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## Economic Cycles and the Valuation of Oil and Gas Properties

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### Abstract

During the period of the 1980's and 1990's the oil business endured or, at times, benefitted from several economic cycles which brought about extreme fluctuation in the prices for oil and gas, changes in interest rates from as low as 3% to over 20%, substantial declines in domestic U.S. production and continually increasing regulation of the physical and economic aspects of the industry worldwide. This paper will examine the effects of the cycles in prices, interest rates, regulation and other economic factors on the process and component of the valuation of oil properties for sale/acquisition, taxes and litigation and other purposes. The paper will draw on information developed as part of recent analysis work as well as published studies and SPE papers from the past 30 years. Specific areas of study and discussion will include the effects of various methods to identify and account for risk and the influence of interest rates on discount rates.

### Introduction

Economic cycles come in all shapes sizes, and durations. Economic cycles may coincide with business cycles or they may not. Economic cycles can be general and have an impact on all industries in the broad economy or they can be limited to a segment of the general economy. It is not unusual to have changes in the “economy” of the auto industry or the steel industry; there is currently both a general recession and a particularly strong downturn in the so-called “tech” sector of computers, software and semi-conductors. Economic cycles are common in the oil and gas industry. In many cases, the cycle can be shown to have an impact on the industry as a whole or, only the effect may be limited to an industry segment such as the natural gas or refining and not necessarily production.

### What is an Economic Cycle?

The term “cycle” suggests economic events that, while resulting in changes over a period of time, end with conditions similar to, if not the same as, the conditions existing at the start. Of course not all cycles are uniform; they do not return to the starting point. The U.S. economy is currently going through a recessionary cycle which one hopes would end with business back to where it was in early 2000 or a bit better. The cycle is marked by declining incomes, increased unemployment, and slower growth in production. The largest component of the recession is, arguably, the decline in personal wealth caused by the sharp decline in the stock market followed by the decline in corporate value measured by stock prices as well as a decline in fixed income to a portion of the society due to falling interest rates.

What are the elements of an economic cycle? For the economy in general the elements include:

- Interest Rates
- Inflation
- Investment (Savings)
- Equity Returns (Dividends + Growth)
- Political Change
- Taxes
- Regulation

Many more items could be added to the list but most would be included within one of the above. Indeed, changes in any one of the items listed could change some or all of the others. In a dynamic economy it would be expected that an increase in interest rates could reduce inflation, increase savings, cause equity returns to decline and, in the extreme, bring about political change.

The economic cycle is also known as the business cycle. In the context of this discussion we will view the effect of changes in the economy on certain aspects the oil and gas industry in general and on the valuation of oil and gas properties in particular. Our data will be interest rates, inflation figures, stock market returns and other information. We will consider if and how the elements of the economic cycle individually and/or collectively influence the valuation and the value of oil and gas properties over time. We will also examine some of the trends that may occur or appear to occur in the market for oil and gas properties. This is not intended to be an economic treatise. It is an evaluation engineer's perspective on economic conditions and the marketplace for oil and gas properties.

For the purpose, of this discussion “oil property” or “oil properties” will refer to oil and gas producing properties and will be considered to be individual properties or groups of closely related properties where the relation is one of physical proximity, common operation, and/or reservoir/production characteristics.

### **Economic Data**

It might be worthwhile to review some economic data and to examine the size, shape, duration and relation of change in the various elements of the economy.

### **Interest Rates**

The most easily identifiable economic element is interest rates. Interest rates effect virtually every personal and business activity from money market savings accounts and home mortgage rates to capital investment borrowing. Changes in interest rates influence other, higher risk elements such as equity returns. Figures 1, 2, and 3 show three forms of interest rate that should be relatively familiar: the bank Prime Rate for lending, the rate on 30-year U.S. Treasury Bonds, and the total return on Corporate Long Term bonds.

Probably the most familiar of these is the bank Prime Rate. This in a benchmark interest rate that applies to loans from commercial banks to credit worthy borrowers who are primarily corporations or other businesses. The most credit worthy borrowers pay interest at the prime rate; less credit worthy borrowers pay interest at some rate greater than prime usually shown as Prime + (a fraction). The Prime Rate can be a good measure of the health or strength of the economy but not always. Figure 1 shows the Prime Bank Lending Rate from 1949 to the present (12/2002). At the current rate of 4.25% the Prime Rate is the lowest since the late 1950's. As shown in the figure the Prime Rate generally increased through the 1960's and 70's, hit an extreme peak along with everything else in 1980-81 and has been in general decline since that time. When viewed since 1982 the prime rate has declined, with a few reversals, from 11% in 1983 to the current 4.25%. The Prime Rate is a function of Federal Reserve rates and is subject to Federal Reserve monetary policy so that rates go down in periods of recession to stimulate growth and go up, when necessary, to control inflation. Since January, 2000 the Prime Rate has dropped more than half from 9% to 4.25%.

Another interest rate that is useful and informative is the 30-Year Treasury Bond rate. While the Prime Rate is usually thought of as a short-term rate, the T-30 is the interest rate on very low risk Treasury notes with literally a 30-year duration. The T-30 was discontinued in early 2001 but the history is still informative. Thirty-year T-Bonds peaked in 1982 at just over 14% or about 6% below the Prime Rate. This difference could be interpreted as a risk premium in the Prime Rate. Since the peak, and particularly since 1987, the T-30 has been in a relatively steady decline from about 9% to about 5.5% at year end 2001 which mirrors the Prime Rate history. There have been periodic variations as economic conditions and government revenue needs changed but the generally downward trend. A similar pattern is seen for the 20-Year T-Bond which is the new long term standard.

To a large extent all interest rates are tied together in sympathy if not by policy so it is not unexpected that corporate bond yields have performed in a manner similar to T-30 and the Prime Rate. Corporate bonds are issued by companies based on the strength of the corporation as a whole and are graded from AAA downward to B or less based on the perceived risk of repayment of the notes by the company. Bond ratings can, of course, change over/time as anyone holding Enron or Worldcom notes can tell you. As previously observed and as shown in Figure 3, Bond yields for corporate AAA and BAA rated bonds, the lowest risk variety, have tracked T-30 and prime rate over the period reviewed. Bond rates were lowest in the late 1940's and early 1950's, increased through the 1960's and 70's, peaked in 1982 above T-30 but below prime rate and have since been in general decline. At year end 2002, corporate BAA bond yields had decline to 7.45%. Corporate bonds a higher risk than T-Bonds and are longer duration than Prime rate loans so the interest rates tend to be higher than either but they follow the same trends.

