some with large positions in California, seem to have come to categorize California as an expensive and difficult place to operate in terms of production costs, limited revenue margins, and regulatory compliance combined with a concern for current and future abandonment liability. Several companies have apparently determined that capital and assets can be of more use if redeployed elsewhere. Second, smaller companies making acquisitions appear to do so on the expectation of improved margins, primarily through lower operating costs, and possibly increased development, which is often heavily risked. These same companies tend to make explicit allowances for current and future abandonment costs. Third, mineral rights in urban areas such as Los Angeles and Orange Counties are experiencing diminished value as encroaching surface land use effectively limits the economic life of producing properties, particularly those subject to marginal economics. While some of these factors may be counter-balancing, the overall effect is to reduce property values.

Review of the sales occurring in recent years indicates that they meet the criteria for fair market value transactions and, in most cases, were evaluated using reasonably sophisticated methods of discounted cash flow appraisal. These transactions indicate several characteristics that were not common or obvious in evaluations and transactions done in prior years. These include:

- An increase, or at least a more obvious expression, of the use of risk adjustment and/or probabilistic methods of evaluation wherein specific risk adjustment factors are applied to the production projection and/or cash flow components of the income stream prior to discounting.

- Reduction of the offered purchase price by an amount sufficient to compensate for anticipated abandonment and clean-up liability.

- Inclusion in the cash flow of expenses and/or set-asides for abandonment and environmental cleanup of the property.

- Requirements by the seller for escrow accounts, letters-of-credit, or cash set-asides to provide funds for abandonment and cleanup.

- Retention of recession rights by the seller.

- Inclusion of production payments, overriding royalties, or other revenue-sharing approach, in the event that certain conditions, such as oil price, occur.

- Increased costs for regulatory compliance as part of normal operating expense as well as capital budgeting.

These considerations directly and indirectly affect the cash flow, purchase price and derived discount rate for a given transaction. The increasing frequency of these conditions in the transactions reported for the study and/or in the deliberations of buyers and sellers requires that full consideration be given to the impact of these conditions on property valuation.

Product Price and Operating Cost Projections

The oil and gas price projections used in the buyers' cash flows are evaluated to determine expected future annual changes in oil and gas prices and operating costs. The methodology used in prior studies to analyze price/cost expectations by purchasers has been retained to allow results from one study to be compared to results from other studies in terms of (1) the apparent escalation rates for each year, and (2) of the historical context of current price/cost relationships. The annual percentage change, if any, in oil price, gas price and/or operating costs for each transaction is obtained directly from data provided by the buyer or was calculated from the buyer's cash flow.

As used in this study:

- **Escalated** transactions are those evaluations where any change occurred in product prices or operating costs during the life of the cash flow. The base, or initial price, was taken as the first price used in the evaluation. Any change in price from the initial price, positive or negative, at any time is considered to be escalation. The same criteria are applied to operating costs, and a change in either prices or costs can cause the transaction to be put in the Escalated sub-group.

- **Non-Escalated** transactions are those in which the initial prices and costs are projected flat at the initial values. These are also referred as "*flat projection*" evaluations.

Over the past several years it has been noted and reported that an increasingly large percentage of purchase appraisals are done in nominal terms, but with no escalation of prices or costs. These have been termed "*non-escalated*" or "*flat projection*" cases. These flat projection cases should not be confused with "*real*" price/cost projections, which explicitly remove anticipated inflation as a component of the price/cost projection. Flat projections simply assume that over the life of the projection, increases and declines in prices and costs will balance. Flat projection cases make up a significant percentage of sales (50-60%), depending on time period, and have often been more correct in predicting future prices than have the escalated cases. To not include these projections would be to ignore information from a large segment of the marketplace for oil properties.

Several sales in the 1998-2003 period, for which data were received and evaluated for the study, used projections of nominal oil prices which remained flat at the initial price for the life of the cash flow or declined from the initial price to a lower level, which was then held constant. Operating costs in these cases were also projected with no anticipated increase. In several cases the cash flows provided as a supplement to the COS form were derived from or were evaluations done under Securities and Exchange Commission rules.

Most of this discussion centers on oil price escalation for three reasons:

A. There are a relatively few gas property transactions, and since gas prices are often a function of contract terms, gas prices do not show the volatility of oil prices.

B. Unless the escalation rates for operating costs are specifically stated, it is often difficult to know or determine what the operating cost escalation rate, if any, may be.

C. Operating costs are applied in evaluations in many different forms and can be subject to changes in production volume, number of wells, time of year, or other conditional variable.

Real or Nominal

There is often confusion between the terms ***Real*** and ***Nominal***, regardless of whether those terms are applied to price/cost escalation or discount rates.

Nominal Price = Real Price + Inflation

The oil price and operating cost projections provided by buyers for the WSPA Study are generally in nominal dollars and can be highly sensitive to the buyers' perceptions of future inflation. A very small minority of buyers use "*real*" price/cost projections. The nominal price or price/cost escalation rate includes an expectation of future price/cost inflation; if there is no expectation of inflation, then the nominal price/cost escalation equals the real price/cost escalation. Inflation, in economic terms, is caused by an excess of money and a limited volume of goods, which results in increases in prices (and costs) in excess of any increases which might occur due to normal interactions of supply and demand. Supply and demand under normal conditions can result in increases or declines in real prices and/or costs. Inflation accelerates or "*inflates*" the rate of increase by bidding up the price of goods and services. Pro-ration maintained a stable, nominal price of oil in the U.S. by measuring and then balancing the supply of oil with the demand for oil.

As has been reported many times in this study and elsewhere, over long periods of time, nominal oil prices have more often been in decline rather than increasing. When inflation has been taken into account, *"real"*oil prices have shown a consistent tendency to decline. Therefore, any treatment of oil price projection in real terms over more than a few months should consider that the real price will go down over time.

Of the 243 transactions in the Working Database for the 2004 Study, 136 transactions (60.0%) were escalated, and 107 transactions (40.0%) were done using flat price/cost projections. These changes, or the volatility of prices, have occurred for a wide range of economic, political and other reasons. A graph of Kern River 13º API crude oil price (Figure 3) for the period 1983-2003 shows a significant number of changes in posted price from high to low and back to high oil prices. Any forward projection of oil price from any point during the period would have been incorrect. Using the same graph of Kern River 13º API, a plot of monthly change in price indicates that the average change has been zero - a best fit curve through the points is linear and flat at zero % per month.

Many evaluators have apparently decided that, given the past performance of oil prices relative to inflation and supply/demand issues, projection of a flat oil price from a rational starting or initial price would reasonably approximate the overall performance of oil price over a long term projection of several years. In most, if not all, of these cases the operating costs are also projected flat from the initial cost. In these projections the evaluator is not attempting to use real pricing as opposed to nominal pricing. These evaluators simply use a best estimate averaging of nominal prices that are expected to be volatile over the life of the projection. There is no indication in these cases that the evaluator used a nominal price/cost escalation and then subtracted an estimate of inflation to obtain a

flat projection. Were that the case, one would have to assume that the original nominal projection was flat, unless one also assumes that the projection of inflation used by the evaluator had increases and decreases equal to and coincident to the price/cost escalation changes.

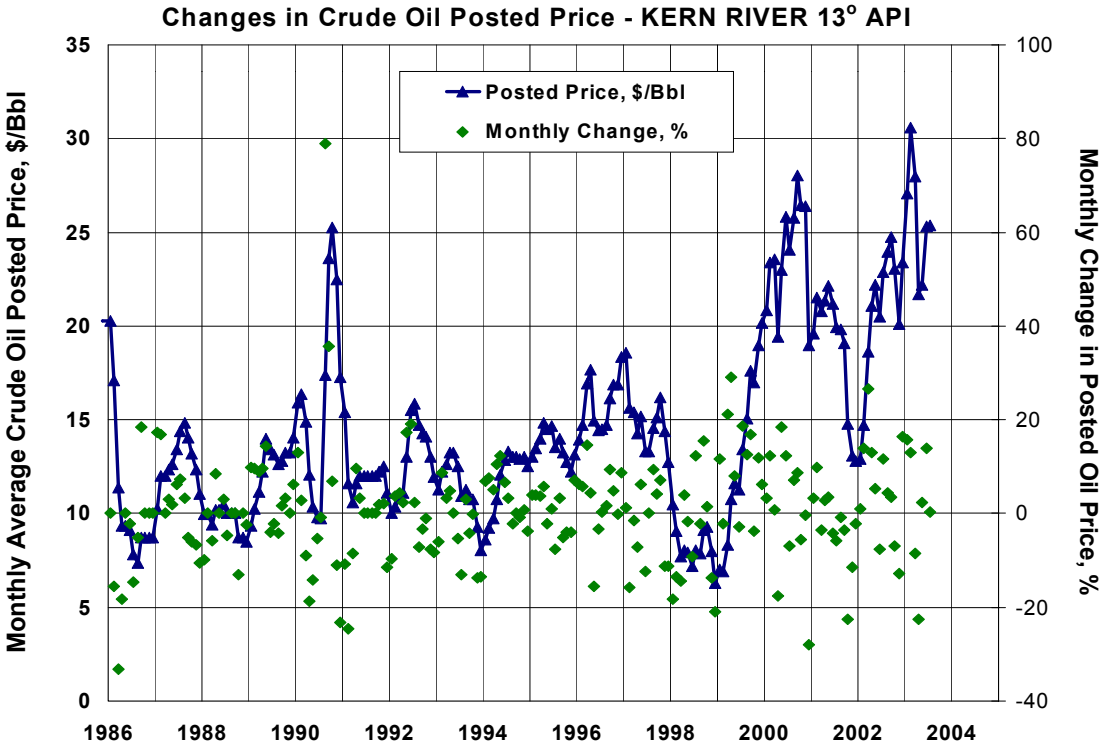

FIGURE 3

Escalation/Non-Escalation Over Time

As noted above, 56.1% of transactions over the period from 1983-2000 used *escalated* prices and/or costs in the cash flow. However, as shown in the table below, the number of sales using escalation has been declining over that same period.

	Total	Escalated	Not-Escalated
1983-1989	140	93	47
1990-2001	100	41	59
1990-1995	75	29	46
1996-2001	25	12	13

Furthermore, even in those evaluations that included escalation the *expected rate of increase* in oil price has declined over time as shown by the studies by Glanville [40] and Evans [41] and by survey data such as the SPEE Parameter Survey. [42] The trend toward flat price/cost projection could be the result of numerous factors, but perhaps it is a recognition of the difficulty of making such projections and that a flat price/cost projection, assuming a rational initial point, is as likely to be correct as any other projection.

Fair Market Value Discount Rate

The determination of discount rates from market sales is based on detailed analysis of buyers' cash flow data. The data analyzed for each transaction are obtained from (a) the Change of Ownership statement or equivalent data, (b) the buyer's cash flow and supporting documentation, and (c) conversations with the buyer and seller to clarify and augment data. In a few cases, sales in the database include information provided by the buyer that is not part of the cash flow but was considered by the buyer in determining a purchase price, such as anticipated abandonment cost. Some cash flows are constructed from input data provided by buyers and sellers with confirmation of the cash flow by the buyer. In these cases, only buyer-supplied data is used with no substitutions of date by this firm. Various statistical methods are used to relate the derived discount rates to the marketplace.

