APPRAISING OIL & GAS PROPERTIES

A Newsletter for Appraisal Professionals

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Football It was a beautiful autumn day in Southern California 60°F (parka weather for us), just right for a tailgate party, visiting old friends as the season comes to an end, and imbibing a prudent amount of school spirit. It was the annual classic, the game that would be bragged about all year, the statwart local heros against those guys from across town. It would be the epitome of college football at its best; a Legend in its own time. No Way, Jose. The kick-off went well - actually about 40 yds. - and from then on it was down hill. What it was was in-artful, inept, clumsy, border-line comical, and notable only for what did not go right. There were (count'em) 3 fumbles, 3 interceptions, 13 punts, and 25 penalties (3 on one play) for 194 yds. Both sides got their share. There were so many offsides that some players were on both teams - and one TD probably was not (see instant replay). BUT, this time the best 1st-Half team in the PAC-10 showed up for the whole game and, after 8 years, we'll take it.

USC 17 - UCLA 7
Fight on!

Y2K Complacent? We are beginning our preparation for whatever effect Y2K may have on our computer systems. We bought some Y2K checkup software, and I note that Gates & Co. have all the necessary patches and fix-its on the net. The local Gateway service center tried to help by wiping out one of our hard drives, but otherwise we have raised procrastination to levels heretofore only imagined. This is a weekend job - and is scheduled right after Christmas. Just in case I don't get to it and catastrophe occurs, I may have to unlimber the old slip-stick. [Codger Note: For those of you born after 1970, a slip-stick is a slide rule.]

All this mental effort got me thinking. You and me are taking this change in dates seriously - building shelters, etc. But if going from 1999 to 2000 is causing all us high-tech folks so much angst can you imagine the problems with which the Romans had to contend. Think about it; they not only went from -1 to +1 but from BC to AD and had to cross 0 to get there. Considering that this sort of thing had never happened before, this event required some planning. Let's hop on the old time machine and travel back to Rome where we drop in on a meeting of the Year Zero Compliance Team at Rent-a-Lion Entertainment Spa; the Team Leader, Dilbertius, is speaking:

"Ok, ok, quiet down. Is everyone here? Legal, Accounting, Operations, Info. Services? We need to get with the program - it's darn near Christmas, and we still haven't figured out how we are going to be affected by this millennium [Editor's Note: that's Latin] business - yeah, Sextus, what is it?" "Dil, are you sure we have a problem? I mean how do we know there will be a millennium?" "Well, look, [Dil points to calendar] here we are in year *I,* and everybody knows that the years have had declining numbers for as long as anyone can remember. We beat the tunics off those pesky Carthaginians in *CC,* and Liz Taylor was here in *XXIV*. Now we are in *I* and we are running out of numbers, so something must be going to happen." Torticus, the guy from Legal, says, "Don't forget that report on Chariot News Network about the study done by those three Eastern Wisemen saying that at midnight on December *XXXI*st time, as we know it, will end." Beancounticus from Acct. says, "That's right. As I see it, the biggest problem is what comes after *I*? Do we start over at *D* or what? Something has to come after *I*." Nerdius, from Info. Services (IS), chimes in, "I think it is zero." "What is zero?" "It comes after *I*." Legal opines, "We don't have a zero. We have *I, V, X, M, L, C,* and *D* but no zero." IS says, "Uh ho, that is a problem." "Only if you need zero," Operations pipes up, "We don't need no stinking zero." "How do you write that?" "What?" "Zero." "I don't know." "Well, if I rent *V* lions to the Coliseum next year, how do I date the invoice? On ZERO date you owe *MM* ducats? If there is no zero there is no date, so is there a receivable?" "Maybe we SKIP zero and go to whatever comes next." "What is next?" "I think it is *I*". "But are already at *I*, won't that be confusing?" "Maybe it's minus *I*." "What's a minus?" "Besides, if we use *I* what do we do next - go up? *II, III, et cetera*." "Can't do that, how would you know which *I* you were referring to?" "We could call this *I* 'Before Now' (BN) and call next year 'After Now' (AN)." "That won't work - next year Then will be Now and Now will be Then, so every year will be *I*." "Good point." "Say, anybody going to the Count down party?" "There's a party for this?"
[Editors Note: The zero was invented by the Arabs and did not begin to be used in Europe until almost 1000 AN. The recent rumors that ZERO was invented by Al Gore are unfounded].