### **Inflation**

Another element of the economy with which we are all familiar is in inflation as measured by the Consumer Price Index (“CPI”) and Producer Price Index (“PPI”). As shown by Figure 4 the CPI has moderated substantially since reaching a peak at over 14% in 1980. After a short-lived upsurge in 1990 the CPI has declined to a current level of around 2%. The PPI has demonstrated a similar pattern.

### **Equity Returns**

Another element of economic cycles is the return, both actual and anticipated, from equity investments most commonly reflected in common stocks. The stock market is probably the most visible and quickest indicator of economic cycle. Indeed, the stock market is often said to anticipate changes in the economy months before the changes occur. The truth of this is a subject for another paper in a different field, however, the point is valid that equity returns do reflect economic cycles and may have a part in causing change in the general economy to occur. As shown in Figures 5 and 6, the total return on both large and small company stocks has generally increased over the period since 1970 through the present. Total return is dividend yield plus capital (price) appreciation. While it is obvious that there is considerable volatility from one year to the next, and a rather lengthy period (1975-93) where the long-term trend appears flat the overall trend in later years does appear to be up. The same trend occurs in both large and small company stocks.

A somewhat different measure is shown in Figure 7 for three groups of companies. The After Federal Income Tax (AFIT) Return on Equity (ROE) for the All Industrials group shows a significant cycle of performance where AFIT ROE declines sharply from 1988 through 1992 (a period of recession) than increases to about 17% where it remains relatively steady until 1997± when a decline sets in to be followed by a short increase in early 2000 but with a sharp drop in 2001-2. During the period from 1995-2000 AFIT ROE varied in a range from 15-17%. This was a period of lowering interest rates and inflation.

### Political, Tax and Regulatory Influences

Changes in the economy or the trend shown by economic cycles are readily measured by changes in interest rates, inflation, and equity returns augmented by other factors such as capital investment, gross national product, employment and other measures.

Some changes in the economy or elements in economic cycles are readily observable as events but not as easy to measure. Political changes are notable as occurring at certain times and often signal shifts in emphasis when Congress changes hands or a new President is elected. Such changes often come with high expectations but rarely amount to much in a practical sense that is not measured by interest rates, inflation or equity returns.

Changes in tax policy are a major element in economic cycles particularly as those changes influence capital investment. An argument can be made that reductions in tax rates in the Kennedy and Reagan administrations resulted in significant increases in economic activity. Other changes, such as the 1986 removal of virtually all tax incentives for capital investments including accelerated depreciation and the various Investment Tax Credits, can result in profound changes in business and personal activity, however, the result may only be seen years after the event.

Regulatory activity has an effect on economic cycles that is subtle and difficult to measure outside of other influences. Regulatory efforts are often disguised tax changes or have the same impact as a tax change on the economy or parts of the economy. Proposed requirements to change air quality standards, impose content on gasoline, or restrict manufacture of certain types of products while encouraging other products often bring about unintended changes in the economic cycle.

### Economic Cycles in the Petroleum Industry

Changes in the economic cycle measured by interest rates, etc. influence the general economy and have varying effects on the components of the economy - business, personal, government. Such changes may be beneficial to one industry and adverse to another industry.

The petroleum industry is characterized by large capital investments in plant, equipment exploration, production development and transportation facilities. A new refinery or production development project can require billions of dollars in capital investment, require years to complete and then must depend upon many years of income from commodity sales to obtain a return of and on the initial investment. Capital intensive industries such as oil and gas are more susceptible to changing interest rates than service industries but on the other hand do not gain or lose directly as does the financial industry. Similarly, inflationary expectations more so than the activity or inflation, can have an influence on industries with large investments to be recovered over long periods of time.

The economic cycles of the petroleum industry are relatively easy to identify and measure. Interest rates are not much help because the same changes in Prime Rate and corporate bond rates that effect Ford, GE, and IBM also effect oil industry

borrowers. The degree may be different but there is no separate debt market for the oil industry. Inflation can have a disparate effect on the petroleum industry by causing an increase in (a) costs of operation, production and (b) capital investment. However, since the overwhelming majority of oil industry income is dependent upon commodity prices for crude oil, gasoline, etc, and which are not subject to inflation, periods of high inflation can significantly impact petroleum industry economics.

Equity returns can be used to measure economic cycles in the oil industry. Viewed from 1968 forward AFIT return on book equity has gone through several very obvious cycles or changes from lows of 10% or less in 1973 and the 1986-87 period to peaks over 20% in 1979-80 and 2000-2001. As shown in Figure 8 the change in ROE have in some periods has been very sharp such as in 1973-74, 1979-80 and 1985-87. When viewed as quarterly data from 1988 forward the changes are a bit more moderate and do not appear as sharp until one looks at 1997-2002 quarter by quarter.

These equity returns contrast in some interesting ways with interest rates. While oil industry ROE and corporate bond yields follow a similar path in the late 1960's and 1970's and both peak in the 1980-82 period, interest rates, while declining, take a shallower path than do oil industry equity returns which drop precipitously after 1982 through 1988. Oil industry ROE fell below the BAA bond rate for a couple of years in the middle 1980's.

Oil Industry equity industry returns have also varied to some degree from the equity returns from other industries as shown in Figure 8. During the latter half of the 1990's oil industry return on book equity lagged other industrials and when it did catch up in the 1996-97 period other industrials began to decline.

### Oil Price and Industry Economic Cycles

The fortunes of the oil and gas industry can be traced to the prices for two commodities - crude oil and natural gas. Of these, crude oil is arguably the more important and the more easily measured. As shown in Figure 9, the monthly average posted price for West Texas Intermediate (WTI) from 1946 through 1973 was essentially flat. After the 1973 oil embargo, WTI price began to increase up to \$40.00/Bbl in 1980. This euphoric peak was followed by a steep decline to 1986 followed by an even sharper drop. Since 1987, WTI price has varied considerably in a broad range between \$10 and \$25/Bbl.