Derivation of Discount Rates

The objective of this part of the Property Sales study is to derive risk-inclusive, before income tax (BFIT), discount rates from actual market sales. The approach used is to take the full cash value purchase price of the property and calculate the internal rate-of-return on the purchase price using the BFIT cash flow (after investment and before income taxes). This process requires the conversion of non-cash payments such as stock and/or production payments into cash. In those cases where the buyer explicitly considered other non-cash items, such as abandonment liability as an addition to (or deduction from) the purchase price, those items are made a part of the price. The process also requires that any risk adjustments applied to the expected production stream or cash flow be defined and that the adjustments be backed-out so that a risk-inclusive discount rate can be calculated. These adjustments are, in some instances, significant and can result in measurable differences in adjusted and un-adjusted discount rates. In many instances, however, the buyer has related that the evaluations are adjusted in some manner for risk, but the specific adjustments are unknown or the relevant records cannot be located. In order to recognize this problem of a mixed database, results

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[40] "*Oil Price, Gas Price and Operating Cost Escalation Data*," Glanville, Roger S, prepared for Western States Petroleum Association, January, 1997

[41] *"Oil Price, Gas Price and Operating Cost Escalation Data Survey Results*," B. L. Evans & Associates, Inc., prepared for Western States Petroleum Association, January, 2000

[42] Twenty First Annual, "*Survey of Economic Parameters Used in Economic Evaluation*," Society of Petroleum Evaluation Engineers, May, 2003, Houston, TX

are reported for the *Combined* or total database, separately for the *Risk-Inclusive* database and for a database made up only of those transactions that contained or were valued on the Proved Developed Producing (PDP) reserves; the 100% PDP database.

This procedure has the virtue of being relatively uncomplicated. The derived discount rates are descriptive of most transactions and are satisfactory for use in property appraisal situations including ad valorem tax. However, the approach is based on certain simplifying assumptions which must be considered when applying discount rates derived in this way.

Many buyers estimate future ad valorem tax and deduct the tax from revenue as a cost. This deduction is not allowed for property tax appraisal. However, for this study, no adjustment is made to allow the cash flow to conform to property tax rules. Another significant simplification is to ignore the effect of prevailing state and federal income tax regulations on investment decision making. The calculation assumes that a buyer who values properties AFIT would have paid the same price for the property if he had valued it on a BFIT basis. The approach accepts the purchase price, which may have been determined on an after-tax basis, but ignores the effect of income taxes on the buyer's cash flow. This is particularly true of those income tax deductions which are designed to effectively reduce the amount of future BFIT investment. The calculation method can, of course, be modified to produce BFIT discount rates that (1) account for the impact of income tax on the purchase price, and (2) conform to the requirements of specific rules and regulations for appraisal of oil properties as they may occur in various jurisdictions. However, for the purpose of this study no adjustments related to income tax are made.

Risk Adjustment

It has become a common, although not universal, practice among industry evaluators of oil and gas properties to account for the perceived risk of a property by making quantitative adjustments to the income stream portion of the evaluation of a property. This process incorporates 3 or 4 steps:

A. Completion of a best estimate of future production, revenue, operating expense, capital costs, and cash flow. As part of this step, future production and/or volumes of estimated reserves are categorized into classes of reserves based on qualitative conditions derived from standard definitions.

B. A quantitative estimate of the likelihood of actually recovering the expected reserves, attaining the production rates, and/or achieving the cash flow is made. This estimate usually takes the form of a probability factor between 0 and 1.0, which is commonly termed a "*chance-to-occur*" or risk-adjustment factor.

C. The risk adjustment factor or factors are applied to the production projection, revenue stream or cash flow to produce a reduction in the production rates, reserves, and/or cash flow.

D. This risk adjusted cash flow is then discounted to present value at a rate which reflects the evaluator's perception of a uniform risk return comparable to an acceptable opportunity rate.

This approach to valuation has some advantages in the management of the evaluation process and is particularly well adapted to the capital budgeting and investment procedures of large corporations and investors. The internal risk adjustment and the use of a uniform discount rate allows comparison of many options and affords a relatively simple means of selection of projects based on one or more parameters. The alternative approach, which is still heavily used throughout the industry, is to, in a general sense in the case of acquisitions, adjust the purchase price and/or effective discount rate to account for the perceived risk. This latter approach is more abstract and less mathematical than the formalized risk-adjustment procedure, but is no less effective.

The methods are not mutually exclusive. A property evaluation done using quantitative risk-adjustment is not immune to further adjustment for risk or other factors not previously addressed or considered by the evaluator, or not subject to quantification.

The existence of the two approaches results in a mixture of sales data results which are not consistent. A discount rate derived from a purchase price and a risk-adjusted cash flow would in all probability be different from a discount rate derived from that same cash flow without risk adjustment. The general outcome is that risk-adjusted cash flows result in lower discount rates because the risk has been accounted for in the cash flow rather than the discount rate. For this reason, the WSPA database is sub-divided into Risk-Inclusive and Risk-Adjusted data sets. The data results presented as Composite or Combined results reflect all sales.

Annual and Composite Discount Rates

The entire WSPA database contains 271 sales. The discount rate distributions of these sales is shown as Figure 4. It is apparent that the large percentage of sales occur in a grouping near the lower end of the scale.

For analysis proposes, all sales with discount rate greater than 42% were excluded from analysis. This truncated database is termed the "*Working Database*" and includes both Risk-adjusted and Risk-inclusive transactions. The discount rate distribution (Figure 5) for the combined eighteen study years, and for selected sub-groups are presented in graphical and in summary form below. For presentation purposes, (a) the years 1983 through 1989 (Figure 6) have been combined in the table, and (b) the years 1990 through 2003 (Figure 7) have been combined. Data for 18 sales that occurred in 1998 through 2003 are included in this study.