Painting We did not quite get finished this year. Details and excuses in a later newsletter.

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Using Financial Market Data In the Appraisal of Oil and Gas Properties

Using an income valuation to estimate the market value of specific oil and/or gas producing properties, requires the use of a discount rate that reduces future cash flow to a present value consistent with the value which would be offered for the property in the marketplace. The market value discount rate can be derived from several sources. Empirical data from actual sales of properties and cost-of-capital data derived from financial markets are the most commonly used and offer the greatest accuracy. Earlier newsletters have focused on market sales data and the cost-of-capital as useful sources of discount rates but have also noted that there are measurable differences between the rates derived from these two sources. Analysis of the data suggests that the apparent differences are rational and can be bridged using recent work in Pure-Play analysis, Size Effect considerations, and the Fama-French amendments to the Capital Asset Pricing Model, particularly when full consideration is given to the inherent and definable risk associated with acquiring and operating oil production properties. The result provides (1) an enhanced understanding of the link between empirical sales data and more readily accessible financial market data, and (2) a format for the use of the latter in oil property appraisal.

The Income Approach to Value

Our recent discussions of the Income approach and its estimable offspring, the Discounted Cash Flow ("DCF"), determined that the DCF is the only functional method of valuing oil properties, and of evaluating investment options regarding such. This method is particularly useful because, when properly constructed, the evaluator of a project or property can include within the calculation, or in multiple variations, virtually every definable physical, operational, and economic characteristic of the property. The resulting income stream is a mix of the objective and the subjective - a combination of measurable fact and judgement based on experience.

The Discount Rate

Only when the income stream is reduced to present value can the anticipated returns from an oil property be compared to (a) the investment required to obtain that income stream, or (b) the returns from other investment options. The discount rate receives a so much attention in the evaluation process because of its important role in making correct investment decisions, but also because, depending on the size of the future cash flow, the duration of that cash flow, and the shape of the cash flow the application of the discount rate can have a very significant, often overwhelming, influence on present value.

The Financial Source

When empirical data is limited or lacking altogether, and experience is insufficient to define broad market expectations, the Financial source of data becomes not only useful but may be the default source. Unlike the empirical data, using financial data as a source for a FMV discount is indirect and requires adjustment to be a fully applicable rate. The Financial or Cost-of-Capital ("COC") approach provides a starting point for the development of market value discount rates and also provides a point of comparison to empirical data.

What do we mean by financial market data? And Why would such data be useful in valuing, say - the Bonanza lease out in No Trees County? Some of the data we are talking about is historical data such as the interest rates on loans and bond debt and the return-on-equity of common stock. This information is useful in providing a perspective against which to compare discount rates. However, the financial data in which we are really interested is the forward looking data, the yield-to-maturity (YTM) on debt and the *expected* return-on-equity of stocks. After all, we are trying to derive a discount rate to value an expected future income stream that may extend 20-30 years so, while the historical data provides perspective, it is the forward expectations that are important. Of course, all of the commonly used methods of estimating forward rates are based on the past performances of the debt and equity markets. But, you say, "Why do I want to do this? I am not some Wall Street wizard!" Fair Question. There is one attorney out here who always (I can predict when) pops off with: "This is irrelevant - we are valuing properties not companies." True - we are not valuing companies but it is extremely relevant nonetheless.

First, the general reason. Every investor, from Mega Merger Oil Co. down to you and me, has options. When we appraise a property to market value we assume there are knowledgeable folks in the market place willing to invest a certain amount of hard earned bucks in that property - the amount being our estimated market value. People make investments with the expectation of a return - at least knowledgeable ones do so. If the return provided by an oil property is not sufficient, the investor can do one of two things - pay a lower price and thereby increase his potential return or invest those funds elsewhere where returns are better. That 'elsewhere' place of better returns is called Opportunity Cost - a misnomer - it should really be called an Opportunity Return. If Option A has a higher return that Option B, all other things being equal, A would be preferred to B.