### Oil Price and Equity Returns

It should not be surprising that the oil industry ROE tracks relatively closely to the WTI posted price. Each marginal dollar change in oil price results in a more or less direct change in industry revenue, earnings and anticipated return-on-investment. A comparison of WTI posted price to industry ROE indicates a very close relationship particularly since the spike in 1980. As might be expected for most of the period since 1980 changes in ROE lag changes in oil price. Of course, WTI is not the only crude oil and oil company returns are made up of far more than revenues from crude oil but it is hard to escape the relationship

between the two. It might be instructive to compare returns to natural gas prices or to retail/wholesale gasoline prices. Another interesting view is shown in Figure 10 which adds in the returns from non-petroleum manufacturing companies.

### Oil Property Valuation

What if anything does this have to do with oil property evaluation? How do apparent relations between oil price and equity returns influence the value of properties? To what extent are interest rates and other economic factors related to oil property evaluation?

Before proceeding, we should examine the purpose of oil property evaluation. Aside from the requirements of the regulation covering SEC evaluations, estate tax, property tax, the primary function is for capital investment/budgeting. These can be internal purposes such as whether to expand development of a property, build new facilities or go into an EOR project but they can be also for external uses such as acquisitions of new properties. Regardless of the specific application of the evaluation, decisions made in the oil industry seem to relate to trends and expectations in product prices and returns to equity and/or returns on invested capital.

The valuation of oil and gas properties for acquisition is an activity that is often considered to be influenced by economic cycles and by certain economic criteria. Acquisitions and divestitures of producing properties is a high profile activity involving annual investments in the billions of dollars. It is also an investment activity for which some data is available. While acquisition/divestiture is not the only use of investment funds or evaluation it would seem to be a good indicator.

For this discussion we will look at several indicators of value and elements of evaluation which can be contrasted with economic data to try to derive a relationship between economic cycles and the valuation of oil and gas properties. Several firms collect and publish data regarding acquisitions and divestiture of oil and gas companies and properties. Probably the best known of these is the John S. Herold, Inc quarterly reports which include a considerable amount analysis of transactions. These reports are prepared for subscribers and are not publically available. Other sources include investment banking firms and consulting firms that compile lists of transactions and provide some analysis of the transactions. This data is often published in newsletters and/or more recently on the Website of such firms. For this analysis a database of transaction data accessed from the Website of Scotia Group, Inc. is used. The Scotia Group data is a broad collection including transactions in the US and Canada.

Another value element that is reviewed are oil price projections used in property valuation and/or considered by evaluators of oil properties. For this data only indirect indicators are available. In this study data is obtained from the Annual SPEE Survey of Parameters, a series of studies done for WSPA independent consultants, and data from the DOE Energy Information Agency.

Finally, we look at what is arguably the most important element of a property valuation - the discount rate. For this analysis

discount rate data is obtained in two forms from two sources. Discount rates from actual transactions are obtained from the Annual Western States Petroleum Association (WSPA) Study. In addition, financial based discount rates are obtained from weighted average cost-of-capital (WACC) analysis done for the WSPA Study and separately from the annual studies of the Texas Comptroller's Office.

### Analysis of Transaction Data

The Scotia Group database contains a very large number of transactions dating from 1979 through mid-2002 (the last data point available at the time the database accessed). This data base has the advantage (for study purposes) of being downloadable in Excel™ format for further analysis. Upon review, the list of transactions includes a mix of corporate mergers and stock transactions, acquisitions of large blocks or groups of properties, and some individual property sales. The transactions involving groups of properties include some where the properties would appear to be in the same area or field while other involve properties scattered over several states. The primary sources of information appears to be the Oil and Gas Journal, Wall Street Journal and other publications. While one could hope for a more selective and discreet data sources, the information does provide a broad indicator which could serve as a proxy for the marketplace particularly if the primary use is to assess trends rather than to derive explicit valuation parameters.

The database includes the month of the transaction, buyer, seller, purchase price, oil reserves, and gas reserves. A large percentage of the transactions did not have a reserves figure reported. For this study, a calculation of BOE and a calculation of \$/BOE was done where data was available. Sales for which \$/BOE could not be calculated or where the resulting figure seemed exceptionally anomalous were discarded. This still leaves a sizable set of 1,633 transactions with total purchase price of almost \$390 billion. For all 1,633 sales the average value indicator is \$5.29/BOE for the period January, 1979 through July, 2002.

When the data points are plotted as a function of sales date the result is a scatter plot that contains very wide ranges of \$/BOE within the same month, month to month, and year to year. When all data points are used it is apparent that there is no reliable trend in market value using \$/BOE. When the transactions are averaged by year a more useful pattern emerges. As shown in Figure 11, \$/BOE increased sharply in the 1979-81 period, dropped just as sharply through 1985, and then dropped again to \$4.74/BOE in 1986. The trend continued in the \$4.00-5.00/BOE range through 1996 when an apparent uptrend began which reached an average of \$7.29/BOE in mid-2002. This would appear to suggest, using \$/BOE as an indicator, that the value of oil and gas properties has increased over the past 5-6 years after showing no particular trend for 11 years.

Scotia Group also provides graphs of transaction data based upon their own analysis which allow the data to be viewed in other way. These graphs show some interesting data. For example, when all transactions are reported in \$/BOE (based on BTU equivalence) there is a trend in apparent value similar to that

shown in Figure 11 with an increase in \$/BOE value over the 1996-2002 period. However, when \$/BOE is calculated on a Price equivalency basis there is no particularly discernable trend to be seen - the transaction value is in the same \$6.00/BOE range occupied over the most of the 1990's and there is no trend of increase over the 1996-2002 period.

Another view is shown on the Scotia Group web as a comparison of oil transactions to gas transactions based on Price Equivalency. Oil transactions measured by \$/BOE have declined or remained essentially flat at about \$5/BOE since 1987. Interestingly the value of larger transactions over \$20 million has declined to less than \$4.00/BOE in 2002 while the value for transactions under \$20 million has moved in a range around \$6.00/BOE. Gas transactions apparently have increased in value. After declining in \$/BOE from 1982 through 1992 and reaching a level in the mid-1990's the value of all gas transactions has apparently increased from less than \$0.70/MCFE to over \$1.20/MCFE in 2002. Here again, large transactions over \$20 million have not increased significantly.