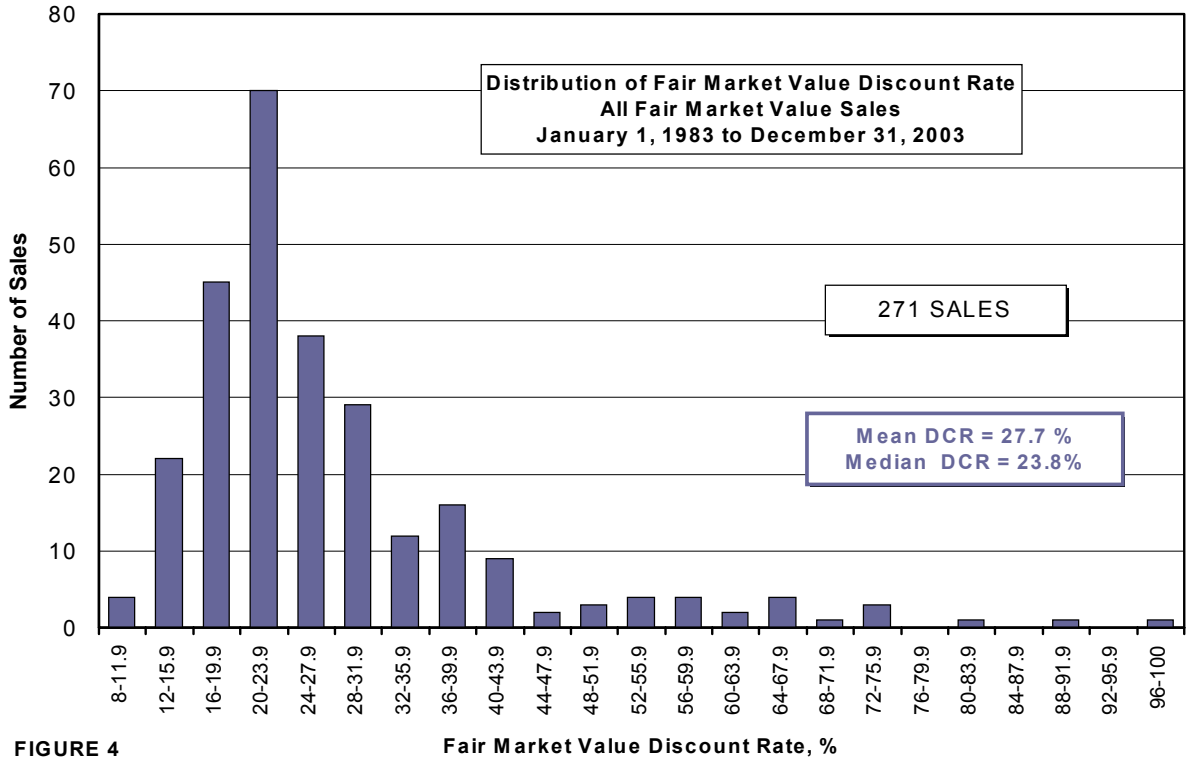

FIGURE 4

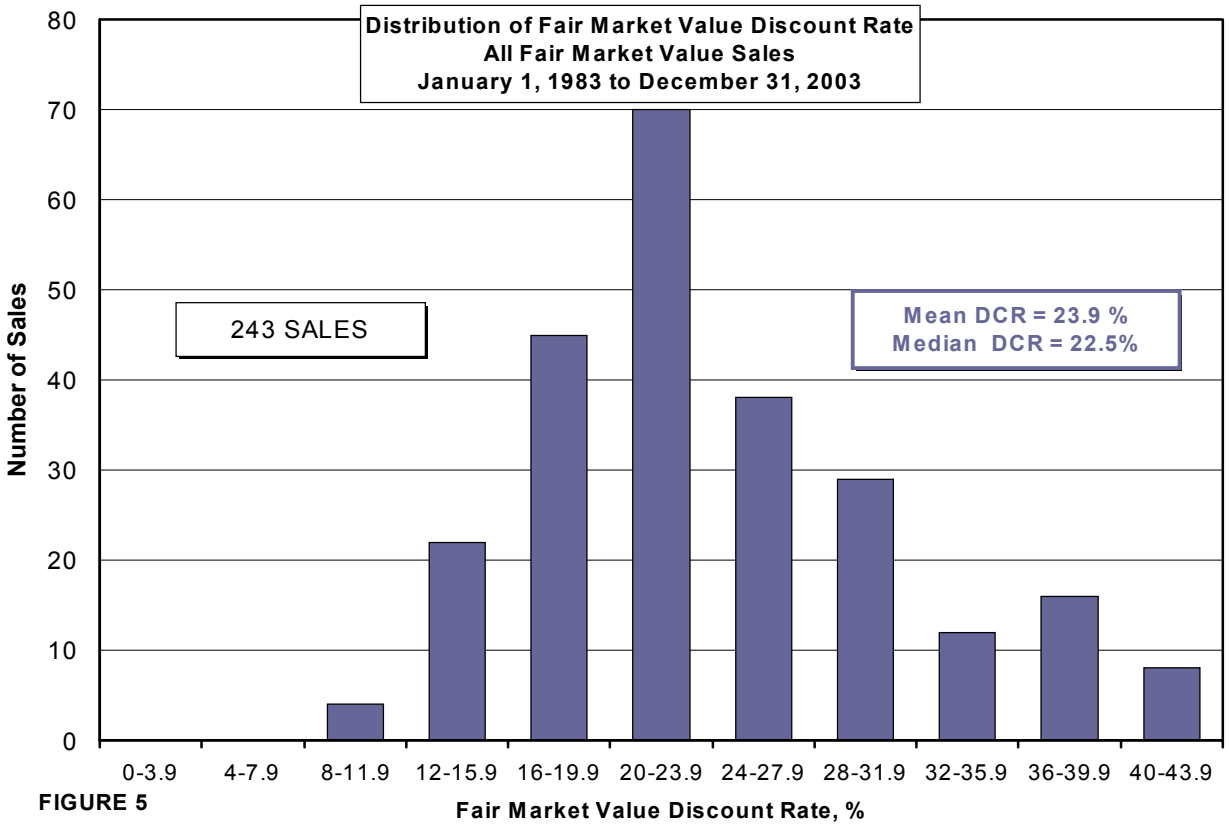

FIGURE 5

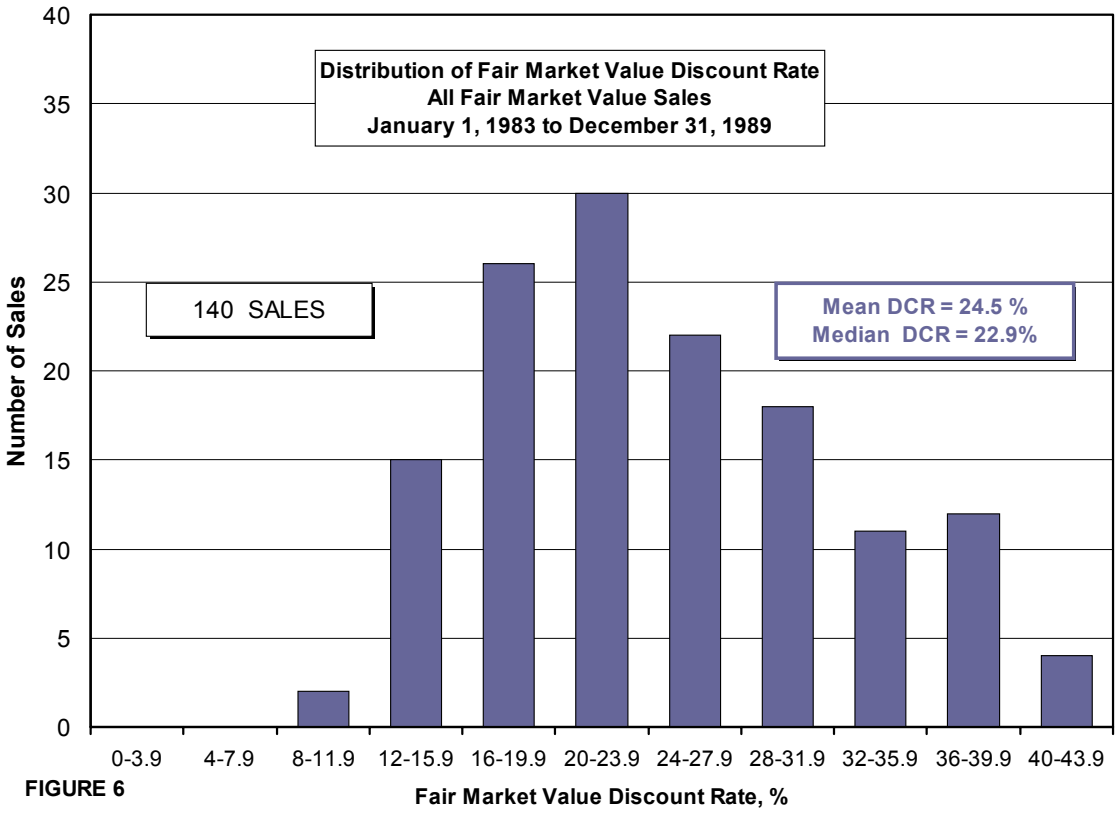

FIGURE 6

Fair

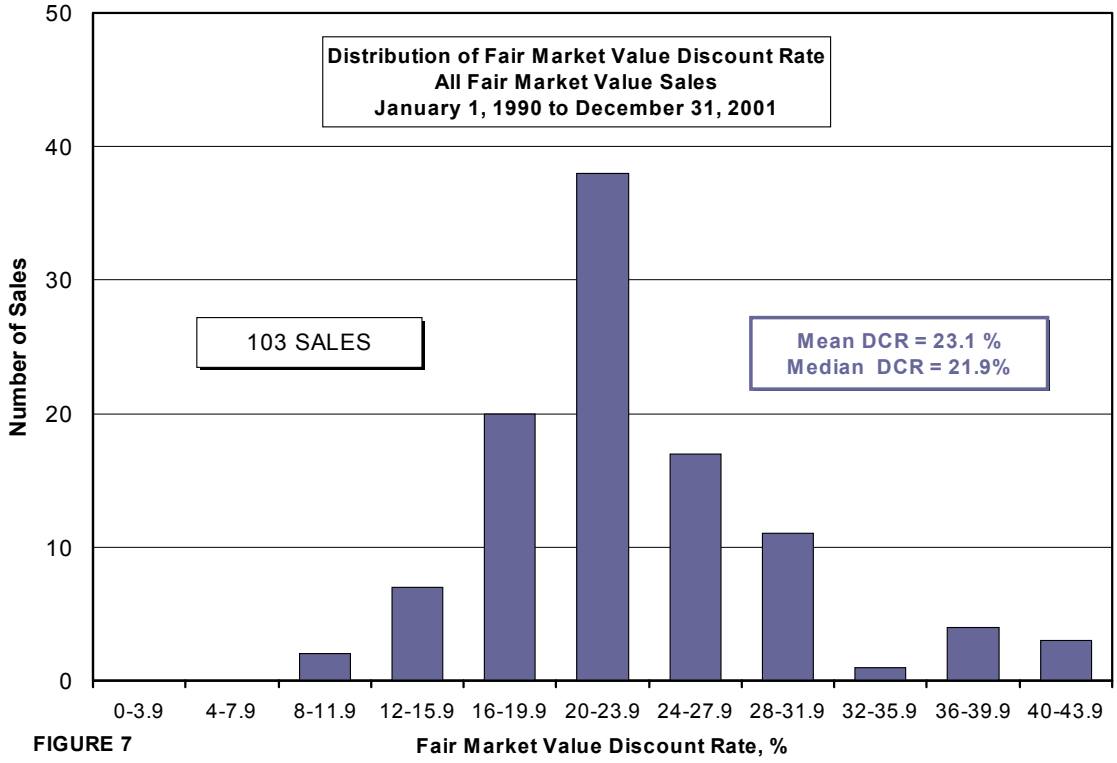

FIGURE 7

Market Value Equivalent Discount Rate (0-42%)
Before Income Tax

	1983-89	1990-2003	1990-95	1996	1997	1998	1999	1996-2003	All Sales Combined
No. of Sales	140	103	75	7	3	8	6	28	243
Mean, %	24.5	23.1	23.6	21.9	20.6	26.3	17.1	21.9	23.9
Median, %	22.9	21.9	22.0	19.4	21.2	23.4	16.8	19.3	22.5

Based on the Working Database, the derived discount rate for the total of 243 fair market value transactions has an arithmetic mean of 23.9% and has an absolute range between 8.0% and 42.0%. No market value sales were found that had a discount rate below 8%. [43] The 243 data points have a standard deviation of 7.1 percentage points above and below the mean, ranging from 16.8% to 31.0% and containing 175 (72.0%) of the 243 sales. Arithmetic averaging is used in preference to a weighted average discount rate because, as discussed below, there is no statistically significant correlation between discount rate and such factors as the magnitude of reserves, purchase price, date of-transfer or any other factor. Therefore, there is no reason to weigh a discount rate obtained from one sale as more influential than another.

It is of interest to note that (a) the average discount rate for the entire 20-year period (23.9%), and the average discount rates for the 1983-89 period (24.5%) and for the 1990-2003 period (23.1%), are very close and (b) the year-to-year data, while showing variation from a high of 26.3% in 1998 to a low of 17.1% which occurs in 1999, vary about the longer-term Mean. This year-to-year fluctuation in the effective discount rate around a relatively consistent average over this period is in contrast to (1) the financial changes in the industry caused by changing prices, excess production, significant changes in the natural gas market, restructuring of companies and general financial strain in the same period, and (2) the significant changes in the capital markets over the same time period. The level of discount rate during the period is reflective of the uncertainty felt by purchasers and is manifested in the assignment of risk premiums over and above the Cost-of-Capital alone. This explains the continuum of relatively high discount rates despite a general reduction in interest rates and inflation over the period.[44] Refer to the section: Reconciliation of Market Sales and Cost-of-Capital (pg. 48).

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[43] While there are certain transactions from which a discount rate of 10% or less can be derived, there is a serious question regarding the degree to which these sales represent the market value of the oil producing asset. In many cases, it would appear that (a) the purchase price and derived discount rate reflect a different objective, such as removing impediments to surface real estate development, or (b) reflect corporate objectives that go beyond the value of the property itself.

[44] On the other hand, annual fluctuations in average discount rate should not be given undue weight since the assignment of a sale or rate to a particular year is done on the basis of the date of transfer of the property and is a function of the agreed-upon purchase price. Further, in some years there are only a few sales so that one sale may have a disproportionate impact on the combined rate for that year.

A separate analysis of the 103 sales occurring in the 1990-2003 period indicates overall results very similar to the results obtained from the entire Working Database of 243 sales. However, only 27 sales (26.2%) out of 100 occurred at discount rates of less than 20%, and only 9 sales occur below 16%. This is a significant change from the pre-1990 period when 30.7% of sales occurred at discount rates below 20%. The change may be reflective of several market factors. It is known that many sales in the pre-1990 period were (a) risk-adjusted, and, probably more importantly, (b) were heavily influenced by income tax credits and other tax factors which are no longer available. The increase in discount rates may be a function the changes in tax laws and the change in posture of major companies from buyer to seller.

The use of a calendar year grouping based on date-of-transfer is artificial, and differing results might be obtained using lien year, fiscal year, or other time period. The date-of-transfer does not, however, appear to be important in defining the appropriate market discount rate. An analysis of discount rate as a function of the date-of-transfer of the property indicates a virtually flat trend of discount rate over the nineteen years at about 23%. Linear regression of discount rate against the date-of-transfer indicates essentially no relationship between discount rate and transfer date.

Market Level Discount Rates

The mean discount rate for a group of transfers, whether of an annual or multi-year sample, is only a measure of the *level* of discount rate required in the market. This Market Level discount rate is not a discount rate that could be applied to every property in every economic situation. It does, however, describe the average discount rate that would be expected to occur from a large group of sales of properties with characteristics similar to the sample database.

The Role of the Management Decision Process

As previously noted, the discount rate values used in the Market Sales study are *derived* values obtained by comparing a post-sale purchase price with a pre-sale BFIT cash flow. They are not necessarily the discount rates input by the appraiser or buyer. They are nonetheless a direct measure of the returns expected by the buyers and sellers in the marketplace. Given the relative sophistication of many of the buyers and sellers represented in the database, it is reasonable to assume that the purchase price and, therefore, the discount rate, contains certain deliberate considerations of the buyer such as:

- Cost-of-Capital
- Specific Project/Property Risk
- Corporate Requirements
- Income Tax and Other Financial Considerations

Some of these factors may be definable and quantified so that the discount rate can be dissected into a semblance of its component parts. However, it is likely that these components, and others not identified, overlap or influence each other and cannot be explicitly extracted. The discussion in Appendix E of income tax considerations and the relation of discount rate to Reserves Risk and other

factors indicates that some components can be identified, quantified and related to the market as a whole.