This is where financial markets come in (we could add other markets such as real estate, but let's keep it simple) because they provide the opportunity for the Opportunity Return. The 11/22/99 issue of *Business Week* tabulates 3rd Quarter, 1999 financial results for several hundred companies in all industries from Aerospace to Utilities. The average After Income Tax (AFIT) return-on-equity (ROE) for all companies in the listing - the all Industry Composite - is 15.2% for the quarter. Some

industries and companies did better than 15.2% and some did not. But if you owned one share of each company your return would be 15.2% AFIT. This is your Opportunity Return - at least one of them. By the way, we are not talking about dot.com's here; you have to have earnings in order to have a return-on-equity. But, is Yahoo.com an alternative opportunity? Ask someone who owns a few shares.

The idea of Opportunity Return is an extremely important concept - it is not anything foreign or esoteric - it is common sense. It should prompt the question; Why would any rational person buy an oil property to obtain an X% BFIT return when the same money could earn 15% AFIT or more by investing in equities? That is why financial market data is relevant.

The specific reason - and the one that gets to our discussion - is that it is essential to selecting discount rates. Many oil companies routinely define a range of discount rates for use in project evaluation and capital budgeting. This discount rate is a derivative of company policy and, as shown by several authors is generally based on an estimate of the company's weighted average cost-of-capital. Finance-based discount rates are applied to the estimate of income from new projects, capital investments, and acquisitions/sales and are structured to allow comparison of those projects, etc. usually as part of the Net Present Value (NPV) method of capital budgeting. According to financial theory, a company or other investor should attempt to make investments of capital only in projects which will provide a rate-of-return at least equal to the cost of the capital (measured as required returns) used to make the investment. This is functionally known as a Minimum Required Return ("MRR"), the "hurdle" rate, or other terms connoting a threshold rate. Campbell[1] refers to this as the Minimum Return Standard ("MRS") and notes; "Every project is compared against a threshold to determine if it meets corporate objectives. Companies arrive at threshold value differently and, regardless of the company, a certain arbitrariness occurs in defining the standard."

In practice, this MRR or MRS may exceed the actual cost-of-capital by a few percentage points in order to provide a margin of return over the minimum. For use in valuing the potential acquisition of a producing property, a minimum return might be cost-of-capital plus Y%. However, the purchase price may be based on other considerations such as relative desirability or risk and, further, is the result of a negotiation with a seller which, if successful, may yield a total return equivalent to COC plus Z%. This latter is the market discount rate.

Estimation of the MV of a property requires a discount rate which is representative of the return that an investor in that property would require to make that specific investment. Investors always have options and the property return must be sufficient to justify investing in that property and not in some other option.

Components of The Cost-of-Capital

The Cost-of-Capital can be described as the price (in the form of a rate-of-return) that must be paid in some form to investors in order to obtain and retain the funds necessary for capital investment projects. Put another way, Cost-of-Capital is "....the expected rate of return that the market requires in order to attract funds to a particular investment."[2] The standard form of cost-of-capital has three basic components: Capital Structure, Cost-of-Debt, and Cost-of-Equity. The common approach for calculation is known as the Weighted Average Cost-of-Capital (WACC) where:

$$WACC = [(COD \times \%Debt) + (COE \times \%Equity)]$$

The ***Capital Structure*** is the mix of debt and equity used by the corporation to finance on-going operations including capital investments. The typical capital structure for oil companies can be shown to consist of about 30% debt and 70% equity based on market value; however, the proportions may vary with time as a function of changing tax laws, corporate policy and/or requirements, and interest rates. The maintenance of a balance between debt and equity is an important part of financial management in companies of all sizes. At year-end 1996, a sample group of 40 public oil and gas companies had an average 22% debt and 78% equity. At year-end 1997, the 30/70 relation had generally been restored.

The ***Cost-of-Debt*** component consists of (a) public and private instruments issued by the corporation, such as bonds and notes, and (b) borrowings from banks, insurance companies, and other institutions. The cost-of-debt is the return demanded by the holders of the company's bonds and the interest rates on outstanding loans. The overall cost-of-debt for a company is calculated as a weighted average of the interest rates and yield to maturity (YTM) on each debt instrument, weighted by the dollar amount outstanding.