### Changes in Projected Oil Prices

Numerous studies and papers over the past 10-15 years, particularly since the 1986 price decline have consistently documented an interesting trend in property valuation. This is the trend toward flatter or less aggressive price projections over time. Starting from the so-called "hockey stick" projections of the 1980's oil price projections, as either annual percentage increases or as \$/Bbl changes, have shown a tendency toward lower increased year over year and/or have shown an disposition to move from a high or low current price toward a central tendency consistent with previous projections and/or actual performance. As an example, the SPEE Annual Survey of Parameters collects and reports projections of future oil and gas prices used by persons and companies in the evaluations of properties. As shown in Figure 5 of the 2002 Parameter Survey,<sup>1</sup> the oil price projections for the years 1994 through 1997 followed very similar paths which, while not necessarily overlaying each other were very consistent. In 1998 and 1999, years with low oil prices, the projections start near the current price, increase toward the trend of the prior years then assume the same trend but at lower levels. In 2000 and 2001, years of higher oil prices, the reverse occur of the projections started from the higher current prices, decline toward the prior years (1994-97) trend and then assume the trend at a somewhat higher price level. The oil price projection reported for 2002 is a continuation of the 1994-97 projected trend.

Gas forecasts reported in the SPEE Parameter Survey exhibit essentially the same trend line as a percent per year increase where the only difference is the starting point. The sole exception is 2001 where the projection started at a relatively high price, declined to a lower level, and then assumed the trend shown in prior years. The 2002 projection is a virtual extension

of the 1994 projections which may suggest that, over time, price growth expectation do not change.

### Discount Rates and Cost-of-Capital

While subject to debate, the discount rate is easily one of the most important factors in a property valuation. When constructed properly and used correctly, the discount rate represents the return desired by an investor in the property or project as compensation for assuming the risk of using his funds to make the investment. The discount rate used to value a property for acquisition or other purpose should include consideration of the returns on alternative investments and the risks associated with the investment. The discount rate is primarily a financial rather than an engineering factor and should be expected to be effected by economic cycles.

### Cost-of-Capital

Numerous studies of capital budgeting processes including two of the oil industry, indicate that discount rates are derived from some of the same parameters discussed above; interest rates, equity returns, and inflation. The financial aspect of the discount rate is captured in the cost-of-capital used for investment. In theory and as a practical matter, the cost of the capital used for an investment in a project, property acquisition or other use should be the minimum return to be expected from the investment. Put another way, the anticipated return from an investment should exceed the cost of the invested capital and, if it does not, the investment should be reconsidered. The standard measure of the cost of investment capital is the weighted average cost-of-capital (WACC). The purpose and construction of WACC is presented in any number of financial texts and papers and will not be further discussed here except to point out that:

- (1) WACC, if properly calculated, is a forward looking investment criteria, and
- (2) WACC is a function of the mix of equity and debt capital available for all similar investments and/or available to corporations and individuals for investment.

It is of interest then to review estimates of WACC for a sample of the oil and gas industry over a period of time to see how this minimum discount rate may be influenced by economic cycles. Two sources are available from the oil industry. As shown in Figure 12 the weighted average cost of capital for independent oil and gas companies from (a) the annual WSPA studies and (b) the annual Texas Comptroller's studies indicate a relatively stable range in the 14-20% with an arithmetic mean over the respective periods of 16.0% for the WSPA study and 14.6% for the Texas study. These figures are before federal income tax (BFIT). The WACC is derived from corporate data reported to the SEC and generally reflect a capital mix of about 70% equity and 30% debt. These data suggest that for much of the period 1984 through 2001 the cost of investment capital, if used as a minimum return criteria, would be a relatively flat 15-16% BFIT.

### Market Derived Discount Rates

Data regarding the anticipated returns from actual transactions is extremely limited. None of the publically available transaction

<sup>1</sup> *Survey of Economic Parameters Used in Property Evaluation*, Society of Petroleum Evaluation Engineers, June, 2002, Houston, TX, pg. 6

data reports the discount rate or expected return to the buyer of the property. Some studies have attempted to derive discount rates for sales transactions by imputing production streams and cash flows to the property acquired and, using the purchase price, calculate an internal rate of return. These studies give some insight but are artificial data sources since the imputed production, prices and costs may or may not be those of the actual evaluator. The only published data on discount rates from actual transactions are the WSPA study and studies done by the Texas Comptroller. As shown on Figure 12, the WSPA study has derived data for property transactions over the 1985-2000 period for properties with (a) 100% PDP reserves and (b) properties with a mix of Proved reserves classes. These data points indicate that for most of the 1980's and 1990's the mean annual discount rate from actual transactions ranged very comfortably in the 20-25% range while the mean for a total of 240 transactions over the period was 23.9% BFIT. The overall arithmetic mean for the 160 transactions with 100% PDP reserves is 23.3% BFIT. The apparent volatility in discount rates in recent years is currently interpreted to be due to the relatively small number of data points available. The Comptroller's study covered 73 transactions with primarily 100% PDP in Texas over a period from 1987 through 1993. While the averages varied from year to year the composite average is 21.2% BFIT which is reasonably consistent with the WSPA results.

When these data are compiled on Figure 17 one conclusion becomes immediately apparent. The market derived discount rates consistently exceed the cost-of-capital by several percentage points in every year. While individual transactions may for whatever reason fall below the average WACC, the WSPA study has consistently shown that 90% or more of sales exceed WACC. This relation should be expected.

### Analysis

What does all this mean and how does it relate to the question of how economic cycles influence or do not influence the valuation of oil and gas properties? Perhaps a predicate question should be - What is meant by valuation? In this study valuation is the value of an oil and/or gas property based on the income it is expected to provide to an investor. If we use the afore discussed \$/BOE as the criteria for measuring the value of properties then we can compare that criteria to the economic cycle and the elements which make up that cycle, particularly as it relates to the oil and gas industry and attempt to ascertain what, if any, relationship exists.