In addition, there are other factors or components that result from the buyer/seller process which probably cannot be defined and/or quantified such as:

- Relative Negotiating Skill
- Relative Corporate Imperatives
- Relative Perceived Risks
- Differing Concepts of Value

Taken together, these components result in the sometimes wide absolute range of discount rate values obtained from the sales database.

Statistical Analysis of Discount Rate Data

The determination of a market level discount rate is a highly useful result and, combined with a modicum of judgment on the part of the appraiser, would be sufficient to satisfy the discount rate requirements of most appraisal uses. Under ordinary market circumstances, this basic analysis would be as far as one could be expected to go with the data available. However, the amount of data obtained by assessors and appraisers under California disclosure regulations is far more informative than would be available to participants in the market place and allows a more detailed and far-reaching analysis of the relation of discount rate to the market and the properties evaluated.

Purpose and Procedure

Except where otherwise stated, the database used for statistical analysis is the Working Database sales. The purposes of statistical analysis of market sales data are:

A. To determine whether the sales that occur in the marketplace from time to time are representative of the wider population of oil producing properties.

B. To determine if the discount rates derived from the sales are representative of discount rates that could be applied to all properties.

C. To aid in defining the relationship between discount rate, the marketplace, and the physical and economic characteristics of the properties evaluated.

D. To determine the factors which (a) influence the discount rate, and (b) can be used to aid in the selection of a proper fair market value discount rate for a specific oil and gas property appraisal.

The use of statistical analysis of market sales produces the most important result - the ability of the appraiser to make informed, supportable judgments about the selection and use of the fair market value discount rates. In order to determine the reliability of the discount rates derived in this and previous studies, basic statistical methods [45] were used in a four-step procedure:

1. Descriptive statistical analysis was done to determine if the sales data obtained for the study could be considered a representative sample of the market for oil properties.

2. Correlation analysis was done to determine the relationship of the discount rate to the individual components of the property evaluation.

3. Multiple regression analysis was done in order to define combinations of evaluation components which influence the discount rate.

4. Additional multiple regression analysis were done on sub-sets of the data base in order to define relations which may be apparent in one group of sales but not in another.

Relation of Market Sample to Sales of All Properties

The number of actual fair market value sales in any one year is a small percentage of the number of properties in production. This may lead to the question of whether a discount rate derived from a small sample of sales could be expected to represent the fair market value discount rate if all the properties in the population of properties were to be sold. This question in turn has two parts: (a) are the properties for which data is obtained representative of California producing properties, and (b) are the discount rates derived from those sales representative of the rates that would be obtained if all producing properties were sold?

The starting point for the statistical study was to recognize both the content and the limitations of the WSPA database of sales information. It is a sample of the large market that spans 20 years of sales (1983-2002 inclusive) consisting of an average of about 13 sales per year. In this time period, there were an estimated 600-700 market value transfers of oil properties in California including (a) property exchanges, and (b) numerous transactions where no evaluation or appraisal was done. The sales database has categorized virtually all these transfers and has collected and reported data for over 300 transactions that were evaluated by the buyer. This number accounts for about 60% of all fair market value transfers and a much larger percentage of those for which an appraisal or economic evaluation was done.

The database contains a mix of data from a broad range of buyers and sellers; where acquisitions were valued by different methods; where the acquired properties differed substantially; and where the transactions ranged from the very simple to the extremely sophisticated. The property

[45] For this study, statistical analysis was done using the internal functions in the Microsoft Excel™ spreadsheet.

transitions in the WSPA database include producing properties from all the major fields in California and include old declining properties as well as enhanced recovery projects.

The discount rates derived from sales data are obtained from buyers' cash flows containing each buyer's perspective and represent pure market data. The data set consists of a mix of transactions that were evaluated solely on a BFIT basis and AFIT cash flows that also calculate state and federal taxes. Some evaluations include specific risk adjustments, while others include all risk in the purchase price or discount rate. The largest percentage of the sales are for properties with 100% Proved Developed Producing reserves, but there are a substantial number that include reserves that are Proved Undeveloped or other Proved reserve class(es).

In order to test the validity of the discount rate sample represented by the database, the Mean, Median, Standard Deviation and other statistical criteria were calculated, as shown in the table below.

In analyzing this issue, it is important to note that the Mean and Median value for the combined data set, and most of the annual data sets, show only relatively small differences indicating that the data may be assumed to be a Normal distribution (bell-shaped curve) with no substantial bias or skewing to either the high or low ends. It is also important to note that the range of one standard deviation contains a number of cases equal to or larger than would be expected for a statistically Normal distribution. This result indicates that the market level discount rate is not due simply to one or two high values that pull up the average, or to sales of properties which could be considered to be *"marginal"* or exceptionally risky, but is a trend within the market demonstrated by two-thirds or more of the acquisitions reported. The close fit of Mean and Median, the apparent Normal distribution, and the relative compactness of the discount rate values about the Mean indicate that the database is a valid sample representing all potential sales.

Fair Market Value Equivalent Discount Rates (0-42%)
Before Income Tax

	1983-89	1990-2003	1996	1997	1998	1999	1996-2003	Combined 1983-2003
No. of Sales	140	103	7	3	7	6	25	243
Mean Discount Rate,%	24.5	23.1	23.6	20.6	25.5	17.1	21.6	23.9
Median Discount Rate, %	22.9	21.6	22.0	21.2	20.7	16.8	19.4	22.0
Maximum Discount Rate,%	41.0	42.0	31.3	22.7	42.0	26.1	42.0	42.0
Minimum Discount Rate,%	10.0	8.0	18.0	18.0	11.2	8.0	8.0	8.0
Standard Deviation, ±	7.5	6.3	4.9	2.4	11.7	6.1	7.7	7.1
Sales in One Standard Deviation,%	64.6	76.7	85.7	66.7	57.1	66.7	81.0	72.0

In order to further explore the ability of the observed discount rates to represent the market, the observed data was compared to a model Normal distribution derived from the observed mean and standard deviation. While not perfect, the observed data fits the model distribution reasonably well. This result indicates that the sample data are normally distributed and can be further analyzed using generalized statistical and decision-making techniques that have been developed for normally distributed variables.

Analysis of the combined and annual data sets using small sample methods (Student's-t) indicates that the mean market values for each year can be expected to be within a few percentage points of the calculated mean value. Analysis of the market sample of 243 sales using the Student's t-method indicates that, if all oil and gas properties had been sold during the 1983-2003 period, there is a 95% certainty that the mean discount rate for all those sales would be between 23.0% and 24.8%. A similar analysis for the 103 sales in the 1990-2003 period indicates a 95% certainty range of 21.9% to 24.3%. Since discount rate has no statistical relation to the chronology of the sale, the range for any one year could reasonably be expected to be the same 22-24% range, even for those years where the data sample is very small. Experience with the study indicates that the accumulation of data over time tends to focus the distribution of discount rate toward the mean of the larger data set rather than disperse the values over the range.

Statistical analysis of the data indicates that the sales included in the study are representative of the market as a whole and would reflect the outcome of a market in which all properties were for sale at a given time, such as lien date 2002. The results lead to a high level of confidence that the discount rates and other parameters derived in this study are an accurate and functional representation of the marketplace and can be used in the mass appraisal of oil properties for ad valorem tax or any other fair market value purpose.

Expanded Statistical Analysis

The analysis of the database discussed above indicates that the discount rates obtained from sample of sales in the database are representative of the discount rates that would be derived from a data set composed of sales of all properties. Further information can be obtained by expanding the statistical analysis to define the relationship(s) that may exist between discount rate, the marketplace and various characteristics of the properties and/or transactions. The purpose of this work is to try to define relationships or causal functions that would lead to methods of selecting discount rates from readily observable market and property parameters. WSPA Study reports published in prior years have contained extensive discussions of the statistical analysis. That discussion has been moved to a companion text which encompasses all the analyses done since 1985.

Despite the testing of numerous factors [46] related to the physical and economic aspects of the sales evaluations, the only factor that has been shown to bear a rational and measurable relationship to the discount rate has been the percentage of PDP reserves that were included in the evaluation. The % PDP is referred to in this study as *Reserves Risk*. This relation is drawn from a single linear regression analysis of the sales included in the Risk-Inclusive database. Using 146 sales data points, (Figure 8) the regression found a positive correlation of discount rate to %PDP reserves. The R^2 for the relation is 0.3178, which suggests that %PDP, or Reserves Risk, accounts for just over 30% of the variation in the discount rates observed from sales. Somewhat higher values of R^2 (0.3208, 0.3308 and 0.3486) are achieved with second, third and fourth order polynomial equations, however, the improvement in R^2 is obtained as a result of better data point curve fits, which are not rational for real properties.

Analysis of Properties with 100% Proved Developed Producing Reserves

Reserves risk accounts for only about 32% of the data dispersion in the Risk Inclusive Database. The removal of the most significant factor relative to discount rate should allow the influences of other factors to be more readily measurable where risk is essential uniform. The reserves risk variable was eliminated by taking out all data points that were not 100%PDP.

An analysis of the 97 sales in the Risk Inclusive Database that have 100% Proved Developed Producing (PDP) reserves and which anchor the 100% end of the plot of discount rate as a function of reserves risk provides some very useful and interesting information. As shown in Figure 9 and the table below, the 100% PDP data set exhibits a central tendency toward a Mean of 21.8% with a relatively small standard deviation of 4.15 for all 97 sales. A breakdown into (a) sub-groups covering multiple years, and (b) annual groups for most years, reveals only modest changes from year to year: the results of the sub-group analysis for 49 sales occurring in the 1983-89 period is virtually identical to the results obtained for 48 sales from the 1990-2003 period. While the annual averages change somewhat, the difference in Mean from year to year is modest.

The discount rate data for the 100% PDP sales is more stable than is the data from the total database, which contains properties with Proved Undeveloped and other categories of Proved reserves in addition to PDP. This should be expected. Concentration on the 100% PDP reserves sub-group removes the increased risk component which is associated with other categories of Proved reserves. Proved Developed Producing reserves are low risk; discount rates obtained from this group should be more stable and consistent than for other categories of reserves.