The ***Cost-of-Equity*** component is commonly defined as the total value of common and preferred stock of the company as measured by the market value of the outstanding shares of the company on the date of evaluation. Retained Earnings are also equity since they are the property of the common shareholders. Retained earnings of the corporation are invested by company management on behalf of the shareholders for the purpose of increasing shareholder wealth. The COE, is more difficult to determine than the COD but the use of the correct procedures and data sources can provide consistent and useful results. The primary method for estimating cost-of-equity is the Capital Asset Pricing Model or CAPM.

Capital Asset Pricing Model

Like the WACC, the CAPM is discussed at length in financial and appraisal texts and the interested appraiser should review these sources. The discussion by the California SBE[3] is particularly germane to appraisal applications including oil

properties. The CAPM is a simple but powerful forward-looking model which attempts to estimate the future cost-of-equity that should apply to a company or industry when systemic risk factors are considered. In construction, it is nothing more than the equation of a straight line which relates expected return to the risk inherent in an individual stock or group of stocks:

$$R_t = R_f + ß\ (R_m - R_f)$$

where total return (R_t) equals a risk-free return (R_f) plus an adjustment for the risk associated with an equity investment where R_m is the return on the market, (R_m - R_f) is the equity risk premium and where ß is the "Beta" factor of the stock and measures the volatility of a stock, group of stocks, relative to the market as a whole.

In using this model, R_f can be obtained from expected returns (YTM) on Treasury bills and bonds. For use in valuing oil properties, a risk-free rate equivalent to the term of the risk is appropriate. Treasury bond and bill rates are published daily. The market equity risk premium R_m is obtained from market analysis which relates the return from equities in general to the returns from the risk-free investment. The Beta for an individual stock or an industry group can be determined from published performance data compiled by various investor services such as S&P and *Value Line.* Data regarding the equity risk premia are published by Ibbotson[4] and others.

The CAPM was originally developed for use in equity analysis but that is not a unique application. As noted, CAPM is the equation of a straight line so it can be used to evaluate the return on any asset for which the requisite data can be developed. There has been considerable discussion of the application of CAPM to estimate returns for real estate. Oil and gas properties are real estate, so CAPM could be used to estimate the required return on the acquisitions of oil producing properties if there were a sufficiently large database of sale information and a reliable reference market - such as New York Stock Exchange or the S&P 500. Such an application awaits only the development of the data and someone with enough initiative (incentive?) to do the analysis.

Limitations of the Cost-of-Capital

The cost-of-capital can be used as the baseline from which to build a property/project-specific discount rate. However, the WACC is deficient in several elements which must be considered before application can be made to a specific property. The return from a specific property must exceed the COC to account for deficient areas which include but are not limited to Liquidity, Return-of-Capital, and Risk. We must also consider the issue of specific as opposed to corporate debt/equity structure.

Liquidity: COC is derived from the stocks and bonds of publically traded companies. The COD and COE are the returns that are expected by investors in that debt and/or equity. These investments are highly liquid; they can be bought and sold almost instantaneously. The same cannot be said of individual oil properties. This illiquidity demands a premium on the cost-of-capital if it is to be used to value properties.

Return-of-Capital The Cost-of-Capital, as commonly constructed, represents only a return-on-investment. The calculation of a COC, at a specific time, assumes that the calculated return will continue from that time forward - in effect, a level and perpetual annuity. The COC assumes that the original investment is recovered when the debt or equity interest is sold. In finance, this is termed *return-of-capital*. In real estate appraisal the term Reversion is used.

In contrast, individual oil and gas properties generally have variable and declining income streams (not a level or perpetual annuity) and are generally produced to depletion. There is no remaining asset value from which to recover the original investment. Therefore, the income stream must provide both a return-on-investment and a return-of-investment, the combination of which must necessarily be greater than the COC return alone. There is rational debate on this issue but a few minutes thought leads to the correct conclusion. (See Appraiser's Workshop) By definition the COC is a return-on-investment only. The debt component is an interest rate - it is assumed that the debt principal is repaid at maturity. The CAPM starts with the very same interest rate and, while the R_m and/or equity risk premium may contain an element of equity appreciation (stock price increase), it is nonetheless only a return on the investment - it is assumed that the original investment can be recovered by sale at anytime (24 - hours per day on Instinet).