As noted above the \$/BOE data are not without flaws. The data includes corporate acquisitions as well as purchases of individual properties or groups of properties. Further, the data suggests a different trend if the \$/BOE is based on BTU equivalency rather than Price equivalency. Also, the trend lines differ for (a) so-called large transactions compared to small transactions and (b) for gas transactions rather than oil transactions.

Regardless of which composition of \$/BOE is used the data available strongly suggest a decline in oil property valuation through the late 1980's which tends to level out or decline at a lesser rate through the early 1990's. In the late 1990's the value

of properties seems to increase if \$/BOE is based on BTU rather than Price equivalency. Over the same period, the number of transactions declines but the Total Value and Average Transaction Size increase sharply in the late 1990's. There is also a significant change in the trend of gas property transactions in the late 1990's.

Comparison of property transaction values to the various elements of the economic cycle yields some interesting results.

**Interest Rates** - As noted above, interest rates, as measured by Prime Rate, T-Bonds, and Corporate Bonds, have generally declined since the early 1980's in a pattern not unlike that of \$/BOE. The interest rate is usually discussed in the context of discount rates where the suggestion is that declining interest rates reduce the WACC which should reduce the market value discount rate thereby increasing the value of the property being valued. However, while interest rates have generally declined the cost-of-capital has not. There have been fluctuations between 14% and 20% but except for 1990-91 the WACC seems relatively insensitive to interest rates.

**Equity Returns** - The relatively stability of WACC over this period may be due to the performance of equity returns relatively to changes in interest rates. In theory a decline in interest rates should result in an increase in equity returns. The magnitude of the increase would depend on the relative portions of debt and equity in the capital mix. If the corporate standard of 30% debt and 70% equity is used as a model an interest rate decline of 1% could produce an equity change that magnifies the interest rate reduction. Therefore, if interest rates went down the resulting change in equity returns could be expected to balance and hold WACC in a relatively small range of change.

**Inflation** - Oil and gas are commodities so that prices are not subject to inflation. However, operating costs and capital expenditures for equipment, etc are subject to inflationary pressure. A decline in inflation rates such as has occurred through out the 1990's, if incorporated into property valuations, would reduce future operating costs for a property thereby increasing value.

**Tax and Regulatory Policy** - These effects tend to be one-time and are thereafter factored into valuations of properties. A sharp decline in heavy oil property valuations was seen in the mid-to-late 1980's as beneficial tax credits and depreciation write offs were removed from the tax code.

**Oil Price** - A comparison of property valuation to oil price clearly suggests that the primary component influencing the relative value of oil properties over time is oil price. Whether we compare all transactions as \$/BOE on a BTU basis or on a Price Equivalency basis the close relationship to oil price is apparent. The runup in property values in the early 1980's and subsequent sharp decline in value mirrors the performance of oil prices through the period. The moderation of property values in the late 1980 and 1990's reflects oil prices that, while changing from month to month, did so about central tendency of \$19-20/Bbl (WTI). Some moderate price excursions seem to coincide with

changes in property valuation particularly for smaller properties. There is a difficulty with this conclusion when the price projections reported by SPEE are considered. Assuming that properties in most transactions are valued based on future income over a 10-20 year period the use of the current price at the time of the evaluation would not be a good way to evaluate a property. As noted above the SPEE Parameter Surveys indicate a rationalization of this issue by increasing or decreasing prices toward a trend line more consistent with historical prices. This would have the effect of moderating the impact of large changes in prices and would also dampen the relation between oil price and property value.

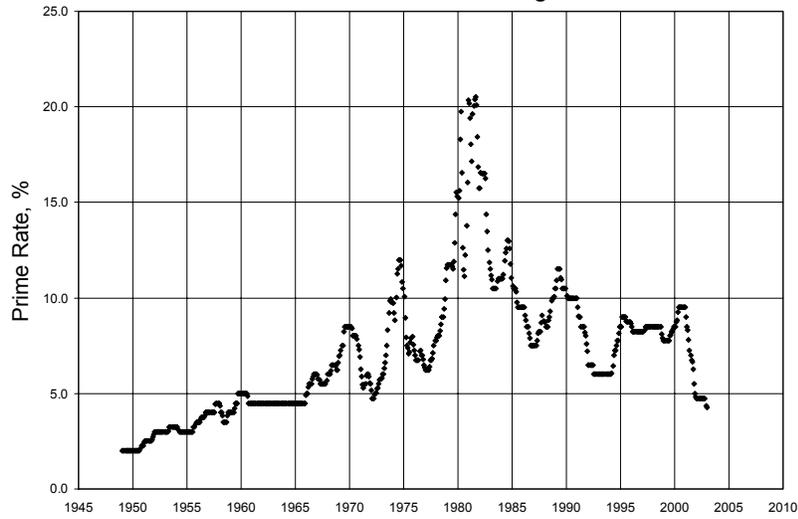
**Gas Prices** - The comparison of property values for gas properties compared to gas prices is less compelling than that for oil properties but it is apparent that the sharp increase in gas property values in the late 1990's and particularly 1999-2001 results directly from the rapid increase in gas prices and concerns that prices might remain above historical levels.

**Discount Rate** - There does not appear to be any notable relation between property values and either market derived discount rates or WACC. While the values of oil properties and of oil and gas properties have declined or remained essentially flat during the 1980's and 1990's, the WACC has remained relatively unchanged in a narrow range while market derived discount rates have, depending upon view point, declined by 2-3 percentage points. This decline is more likely related to the limited amount of sales data. Had there been a real decline in discount rates, the decline should have produced an increasing trend in the value of oil properties. The latter is not apparent and, to a large extent, the opposite has occurred.