[46] A complete statistical analysis of over 20 evaluation parameters is contained in "*Statistical Analysis of California Oil and Gas Property Transactions: A Supplement to WSPA Property Sales Studies 1985 through 2001*," prepared for Western States Petroleum Association by Richard J. Miller & Associates, Inc., September 28, 2001

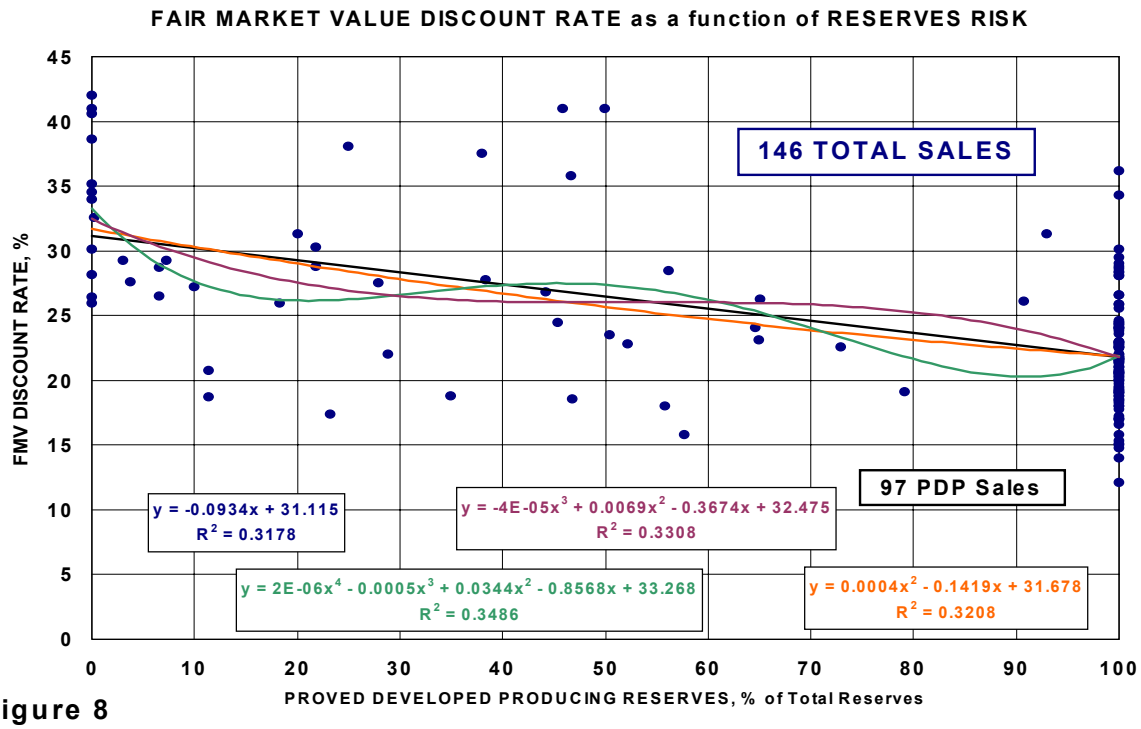

Figure 8

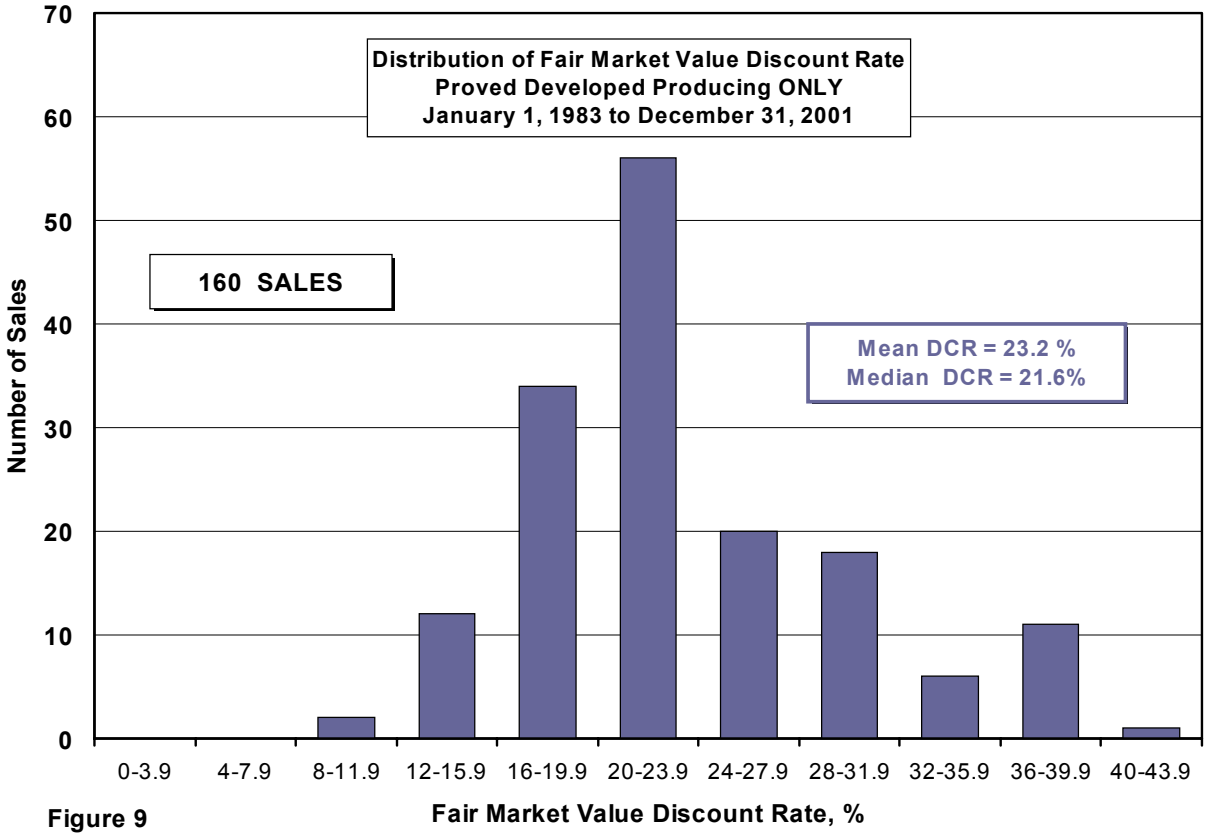

Figure 9

Fair Market Value Equivalent Discount Rates (0-42% BFIT)
Risk-Inclusive Database
100% Proved Developed Producing Only

	1983-89	1990-2003	Combined 1983-2003
No. of Sales	49	48	97
Mean Discount Rate, %	21.8	21.7	21.8
Median Discount Rate, %	21.0	21.6	21.5
Maximum Discount Rate, %	34.3	36.2	36.2
Minimum Discount Rate, %	12.1	14.0	12.1
Standard Deviation, +	4.27	4.07	4.15
Sales in One Standard Deviation,%	73.5	70.8	72.1

A parallel analysis using all 160 sales in the current Working Database that were 100% PDP, produces similar results with a Mean of 23.2% and a Standard Deviation of 6.3 percentage points. The sub-groups for 1983 through 1989 (94 sales) and 1990 through 2002 (66 sales) have average discount rates of 24.0% and 22.1% respectively. The differing results from this sample set occur because of the inclusion of (a) those evaluations using Payout as the primary decision criteria, (b) royalty interest acquisitions, and (c) discount rates from risk-adjusted cash flows.

Interpretation of Results

While the annual Mean discount rate values fluctuate, a market level (mean) discount rate of about 24.0% for the evaluation of producing properties with Proved reserves of all kinds seems to be well-established. Even though most of the evaluations included in the study trend toward more conservative price/cost projections, it is apparent that the discount rate is being maintained at an established market level to account for an assortment of risks and to attempt to ensure a market level return on the investment of capital. The discount rate used or resulting from any particular acquisition appears to be related to the risk associated with the property.

Despite the testing of numerous other independent and contingent factors, none have been found that could be reasonably related to the discount rate and which could be described as a source for adjusting the discount rate above either (a) a minimum rate such as Cost-of-Capital, or (b) a low-risk discount rate such as for 100% Proved Developed Producing reserves. The stability of the discount rates obtained from the 100% PDP sub-group allows the group to be used to establish a firm floor for selection and assigning discount rates for 100% PDP properties and for properties with reserves in the greater risk categories.

The apparently strong relation between Reserves Risk and discount rate would appear to provide a sound basis for discount rate selection. This relation of discount rate to reserves risk can be used to (a) establish a base or minimum discount rate for properties with 100% Proved Producing

reserves at about 22%, and (b) indicate a range of discount rate that can be applied to reserves of increasing risk. The analysis suggests that properties with 100% Proved Undeveloped reserves would require a discount rate of 29-31%. Properties with Proved Non-Producing and Proved Behind-Pipe reserves would have discount rates greater than 22% and less than 31%. Other factors such as the ratio of (Oil) Reserves to (Oil) Production and Remaining Economic Life may be useful in selecting a discount rate from *within* the 22% to 31 % range.[47]

Comparison of Market Derived Discount Rates to Data from Other Studies

There are very few studies of market sales data that are available for review and which have been done with sufficient consistency and frequency to allow comparison to the results of the WSPA Study. These independent studies and surveys have generally supported and confirmed the results of this study, particularly regarding base discount rates and the influence of risk.

SPEE Survey

The annual survey by the Society of Petroleum Evaluation Engineers ("SPEE") has been conducted in a relatively consistent and generally improving format for the past 18 years. As a survey of evaluation professionals, the annual SPEE report provides useful insight into the requirements of the marketplace for return on acquisitions and other investments. In the SPEE survey, discount rate data analysis is based on a "*Cost-of-Money Plus Return*" as a minimum expected return supplemented by specific risk adjustments for each category of reserves. The SPEE survey also reports the adjustment factors that are applied to production and/or income streams in order to account for the perceived risk of recovery of reserves. The risk factor is a function of the reserves class and increases as the perceived risk of each class of reserve increases. The 2003 SPEE survey [48] found that PDP reserves would be adjusted by an average factor of 96.7%, while PUD reserves would be adjusted by 56.0%. In common practice, the risk-adjustment factors are first applied to the production projection and/or the cash flow, followed by application of the Cost-of-Money Plus Return discount rate to calculate a risk-adjusted present value of future net revenue.

For comparison to the WSPA data, the "*Cost of Money Plus Return*" from each survey is divided by the risk factor for each reserve class as reported in the survey to obtain a Risk Inclusive discount rate for each reserve class. The table below shows the results of this calculation for 1992 through 1996 and 2000-2003. The survey data indicate a slight declining trend over time; the average risk inclusive discount rate for 100% PDP properties from SPEE surveys for 1984-1989 is 21.39%, while the average for the 1991-96 period, for the same class of reserves, is 17.99%. The earlier period fits with actual sales data reasonably well. The 1991-96 period survey results are about

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[47] "*Fair Market Value Transactions, Cost of Capital, and Risk: California Oil and Gas Property Transactions 1983 through 2000*," February 2, 2001, prepared for Western States Petroleum Association by Richard J. Miller & Associates, Inc., pg. 35

[48] Twenty Second, "*Survey of Economic Parameters Used in Economic Evaluation*," Society of Petroleum Evaluation Engineers, May, 2003, Houston, TX, pg. 24

2-3% below the actual sales data. It seems apparent that the difference is related to the construction of the survey component that is termed *"Cost-of-Money*," which appears to be heavily influenced by changes in interest rates.[49] Discount rates from actual sales include an equity component and the results of negotiation of a value intended to provide more than the minimum return.

The result is that PDP reserves carry a higher discount rate than the Cost-of-Money Plus Return, which is the minimum discount rate. The results are consistent with the results of the market sales reported in this and previous sales analysis and Cost-of-Capital studies. The discount rates reported in the WSPA Study are derived to include the risk in the discount rate. For the purpose of comparing the SPEE survey to the WSPA results, the Cost-of-Money Plus Return is divided by the adjustment factor for each reserves class to obtain an effective Risk-Adjusted discount rate.