Risk is a very broad consideration but can be narrowed into reasonable categories. The largest difference in risk between corporate cost-of-capital and the returns from investments in individual or properties is diversification. A company which owns a number of properties can expect an income stream from each whereas a single property provides only one income stream. In the corporate context, there is greater risk of loss in the single income stream than in the multiple streams where a failure of one stream has a limited effect which may be offset by an increase in another income stream. The income stream from a particular property may have greater or lesser risk that the other income streams in the portfolio as the result of any number of engineering, geologic, operational, or economic factors. Then there are the property specific risks such as reserves class. If the SPEE survey results are any guide, Proved Undeveloped(PUD) reserves are higher risk than Proved Developed Producing (PDP) and should therefore demand bear higher return. You can make up your own list of property specific risks and adjust your MRR accordingly.

Measuring the Difference

Empirical data from FMV oil property acquisitions consistently indicate that, depending on the source, risk-inclusive discount rates are about 21% BFIT for specific properties with

100% PDP reserves. Since these properties would be expected to have the lowest risk, in comparison to less developed properties, the derived discount rate for PDP properties would seem to be a good point from which to measure the difference in Risk and other factors between empirical data and COC data. In contrast, the WACC for a sample group of oil and gas companies over the period from 1990 through 1996 is about 16% BFIT. Based on this comparison a direct use of the WACC would produce a return about 5 percentage points less than the empirical data. This return would not be commensurate with the property risk.

The observation of this "Discount Rate Gap" begs the question of how do you reconcile the difference between the expected returns from the acquisitions of producing property and the return as measured by the COC for companies in an industry? The connection between the two returns should be not only apparent but measurable. Corporate investors use COC as a basis for capital budgeting and investment decision-making. Presumably individuals do the same. The cost-of-capital often serves as the basis for the Minimum Required Return. Presumably corporations and individuals follow the financial model to obtain a return on their investment in excess of the cost-of-capital used to make the investment.

If a corporation uses the COC as an MRR, then the maximum price that would be paid for a property is the price that would yield a return equal to the MRR. Presumably the investor, be it corporation or individual, can reasonably estimate the risk in the property and translate that risk into a required increment of return - if not absolutely, at least relatively. By the same process, the investor should be able to assess a required return for liquidity and return of investment. It follows then that the investor should attempt to negotiate a purchase price that provides a return based on the investor's expectation of future income from the property sufficient to compensate for his cost-of-capital, property risk, liquidity and return-of-investment. In reality, the investor may not actually calculate a discount rate that includes these factors but more likely juggles his concerns and comes out with... "I will not pay $X but I will pay $X-Y... and no more..." Using the same income stream, X-Y provides a higher return and achieves the purpose. Based on the empirical data available, most market value property acquisitions appear to achieve that goal.

Adjusting the Cost-of-Capital

It is difficult to separate the market value discount rate premium into discrete factors for Return-of-Investment or Recapture, Risk, and Liquidity. It is very likely that there is no specific adjustment made by an investor. The empirical data is too limited in both breadth and depth to allow detailed dissection even if that were possible. However, the knowledge that the differences exist is a sufficient starting point for further analysis.

As noted above, returns calculated from actual sales are total returns which include return-of and return-on investment while COC returns are return-of-investment only. It should be possible to compensate for this difference. Surveys of oil and gas companies, and a review of acquisition evaluations, suggest that Payout remains a useful, if subordinate, investment criteria. The Payout approach simply determines the time required to recover the original investment from the anticipated cash flow of the project or property. Payout provides for the return-of-investment by estimating the time necessary to accumulate the original investment from cash flow; all income received after Payout contributes to return-on-investment. An acceptable Payout period might be 3 to 5 years. The shorter the better. If the Payout period was 5 years, then one could infer an average annual return-of-investment of 20% for those five years. In real estate appraisal the concept of Recapture rate is well documented and contemplates the use of either a fixed or variable rate as part of a built-up or total discount rate.