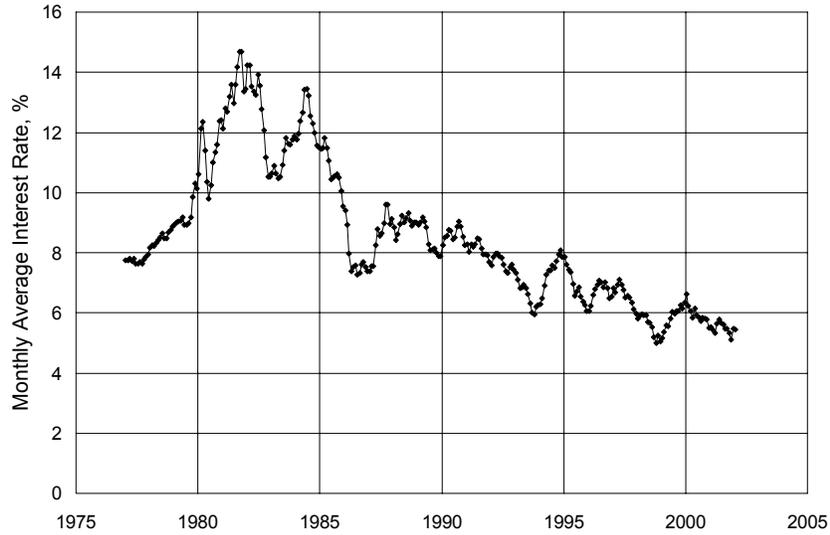
### **Conclusion**

It would appear that economic cycles have some effect on the valuation of oil and gas properties but that long term trends have more impact than short term events. The strongest relation of property value to the economy and changes therein is to the price of oil and, to a lesser extent, the price of gas. This should not be unexpected. Given the relative stability of discount rates over time it seems apparent that oil and/or gas prices are the most influential element in the valuation of oil and gas properties.