SPEE Survey of Economic Parameters

	1992	1993	1994	1995	1996	2000	2001	2002	2003
Cost of Money Plus Return, %	19.14	17.88	17.33	17.64	17.08	16.20	15.40	15.48	15.86
Effective Discount Rate, % 100%PDP Reserves	20.14	18.89	18.30	18.32	17.78	16.68	15.80	16.04	16.40
Effective Discount Rate, % 100%PUD Reserves	34.42	34.12	33.10	31.94	32.99	28.08	29.60	26.52	28.32

Texas Property Tax Division Study

For the past 20 years, the Texas State Property Tax Board, now the Property Tax Division of the Texas Comptroller of Public Accounts, has conducted a study and published a report in which the primary focus is the derivation of a discount rate for the appraisal of oil and gas properties using a Cost-of-Capital approach.[50] This report is provided to local property tax appraisal districts to guide their selection of discount rates for oil and gas property appraisal. For several years the Property Tax Division (PTD) report also included a property sales study conducted by the staff of PTD.

[49] Due to changes in the format of both the questions and compilation of results, the data presented in SPEE studies after 1996 is not entirely consistent or compatible with data found in prior year SPEE studies, so no relation to sales data is possible after 1996. The surveys done in 2000-2002 returned substantially to the prior usage.

[50] The Comptroller's Office is required by law to provide recommendations to County Assessors in Texas as to oil and gas pricing and discount rates for use in oil and gas property tax appraisal and is also charged with auditing the appraisal of County Assessors and/or their consultants

The results of the PTD Cost-of-Capital [51] study are summarized below for 1992 through 2002. The PTD and WSPA results are consistent from year to year. The PTD uses essentially the same textbook approach as is used in the WSPA Study. Some differences occur in the mechanics of the calculation and in the sources of information for components such as beta factors. Those differences aside, either calculation provides a reasonable basis for a base rate.

PROPERTY TAX DIVISION
WEIGHTED AVERAGE Cost-of-Capital
@ December 31

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Major Companies	14.47	15.76	14.42	15.78	14.83	16.14	15.00	13.17	13.94	13.19	14.64
Independent Companies	17.17	20.92	14.69	13.92	13.92	15.81	14.04	14.19	13.66	13.44	15.83
"Hurdle Rate Premium"	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

The PTD has determined that the addition of a 2% "*Hurdle rate premium*" is necessary in order to apply the Cost-of-Capital data to the appraisal of oil properties for ad valorem tax. This hurdle rate premium is consistent with industry and general financial practice of targeting a minimum return rate that exceeds the Cost-of-Capital and with the *Cost-of-Money Plus Return* component of the SPEE survey. PTD also recommends the addition of percentage points to the base discount rate to account for "*Property Risk Attributes*," which are defined to include (a) limited production history, (b) single completion leases, (c) offshore leases, (d) enhanced oil recovery, and (e) short remaining life. For these risk factors, the adjustment ranges from 1 to 3 percentage points. The PTD further recommends that tax appraisers consider other risk adjustments for (a) high or increasing watercut, (b) erratic production, (c) long history-stable production, (d) gas curtailment, and (e) environmental concerns. The ten risk factors can often be accounted for as part of the income stream construction, however, where that procedure is not sufficient, compensation for risk in the form of increasing or decreasing the discount rate is an acceptable approach.

[51] "*2002 Property Value Study; Determination of Discount Rate Range for Petroleum and Hard Mineral Properties,*" Texas Comptroller of Public Accounts, Property Tax Division, August 2002, Austin, TX

RECONCILIATION OF MARKET SALES AND COST-OF-CAPITAL

Access to market data from actual sales offers the best opportunity to understand how buyers and sellers of oil and gas properties determine the price that they are willing to pay and the return they are willing to accept for a specific property. This window is not always clear; it is opaque in some areas and distorted in others. As shown by the statistical analysis, there is a broad consensus as to the appropriate level of FMV discount rates, but there are large areas at either end of the spectrum that promote questions that can only be imperfectly answered. Market data alone may not be a sufficiently reliable base for making discount rate decisions. The use of Cost-of-Capital analysis to supplement, confirm, deny, or reinforce market sales results is necessary. In this portion of the study, an attempt is made to reconcile the seemingly disparate results from the two approaches.

The results obtained from the Market Sales analysis and from the Cost-of-Capital analysis are not independent and/or unrelated phenomena. The decision to acquire an oil property necessarily flows from a determination that a satisfactory return can be achieved from the property. The later return is a function of the Cost-of-Capital but must be related to the difficulty and risk of operation of a specific property, and thereby is related to the anticipated return that is expected from the actual acquisition. Fortunately, several expansions of Cost-of-Capital, particularly cost of equity, analyses have occurred in recent years that allow the Cost-of-Capital approach to be more closely tied to the market sales approach.

Measuring the Difference

A comparison of the discount rates derived from (a) the Market Sales analysis, and (b) the Cost-of-Capital, indicates that the annual mean discount rate from all property sales differs from the annual mean WACC by as little as 3.0% and as much as 10.4%, but over the 1990-2001 period market sales discount rates exceed the WACC by about 7.6% (Figure 10). The values shown as Mean discount rate and Mean WACC are the arithmetic averages of Market Sales and WACC derived discount rates for each year as discussed in previous sections of this report.

The analysis of market derived discount rates from property sales with 100% PDP reserves may be more informative. The annual difference between Mean WACC of 16.0% and the Mean discount rate from the 100% PDP sales of 21.8% averages about 6.8 percentage points. The standard deviation of the 100% PDP discount rates is 1.6, which is close to the standard deviation of 1.8 for Mean WACC over the same period and is considerably less than the standard deviation of 7.0 for all properties.

A slightly different view of discount rate distribution is shown by Figure 11 where the cumulative percentage of sales at various discount rates indicates that 90.5% of all transactions are concluded at discount rates that exceed the average BFIT Cost-of-Capital (~16.0%).

Market Derived Discount Rate vs. Weighted Average Cost-of-Capital

Year	All Properties Mean DCR%	100%PDP Mean DCR%	Cost-of-Capital Mean WACC, %	a_{All}, %	a_{PDP}, %
1985	27.6	25.7	18.9	8.7	6.8
1986	23.8	24.1	15.0	8.8	9.1
1987	22.1	23.0	15.1	7.0	7.9
1988	24.2	22.8	15.6	8.6	7.2
1989	25.5	27.6	15.6	9.9	12.0
1990	21.8	21.1	18.8	3.0	2.3
1991	22.8	22.2	18.5	4.3	3.7
1992	25.5	24.7	15.5	10.0	9.2
1993	24.2	22.4	13.8	10.4	8.6
1994	25.6	22.1	17.3	8.3	4.8
1995	22.4	22.4	14.8	7.6	7.6
1996	23.6	19.2	16.0	7.6	3.2
1997	20.6	19.9	14.1	6.5	5.8
1998	26.3	*	16.2	9.2	-
1999	18.6	*	15.6	3.0	-
2000	*	*	15.6	-	-
2001	*	*	15.2	-	-
2002	*	*	12.9	-	-
1985-2003	23.3	21.8	16.0	7.6	6.8

* Insufficient Data Points

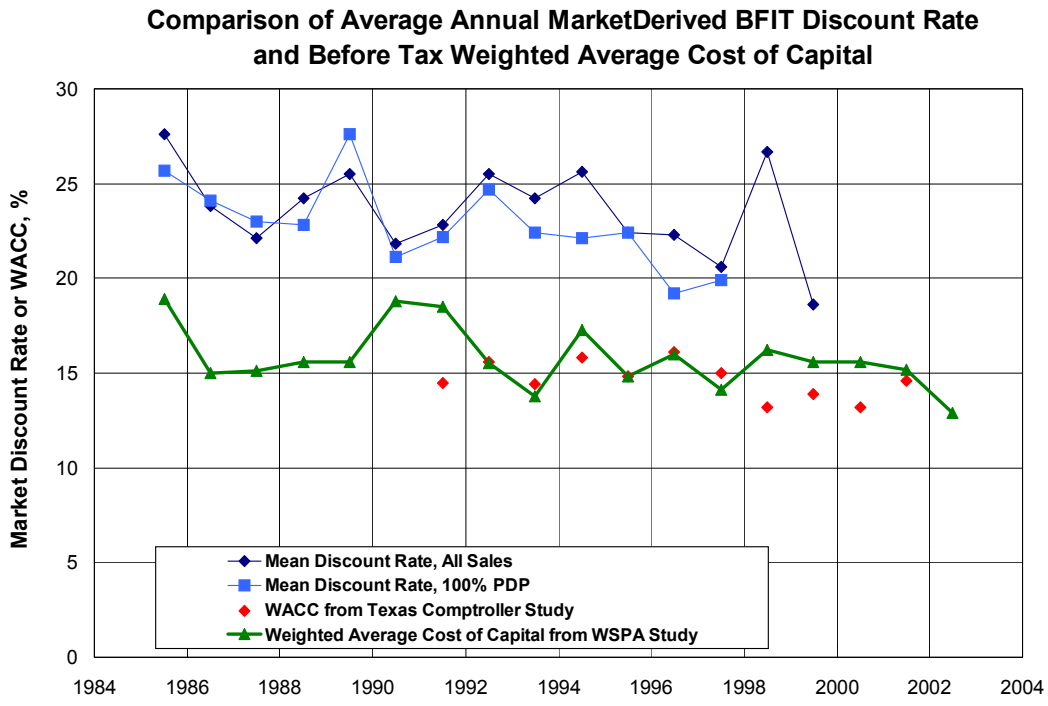

FIGURE 10

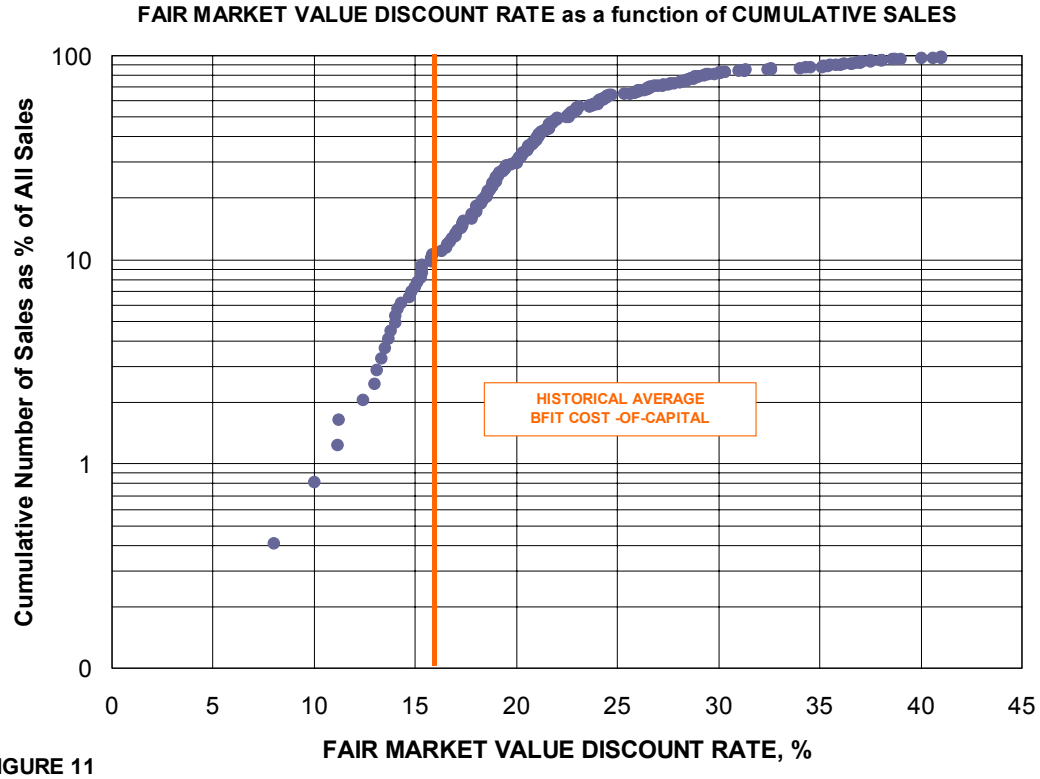

FIGURE 11

Sources of the Difference

From an appraisal standpoint, the differences between the WACC derived discount rates and the market derived discount rates occurs primarily because of the differing composition of the two rates. [52, 53]

1. The Cost-of-Capital, by construction, does not include a return-of-capital component while the discount rate derived from sales explicitly includes a component for return-of-investment in addition to return-on-investment. The market derived rate represents the requirement on the part of the investor to receive (a) a return of and on investment, and (b) to be compensated for the inherent risk in the investment. The WACC derived discount rate consists of only a return-on-investment. See Discussion Appendix G.