Industry surveys and the empirical data suggest a relatively strong relationship between reserves risk, measured as the percentage of PDP reserves in the total reserves acquired, where the risk represented by undeveloped reserves requires a higher discount rate than does PDP reserves. Since, according to the annual SPEE[5] surveys, even PDP reserves require a risk premium, the increase over the PDP discount rate is a measure of property risk. The compensation for liquidity is difficult to separate from the other factors, and there is no simple measure provided by the empirical data.

Pure-Play Analysis

Another approach to evaluating the difference between the COC discount rate and the empirical data from market sales is to consider discount rates derived from so-called Pure-Play analysis, a methodology commonly used in business valuation. The theory is that the discount rate for producing properties can be approximated by determining the cost-of-capital for companies whose business income is entirely, or in large part, from oil and gas production. If a sample group of publically-traded companies whose business consists solely of oil production is assembled, the cost-of-capital for those companies could be used as an estimate of a specific property discount rate.

In 1997, Ibbotson Associates completed a study for the Western States Petroleum Association entitled, "WACC for Pure-Play Oil and Gas Extraction and Refining Entities."[6] In that study, Ibbotson estimated a cost-of-capital for two groups of companies whose business was (a) 100% production or (b) 100% refining. The COC was calculated using a standard WACC approach where the cost-of-equity was derived using CAPM.

Ibbotson used Standard Industrial Classification (SIC) codes to focus on two industries: SIC 1311 (Crude Petroleum and Natural Gas) and SIC 2911 (Petroleum Refining) and then determined the number of companies within each industry which had at least some participation in that industry. Starting with the CAPM calculation, pure-play Betas were derived from the Betas of publically traded companies based on the degree to which that

company participates in each industry. A cross-sectional regression was used to relate the percentage of each company's participation in Production or Refining to the beta for those companies. The result is an estimate of a beta of 0.63 for companies which are 100% in crude oil and natural gas production, and a Beta of 0.73 for companies whose business activity is 100% petroleum refining.

These estimated pure-play Betas are then used to calculate a cost-of-equity using CAPM for each pure-play entity. The cost-of-equity is then combined with the cost-of-debt and a typical structure to calculate an AFIT weighted average cost-of-capital of 9.51% for a hypothetical pure-play producing company and 10.87% for a pure -play refining company. After adjusting for liquidity using standard business valuation methods and adjusting for Income Tax, the Ibbotson analysis obtains a Before Tax WACC of 20.15% for pure-play producing companies and 23.04% for pure-play refining companies. These are useful results which suggest that, when liquidity is taken into account, a company which receives all of its business income from oil production has an effective discount rate of 20.15% BFIT.

The Ibbotson result is also close to the result achieved from the empirical data and reported by the annual SPEE survey of producers and others. In that survey respondents provide, their minimum return requirements for investment. This is not limited to acquisitions but provides a benchmark nonetheless. However, publically-traded companies are not specific properties. Even pure-play companies have multiple income streams. As noted, the Ibbotson analysis took account of the liquidity issue, but Risk and Return-of-Capital remain. In regard to Risk, Ibbotson cautions that the pure-play rates only apply to "...expected future cash flows which ...have been calculated taking all sources of risk into account through probability-weighing." That is, Ibbotson assumes that the pure-play discount rates will be applied to risk-adjusted cash flows so the pure-play rates are comparable to risk-adjusted discount rates, not the risk-inclusive rates which make up most of the empirical data. Further, discount rates estimated from cost-of-capital, whether pure-play or otherwise, assume that the invested capital is recovered when the investment is sold or redeemed. This does not occur with depleting assets such as oil producing properties. Therefore, as discussed above, an additional increment must still be added for recapture.

Small Capitalization Stocks: Size v. Return

Another approach to reconciling cost-of-capital with discount rates from market sales is to consider the relation of the company's total equity capitalization (market share price times number of shares) to the equity return expected and received. Work by Ibbotson, Grabowski, and others has shown a decided relationship between company size, as measured by market capitalization, and equity returns. This relationship is known as the Size Effect.