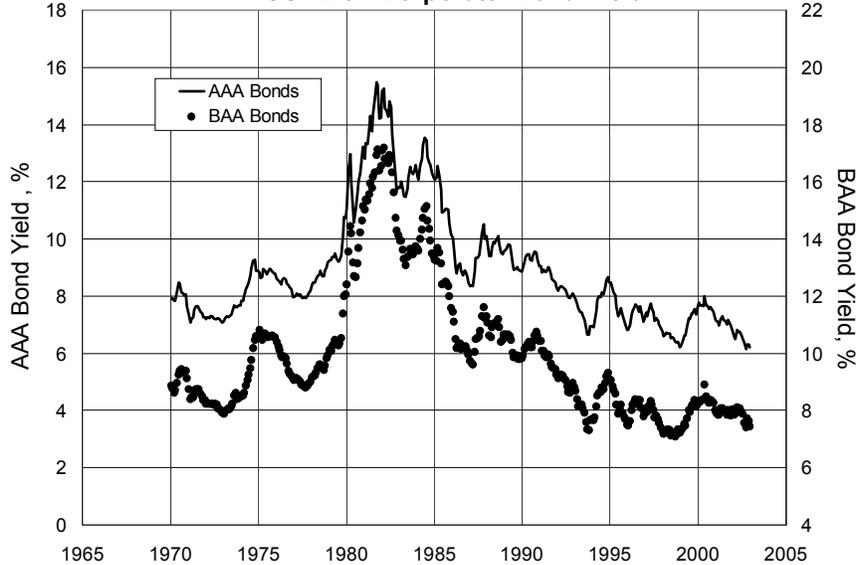
**FIGURE 1: Prime Bank Lending Rate**



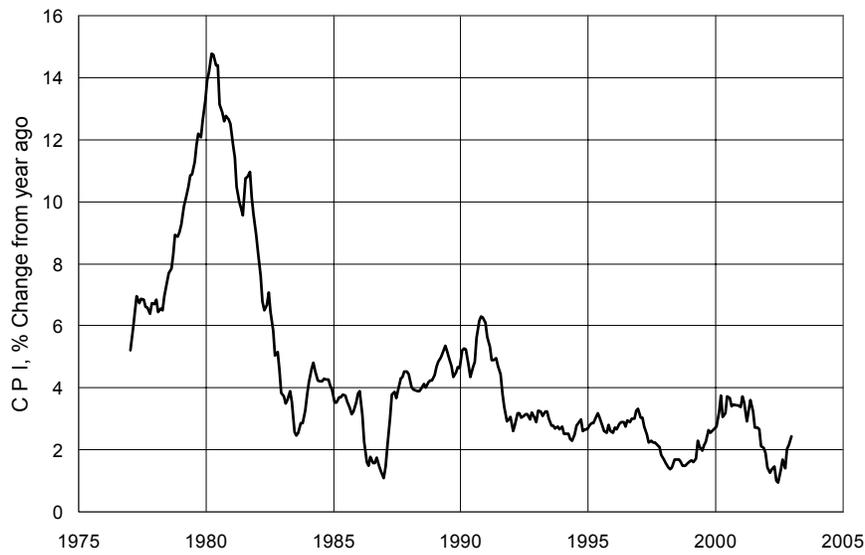
**FIGURE 2: 30-Year Treasury Bond**



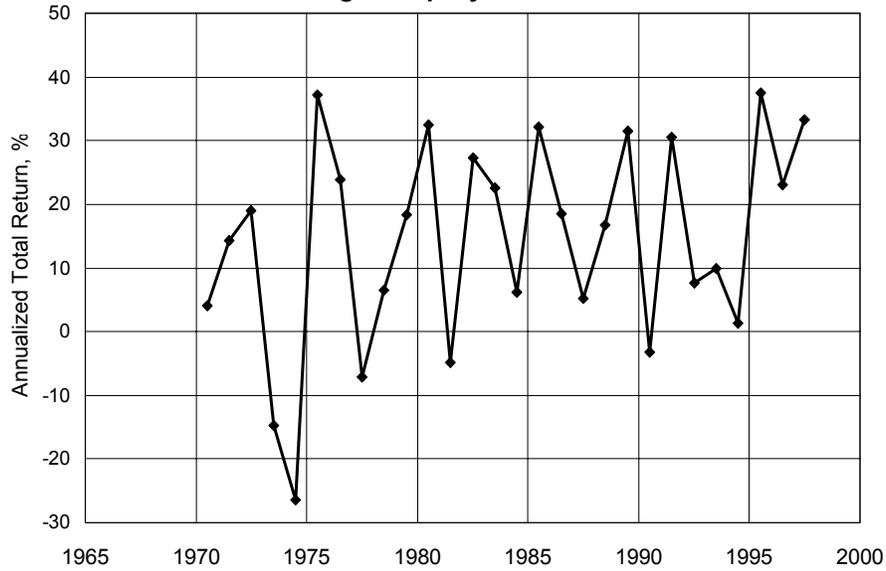
**FIGURE 3: Corporate Bond Yield**



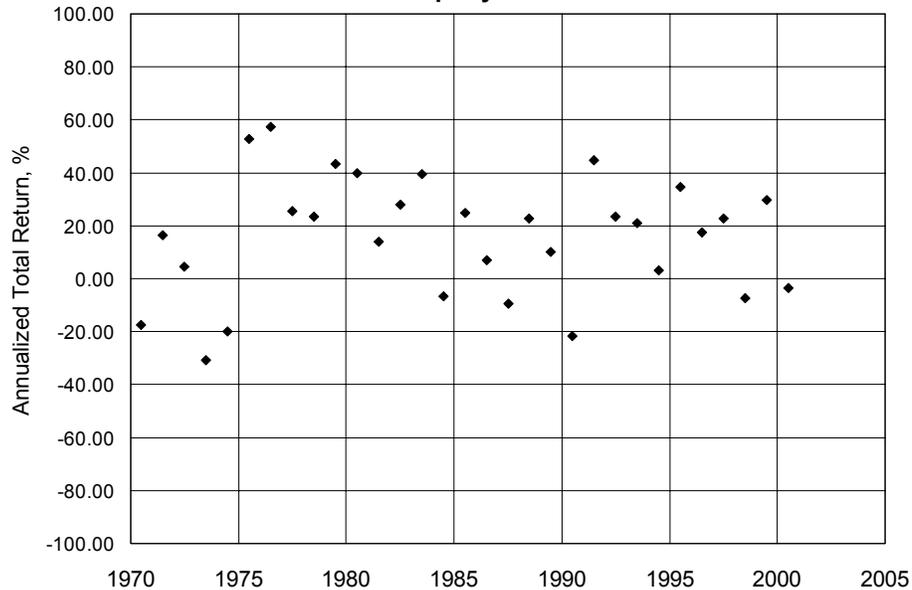
**FIGURE 4: Consumer Price Index**



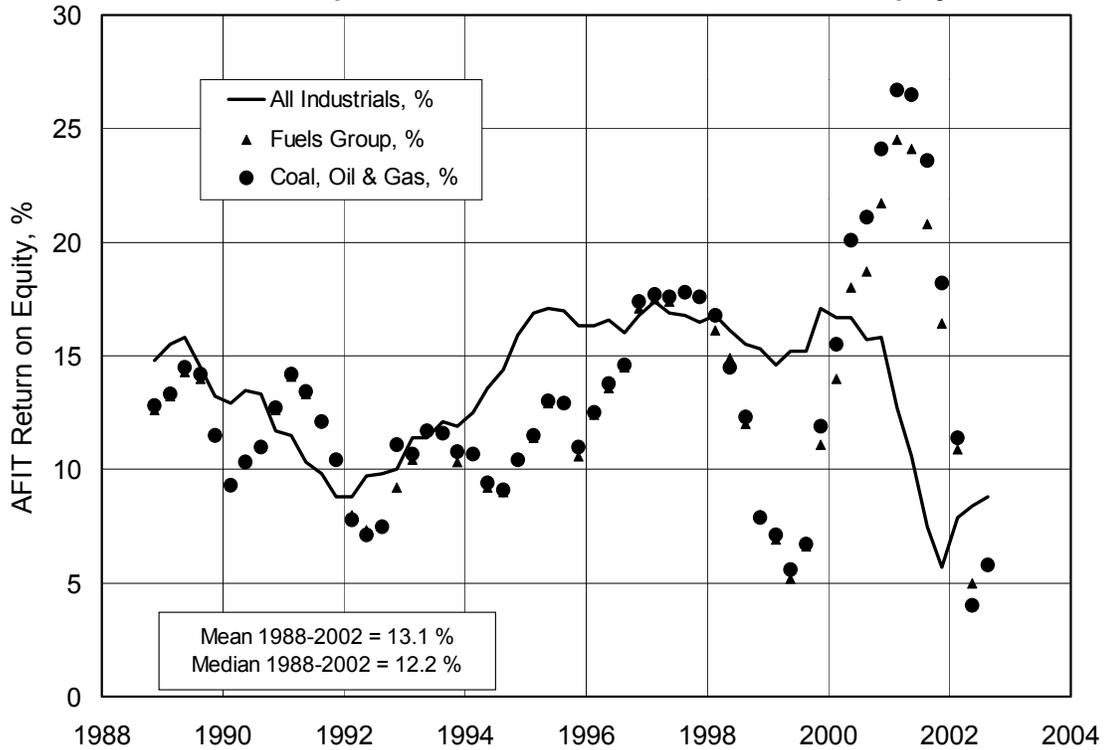
**FIGURE 5: Large Company Stocks: Total Return**



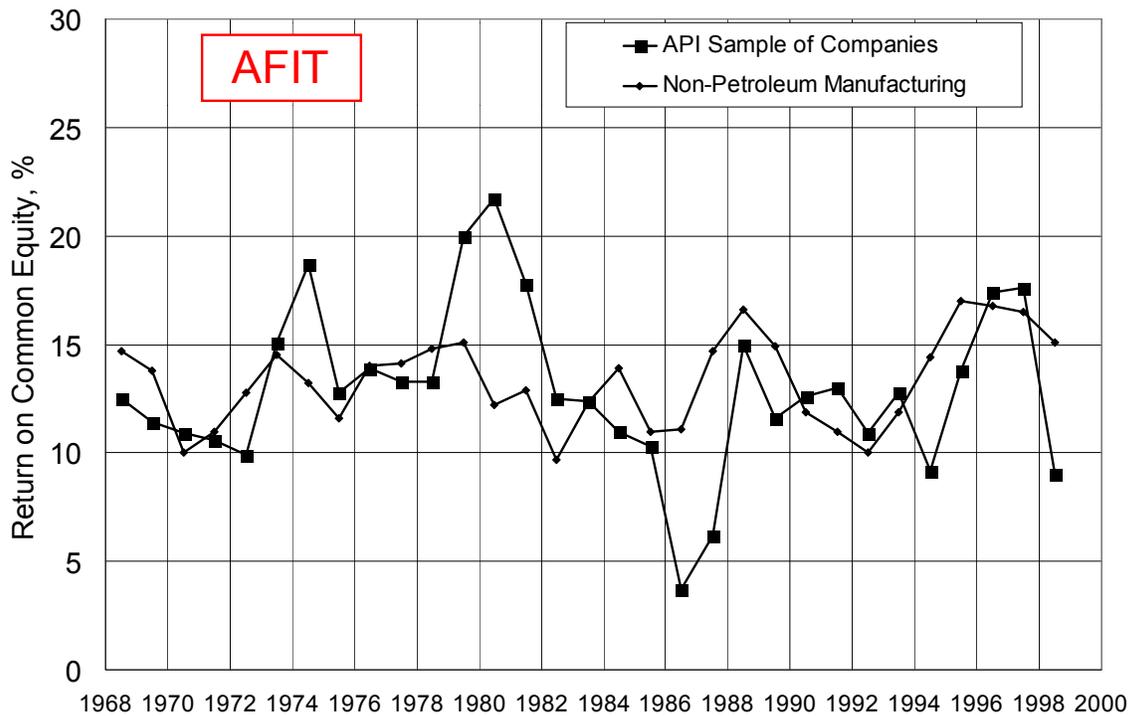
**FIGURE 6: Small Company Stocks: Total Returns**