2. The Cost-of-Capital, as derived for publically traded companies, is the return anticipated on an equity and/or a debt investment. These equity and/or debt investments are highly liquid and can be bought and sold on a variety of markets virtually instantaneously. In contrast, oil producing properties are real estate and are inherently illiquid.

3. The WACC rate includes a measure of risk, but it is the risk of a portfolio of investments where risk is moderated by the diversity of the portfolio. Property sales data are generally derived from discrete individual properties, while the Cost-of-Capital of public companies is reflective of investors expectations for all the activities of the company.

The difference between the rates consists then of the return-of-investment coupled with the difference in risk between a portfolio of debt and equity returns and reliance on a fixture stream of income from a single source. It is often necessary to bridge the gap between the results of the two methods, either because the number of actual sales is small or to provide a second source of reliable data to support market derived data.

Despite the differences, the results from the two methods are, as one might expect, related. The difference between the property sale discount rate and the WACC represents the return required over and above the WACC as defined by each company's assessment of the project risk and desired return relative to its WACC. The difference also represents the need and desire of companies to increase overall corporate return to the level of competing equity capital investments. This is probably more a subjective than an objective decision and is not quantified in any precise way. In those firms where acquisitions are carefully evaluated, the determination of acquisition value is

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[52] The difference between market data and Cost-of-Capital data or usage has been an issue in real estate. See "*The Use and Misuse of CAPM in Property Tax Valuation*," Schweihs, Robert P., Journal of Property Tax Management, Fall 1994

[53] See also, "*Valuing a Business,"* Pratt, Shannon R., Reilly, Robert F., Schweihs, Robert P., Third Edition, 1996, Richard D. Irwin (Times-Mirror)

strongly affected by the desire for a ROR that exceeds the WACC.

The capitalization rate derived from the WACC often represents the minimum value of rate-of-return that would be acceptable to a company assuming there were no overriding considerations. This floor, or minimum value of rate-of-return, can be considered as the benchmark against which all proposed investments by the company are measured. For the major/integrated companies such investments could include the acquisition of producing properties, but might also include refineries, new exploration, pipelines, foreign ventures or retail stores. For independent companies, the range of investments is more limited, but could include new drilling and remedial work as well as property acquisition. In evaluating individual investments, a rate-of-return greater than the WACC is required in order to satisfy investors and maintain growth.

As noted above, for appraisal purposes the difference between cost-of capital discount rates and market derived discount rates for minimum risk properties is no more than 7.0 percentage points. The 7.0% is interpreted to include the risk related to the single source income stream, the relative liquidity of the assets and the return-of-capital. A correctly calculated WACC discount rate could be increased by that amount to be the equivalent of a market derived rate for 100% PDP properties. For properties with reserves of greater risk than 100% PDP, the resulting discount rate would have to be increased in a manner similar to the preceding discussion of reserves risk.

Figure 12 is a classic textbook example which depicts the relative expectation for increased return from accepting increasing risk. This relation, with oil properties added, clearly indicates that higher risk investments demand a higher return on investment. The risk inherent in oil property acquisition is, without question, greater than that of any other type of investment shown and therefore has a higher required return.

This textbook example can be converted to practical use by combining the results of the Cost-of-Capital and Market Sales analysis with data derived from other studies and for financial markets. The results obtained from Market Sales for 100%PDP properties are very similar to the reported data for PDP properties by SPEE and the Texas Property Tax Studies. The Cost of Money Plus Return reported by SPEE is only a few percentage points above the Mean WACC. The difference can be accounted for as return of investment, liquidity, and the ability to have a timely measure of return. If, as noted above, the majority of property acquisitions are made with equity capital, there are some comparisons between equity markets and the market for oil properties which may be useful. The following is adapted from Schweihs: [54]

[54] *"The Use and Misuse of CAPM in Property Tax Valuation,"* Schweihs, Robert P., Journal of Property Tax Management, Fall 1994

Equity Securities	Oil Properties
A. Liquid, Market Investments	A. Illiquid Investments
B. Non-Controlling Interest	B. Controlling Interest
C. Small Absolute Dollar Investment	C. Large Absolute Dollar Investment
D. Diversified Portfolio	D. Non-Diversified Portfolio
E. Short-Term Investment Time Horizon	E. Long-Term Investment Time Horizon
F. Appreciating Investment	F. Depreciating Investment

When the specific property risk is added to the minimum required return, the discount rate is further increased to account for the risk whether it be for 100%PDP reserves or some higher risk category of Proved reserves up to 100%PUD.

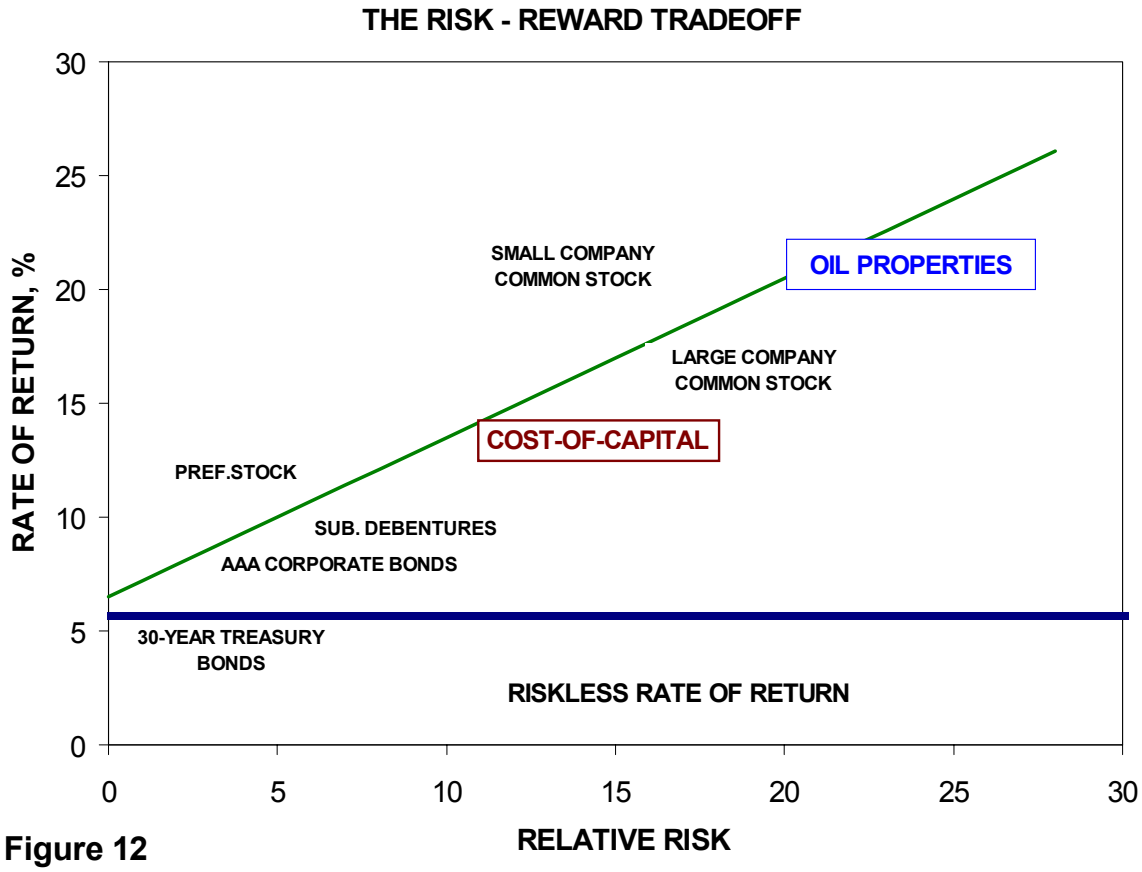

Figure 12

Use of the Cost-of-Capital in Real Estate and Business Appraisal

The reference to Schweihs (above) and also to Pratt and Reilly are in the context of the discussion of the use of Cost-of-Capital as a source for discount rates in the appraisal of real estate and of businesses respectively. Application to real estate is slow, but progress is being made with the suggestion for the use of REITs as the subject and surrogate for specific properties [55] Pratt has recently expanded the topic of Cost-of-Capital for business valuations to an entire book [56] and includes a chapter entitled "*Cost of Capital in Ad Valorem Taxation*." [57]

Application of the Pure-Play Approach

Pure-Play analysis offers a way to bridge the gap between the Cost-of-Capital and market sales data. The work by Ibbotson (noted above) found that for companies which engaged primarily in oil and gas extraction, the estimated AFIT cost of equity is 11.38% (data through March, 1996) and, after adjustment for income tax and liquidity, the BFIT WACC is 20.15%. Ibbotson cautions that this WACC would only be applied to Risk-Adjusted cashflows, so that if the cashflow from a 100% PDP property is properly adjusted using the average of 97.2% noted in the 2001 SPEE survey, [58] the 20.15% could be applied to obtain an estimate of market value. Similarly, the 20.15% could be used to estimate value for a cashflow from a 100% PUD property if the appropriate adjustment factor (52.0% in the 2001 SPEE survey) is first applied to the cash flow.

Ad valorem tax appraisal requires that each property be valued individually based on the characteristics and income producing capacity of that property; that is, as a stand-alone entity rather than as an asset of a company. It is a short conceptual step to think of each property as a Pure-Play company whose only business is to produce that property. This is similar in concept to taking the acquisition value of an oil company, which is purchased in the stock market, and ascribing that value to the company's oil and gas reserves. However correct or incorrect it might be, the latter is a relatively common practice.

If each property is considered to be a Pure-Play company, then the Pure-Play discount rate extracted from equity market data, such as done by Ibbotson, is applicable. Further, the Pure-Play WACC can serve as a check on the market sales data. But a Pure-Play discount rate derived for an entire SIC code is only a starting point and is incomplete. First, in the absence of generally accepted risk adjustments, the single value Pure-Play WACC or cost-of-equity is not adequate and must be adjusted to account for risk. The Pure-Play rate provides a floor discount rate which is already

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55 "*Determining the Discount Rate from a CAPM Equation*," DeCain, Paul F., Real Estate Review, Fall 1994

56 "*Cost of Capital: Estimation and Applications*," Pratt, Shannon P., Wiley & Sons, 1998

57 Ibid, pg. 163, Carl R. Hoemke

58 Twentieth Annual, "*Survey of Economic Parameters Used in Economic Evaluation*," Society of Petroleum Evaluation Engineers, June 2001, Houston, TX, pg. 22

adjusted for liquidity. Second, the Pure-Play rate has no component for return-of-capital since it is derived from capital markets where cost-of-debt and cost-of-equity assume reversion at full value. The risk issue can be partially addressed by considering the Pure-Play results that would be obtained by incorporating the effect of market capitalization on expected cost of equity.