Work on the Size Effect indicates that observed market equity returns increase as the market capitalization decreases. This is, small capitalization companies, which are presumed to have higher risk, are expected to have higher returns than the Exxon's, Mobil's, and GE's of the world. This size relation results from a mass of statistical work that is referenced but not discussed here. However, the Size Effect is particularly interesting when combined with the Pure-Play results. Ibbotson reports the Size Effect in deciles of NYSE listed companies and presents a table and graph of equity return vs. capitalization which shows a range of returns from 11.98% for the largest capitalization group increasing to 21.83% for the smallest.

Size-Decile Portfolios of the NYSE

Decile	Recent Market Capitalization, M$	Arithmetic Mean Return, %
1. Largest	5, 329,014,202	11.98
2.	1,113,737,447	13.69
3.	570,342,252	14.29
4.	332,180,564	15.00
5.	208,397,662	15.75
6.	148,168,080	15.82
7.	101,028,590	16.39
8.	63,084,869	17.46
9.	39,011,173	18.21
10. Smallest	12,720,499	21.83
Mid-Cap 3-5	1,110,920,064	14.76
Low-Cap 6-8	312,281,487	16.33
Micro-Cap 9-10	51,731,657	19.17

This result can be refined even further by using the work done by Grabowski[7], where the market capitalization was divided into 25 categories with related returns. Using this data set, the smallest actual property sale would have a return-on-equity of 11.49% while the largest would be 23.47%. The arithmetic average of the acquisition price of all the sales in the California empirical database is $17.1 million. If translated to market capitalization, this would be in the lowest decile of NYSE companies and, based on Size Effect adjustments, would have a discount rate of about 21.8%.

Use of either the Ibbotson or Grabowski data results in a COC discount rate that has taken into account some of the risk component so that a discount rate derived from cost-of-capital and adjusted for Size Effect could be a useful starting point for valuation. However, a Size Effect adjusted COC discount rate must still be adjusted for return-of-investment and for liquidity. The return-of-investment adjustment can be borrowed from above, and the Liquidity adjustment can be borrowed from the Ibbotson pure-play treatment to give a composite COC discount rate. There is a real question, however, whether these adjustments are additive or are compounded.

Fama-French (Three-Factor) Model

Exploring further into the cost-of-capital is helpful in rationalizing the difference between cost-of-capital rates and empirical data. A primary component of the cost-of-capital is cost-of-equity, and the primary method of estimating COE is the CAPM. In recent years, work at University of Chicago Center for Research in Security Prices ("CRSP") and other academic centers has resulted in an alternative or expanded COE model known as the Three-Factor or Fama-French Model after its principal authors. While suggested by some as a replacement of CAPM, the Three-Factor model is really an expansion that builds on the basic CAPM introducing two additional components.[8,9] [Note: As the authoritative reverences on this work would fill several pages, only the more influential are referenced here.]

The added factors are intended to account for variances in CAPM which are not thought to be captured by the CAPM beta. One of these is the Big vs. Small Factor which is a size factor similar to, but not the same as, the Size Effect discussed above. The second is a Book vs. Market factor which is intended to account for the relative difference between the Book Value and the Market Value of a company. Rather than a simple straight line equation, the Fama-French Model is a polynomial equation that describes a straight line.

$$R_t = R_f + (b_i * ERP) + (S_i * SMBP) + (h_i * HMLP)$$

School is still out of the Fama-French model. CAPM has a 30-year history of usage, and it remains to be seen if Fama-French will hold up as long. If Fama-French is a more comprehensive model for estimating cost-of-equity, then using it to calculate COC may help to resolve some of the difference between market sales returns and COC. The Fama-French factors are based on SIC codes and are not currently available for individual companies. When the Fama-French factors are used for SIC 1311 for oil and gas producers, the result is a cost-of-equity that is 3-4% above the standard CAPM which increases COC by 2-3% BFIT. The effect of the Fama-French model expansion of CAMP is at the margin of the Cost-of-Capital from 16% to 18-19%. If Fama-French is used in place of the traditional or Size Effect adjusted cost-of-capital, there must still be a correction for return-of-investment, liquidity, and the balance of property specific risk.