Cost-of-Capital With Market Capitalization Effects

"*One of the most remarkable discoveries of modern finance is the finding of a relationship between firm size and return*." [59, 60] There is a clearly defined relationship between the market capitalization of companies and the returns obtained by, and expected of, those companies. Statistical analysis of the equity marketplace indicates that equity returns for groups of companies (compiled as decile groups of NYSE companies based on market capitalization) inversely related to the market capitalization. That is, small capitalization companies, as a group, have higher returns than do large cap companies, as a group. The results of this analysis suggest that a market cap size premium can be added to the return calculated using the CAPM formula to account for the return in excess of the risk measured by CAPM. As reported by Ibbotson, [61] the size premium is significant for companies in the smallest group:

Decile	Historical Average Percentage of Total Capitalization	Recent Decile Market Capitalization ($Millions)	Average Decile Capitalization ($ Millions)	Arithmetic Mean Return, %	Size Premium Return in Excess of CAPM
1-Largest	63.27	6,099,523.614	36,306.688	11.25	-0.32
2	14.01	1,174,194.524	6,451.618	12.86	0.42
3	7.60	584,693.698	2,967.988	13.51	0.66
4	4.75	344,651.829	1,723.259	14.03	0.95
5	3.25	282,490.634	1,157.749	14.48	1.16
6	2.37	206,453.954	770.351	14.93	1.48
7	1.72	175,969.268	507.116	15.16	1.35
8	1.27	136,629.517	319.975	16.17	2.06
9	0.97	117,578.857	167.253	17.12	2.56
10-Smallest	0.79	81,984.379	41.116	20.75	5.67
Mid - Cap 3-5	15.59	1,211,836.161		13.82	0.82
Low - Cap 6-8	5.36	519,052.738		15.23	1.52
Micro - Cap 9-10	1.76	199,563.236		18.20	3.53

In the 2003 edition Ibbotson subdivides the analysis of Decile 10 into two groups, 10a and 10b. The market cap size effect would suggest that premiums ranging from 1.36 up to 5.33 should be

[59] "*Stocks, Bonds, Bills, and Inflation - Valuation Edition 2001 Yearbook*:," Ibbotson Associates, 2001, Chicago, IL, pg. 107

[60] Banz, Rolf W., "*The Relationship between Returns and Market Value of Common Stocks,*" Journal of Financial Economics, Vol. 9 (1981) pp. 3-18

[61] "*Stocks, Bonds, Bills, and Inflation - Valuation Edition 2003 Yearbook*:," Ibbotson Associates, 2003, Chicago, IL, pg. 117-148

added to the return derived from the CAPM calculation for companies in the 6 lower deciles. The average capitalization of companies in Decile 6 is $770,350,575 while the average in Decile 10 is $41,115,536. (See also Exhibit II)

Similar but expanded work has been done by Grabowski and King.[62] While Ibbotson relates the size effect to market capitalization, Grabowski and King have defined "*size*" as not only market cap but also 5-year Average EBIT, Sales, Number of Employees, Book Value of Equity, and other criteria. Further, they ranked the companies in their analysis into 25 equally sized portfolios rather than the deciles used by Ibbotson, which allows greater precision in the selection of the appropriate adjustment. The Grabowski work focuses on developing a relation of "*size*" to a total risk premium, which includes size and takes the place of the market risk portion of CAPM. On this basis, the AFIT adjusted market risk premium is 1.84% for the largest companies (average market cap of $119,762 million) to 12.41% for the smallest (average market cap of $39 million).[63]

Application of Market Capitalization Effect Studies

If, as discussed above, each oil property is considered to be a Pure-Play company, the Market Capitalization Effect work of Ibbotson and Grabowski could be used as a base for deriving alternative discount rates, which would then serve as comparison points for actual sales data. The Ibbotson Pure-Play results could be included by scaling the Market Capitalization Effect data to fit around the Pure-Play results or by applying the liquidity adjustment outlined by Ibbotson.

The arithmetic mean purchase price of all the 243 sales in the WSPA Working Database is $21,863,722; the median purchase price is only $1,215,000. If this average purchase price is considered to be the market capitalization of the property, then the average transaction would be in Ibbotson decile 10 and would require a premium of 5.67 to be added to the AFIT CAPM derived cost-of-equity. If all other parts of the WACC analysis were unchanged, the market capitalization Market Capitalization Effect alone would increase BFIT WACC by 4.91 percentage points to 17.81%.[64] Despite the addition of this capitalization premium, the result remains a return on readily liquid securities not on non-liquid, higher risk oil properties. If the median purchase price is used then the median transaction would be in Decile 10b with a premium of 9.16 resulting in an increase in BFIT WACC to 21.15%[65]

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[62] "*New Evidence on Market Capitalization Effects and Rates of Return*," Grabowski, Robert and King, David in Business Valuation Review; September, 1996. Also "*Market Capitalization Effects and Equity Returns: An Update*," Business Valuation Review, March, 1997. See also: "*Standard & Poor's Risk Premium Report*," Grabowski, Roger and King, David; Standard & Poor's Corporate Value Consulting, 2003.

[63] Ibid, pg. 18

[64]
$$(0.623) \quad \frac{(10.353 + 5.67)}{0.65} + (6.509)(0.377) = 17.81\%$$

[65] "*Stocks, Bonds, Bills, and Inflation - Valuation Edition 2003 Yearbook*:," Ibbotson Associates, 2003, Chicago, IL, pg. 117-148

For this analysis the Grabowski data (Exhibit III) is used. Based on the arithmetic mean purchase price of the 243 sales, fully 97.5% of the property sales accumulated for the WSPA Study fall in portfolios 23, 24, and 25, with the overwhelming majority in portfolio 25. The largest transactions in the database would fall in portfolios 18 and 11. Unfortunately, there is no further scaling within the several portfolios.

For Pure-Play or single property companies in Group 19, the size adjusted risk premium is 9.17%, while in Group 25 the adjusted risk premium is 12.41%. The resulting Cost of Equity and WACC for the two groups would be as follows: [66, 67]

	AFIT COE, %	BFIT COE, %	WACC,%
Group 19	11.59	17.83	13.56
Group 25	13.92	21.42	15.79

These results are below the market sales data results where the mean discount rate is 23.2% for 100% PDP properties where the properties with an average purchase price (Market Cap) of $4.634 million. This outcome strongly suggests that a properly determined Cost-of-Capital can be used as a source for a discount rate and can also serve as a means to test the discount rates derived from actual sales. In this context, there is reason to vigorously question discount rates which fall below 18-19%.

As noted by Ibbotson and by Grabowski, these are rates to be applied to *risk-adjusted* cash flows. In the absence of such risk-adjustment, additional premiums would be required to account for whatever risk may remain. Since the Market Capitalization Effect measures some risk, the adjustment may be less than that suggested by the SPEE survey or other sources.

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[66] Long-term Riskless Rate is 4.99 % for 30-year Treasury Bonds @ 12/31/02.

[67] Corrected to BFIT using $\frac{\text{AFIT COE}}{(1 - t)}$

APPLICATION OF STUDY RESULTS TO OIL AND GAS PROPERTY APPRAISAL

The database available for the current study consists of a large percentage of the FMV sales that have occurred in California over the past thirteen years. The data obtained from buyers and sellers, primarily as the result of California's requirement for full but confidential disclosure, is generally quite detailed and more extensive than that available to the market in general. While the quality of the data varies, it is considered to fairly represent the attitudes of buyers in the market at the time of the transaction. The statistical analysis done as part of this study indicates (a) that the derived market data provide a valid representation of the market for oil and gas properties in California, and (b) that the sales included in the study reflect the outcome of a market in which all properties were for sale at a given time, such as lien date 2000 or 2001.

The above suggests that the discount rates and other economic parameters derived from market sales can be used for appraisal of oil and gas properties for most fair market value uses, including ad valorem tax, when the conditions and caveats of the study are recognized and considered.

General Appraisal Usage

The data derived from market sales is intended to conform to generally accepted appraisal practice. The discount rates, in particular, are representative of market conditions and could be used to value properties anywhere in California or the U.S. There is, of course, no such thing as a California discount rate except that there may be a small amount of additional risk reflecting a high(er) level of regulation. Price/cost escalation rates are more regional in nature. The Cost-of-Capital discount rates are generic and would apply anywhere in the United States and Canada.

Some caution must be exercised in using study results - particularly regarding the date of the sales relative to the date of application. While the analysis indicated no definable correlation of discount rate with time over the 1983-2003 period, many of those transactions that occurred before 1987 were influenced by the income tax laws in place and by more optimistic economic expectations than are sales after 1987 when many valuable tax provisions had been repealed. Sales in later years are also influenced by diminished economic expectations, increased regulatory requirements, and changes in market attitudes toward abandonment and future liability.

Ad Valorem Tax

Assessing and taxing jurisdictions often impose rules for the construction of future income streams where the resulting cash flows differ from cash flows that would be constructed for the same property by prospective purchasers in the market place. In such circumstances, the user of the data presented in this report must determine if some adjustment of derived discount rates and other factors may be necessary in order for the discount rate to be compatible with the required construction. **(See Appendix B)**

California

For application to ad valorem tax appraisal in California, some adjustments to the derived discount rates is necessary in order to comply with SBE rules. Rule 8(c) circumscribes the kinds of deductions from the income stream that are allowed. Assessors are not allowed to deduct anticipated property tax from the income stream when calculating value for ad valorem tax since the amount of property tax is a function of the value being estimated.

Buyers and appraisers in the marketplace, however, commonly estimate future property taxes and deduct these taxes as a cost when determining fair market value. As part of the 1997 WSPA Study, 107 sales were found that specifically deducted property tax from the cash flows that were used to determine the value of acquired properties. These 107 sales had a mean discount rate of 23.0%. The buyers deducted property tax as a percentage of net revenue before operating costs or as part of operating costs. The average deduction was 3.63% of revenue. In order to determine a Rule 8 compatible discount rate for these sales, the estimated property tax was added back into the cash flow for each transaction, and a new discount rate was calculated. The result was an average discount rate for the 107 sales of 26.68%. This is a 3.68 percentage point increase in discount rate due to restoration of estimated property tax.

This analysis strongly suggests:

(1) That discount rates derived from evaluations where estimated property tax was deducted are not compatible with Rule 8.

(2) Discount rates derived from these sales are too low by 3.6 percentage points.

(3) The standard adjustment of 1% added to derived discount rates to account for property tax is not sufficient.

Refer to Appendix E for expanded discussion.

Texas

The State of Texas follows a Fair Market Value rule for appraisal and assessment of oil and gas properties. There does not appear to be any difference between the Texas definition of fair market value and that used in general industry property evaluation. The sales derived discount rates obtained from the WSPA Study show consistency with discount rates derived from Texas property sales. The WSPA data should then be applicable for Texas appraisals.