After-Tax Cost-of-Capital

The standard calculation of WACC results in an AFIT (after-tax) value. The cost-of-equity, whether derived from CAPM or another model, is an after-tax rate. The cost-of-debt is a pre-tax rate which is converted to after tax by multiplying by $(1-T_c)$ where T_c is the composite state-Federal tax rate. Most valuations done by companies for investment purposes are done on an after-tax basis; therefore, the after-tax COC is appropriate. AFIT discount rates can be compared to AFIT market-derived rates. But there are many uses for the BFIT COC including use as a baseline for FMV discount rates. There are many applications for BFIT discount rates, including but not limited to: financing, property tax, regulatory reporting, and estate tax valuation. In these uses and other applications, a BFIT discount rate removes the variations in return that would occur between Company A and Company B due to their different income tax structures. The simple approach to converting an AFIT WACC to a BFIT WACC is to re-order the equation and divide the cost-of-equity by $(1-T_c)$.

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Appraisers Workshop

The Return-of-Investment issue can be addressed very simply if it is accepted that, by definition, the COC or WACC is only a return-on-investment. Assume an initial investment of $1 million and a guaranteed level of $200,000 per year for 10 years. There is a reversion of the $1 million in the last day of year 10. The total income is $3 million and the annual payments provide a return-on-investment of 20% per year. Now, assume that there is no reversion only the income stream of $200,000 per year. Assume that the investor elects to recover his investment at $100,000 per year. This leaves Free Income of only $100,000 per year or a return-on-investment of only 10% per year.

In order to obtain a 20% return-on-investment the investor must either (a) invest a small amount (pay less) for the

same income stream or (b) obtain a increase in the income stream. If only (a) is viable how much can our investor pay to receive 20% per year? The answer is $630,000 which is recovered at $63,000/year and which leaves $137,000 per year in Free Income to generate a 20% ROI. The discount rate necessary to provide a total return of and on investment is 35%. Try this example yourself; set it up in a spreadsheet and try some other examples.

Now, as we all know, oil property income streams tend to decline so revise the example such that instead of a level payment of $200,000 per year for 10 years the property provides a first year cash flow of $200,000 but the cash flow declines at 5% per year and reaches economic limit in 12 years. Assume further that the purchase price is recaptured by reversion in year 13. What price can be paid to receive a 20% return-on- investment ? Now assume that the buyer must recapture his investment out of the first 5 years of cash flow and still earn a 20% ROI . What is the maximum price that he or she can pay for the cash flow?

Book (and Other) Reviews

The references above list several finance and appraisal texts that are invaluable sources of cost-of-capital information. However, there are two other very good sources, that do not require an MBA.

"The Wild and Wacky World of Finance (Parts 1, 2, & 3)", written by the Standard Deviants Academic Team, 1997. I'm not kidding. I found this in a university bookstore along with the companion video tapes. This is Cliff's Notes for Finance. The video was running at the time I found the book. Both book and video are very well done and cover the essentials of Opportunity Cost, WACC, and CAPM in a succinct and straight forward manner in a non-lecture format. Paperback $12.95 (800) 238-9669 www.cerebellum@mindspring.com.

The second source is a web site. Who needs books. Try this: www.teachmefinance.com click on Cost-of-Capital and get a very clear and short discussion of the subject. Absorbed that - Print it out. Click on CAPM - one page with hot keys to data sources. Good bye Brealey and Myers - Hello Internet. Ain't life great.

I also found an excellent appraisal text that someone has been hiding.

"Property Appraisal and Assessment Administration", Eckert, Joseph K., Ph.D., published by The International Association of Assessing Officers, 1990, Chicago, IL.

This tome (700 pgs.) is apparently written with property tax assessors in mind but the discussions of general appraisal techniques are worthwhile to anyone interested in appraisal and it presents some perspectives that are not encountered in *The Appraisal of Real Estate* or other texts. I found several very lengthy and detailed discussions of statistical methods and the application of those methods to data analysis, derivation and calibration of appraisal models, and testing of mass appraisal results that will be very helpful in the work done by this firm. I had been led to believe that statistical analysis was verbotten in property tax appraisal but I guess whoever said that was not up to date.

Merry Christmas And Happy New Year

P.S. The Millennium does not occur until next year; there was no year zero. But have a good time anyway.
Drive Safely!

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