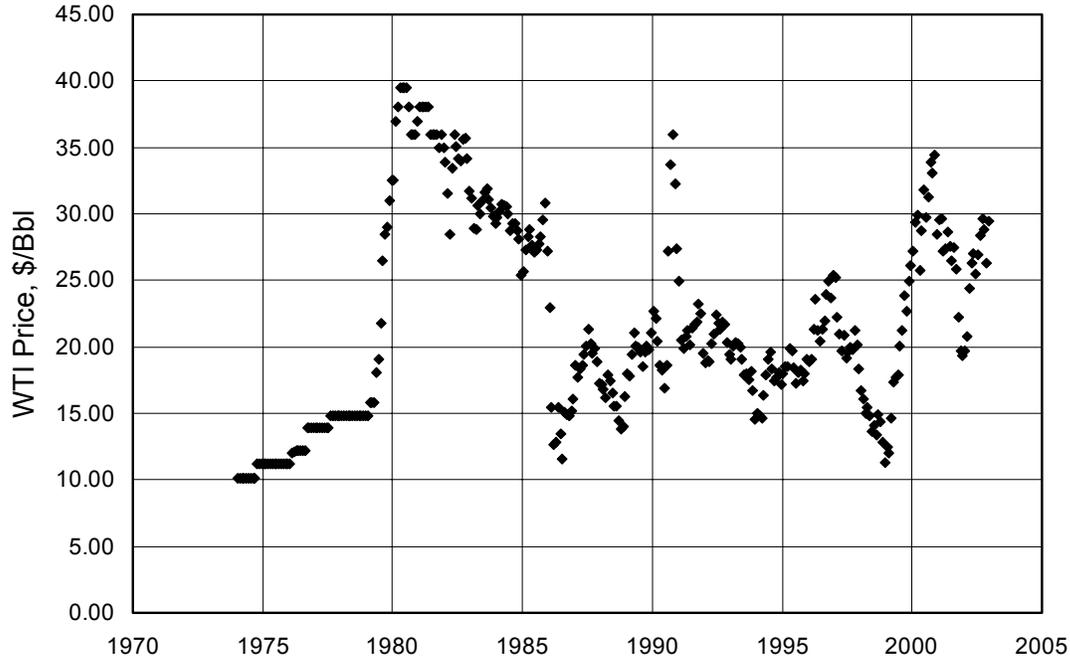
**FIGURE 7: Corporate After Income Tax Return on Book Equity**



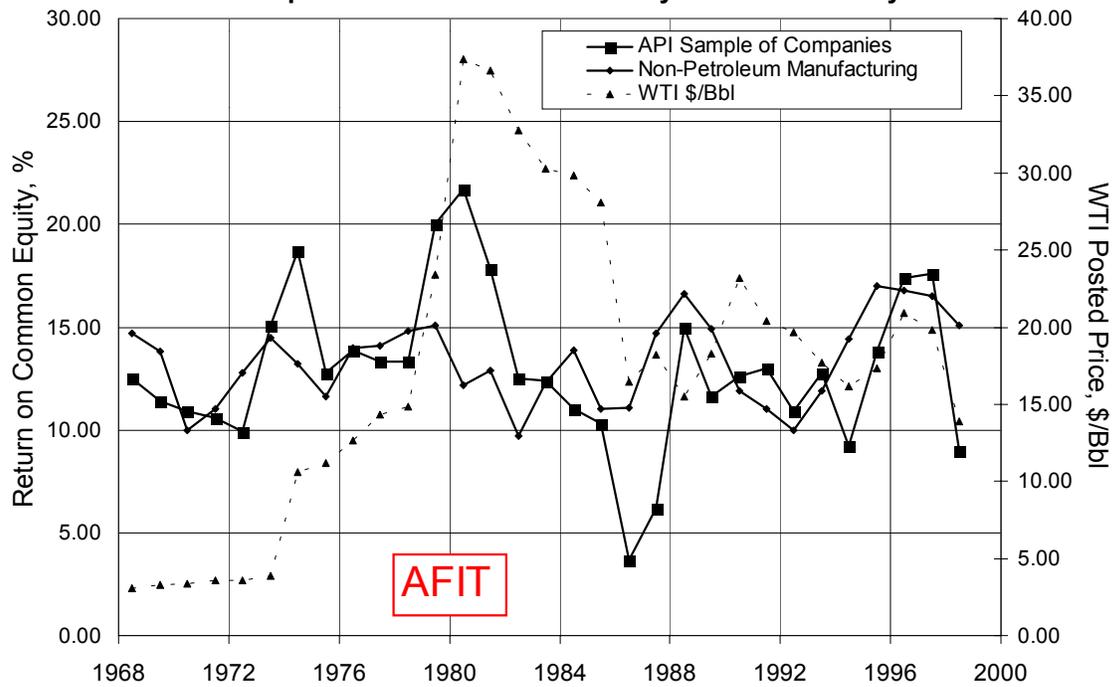
**FIGURE 8: Return on Common Equity  
Comparison of Petroleum Industry to Other Industry**



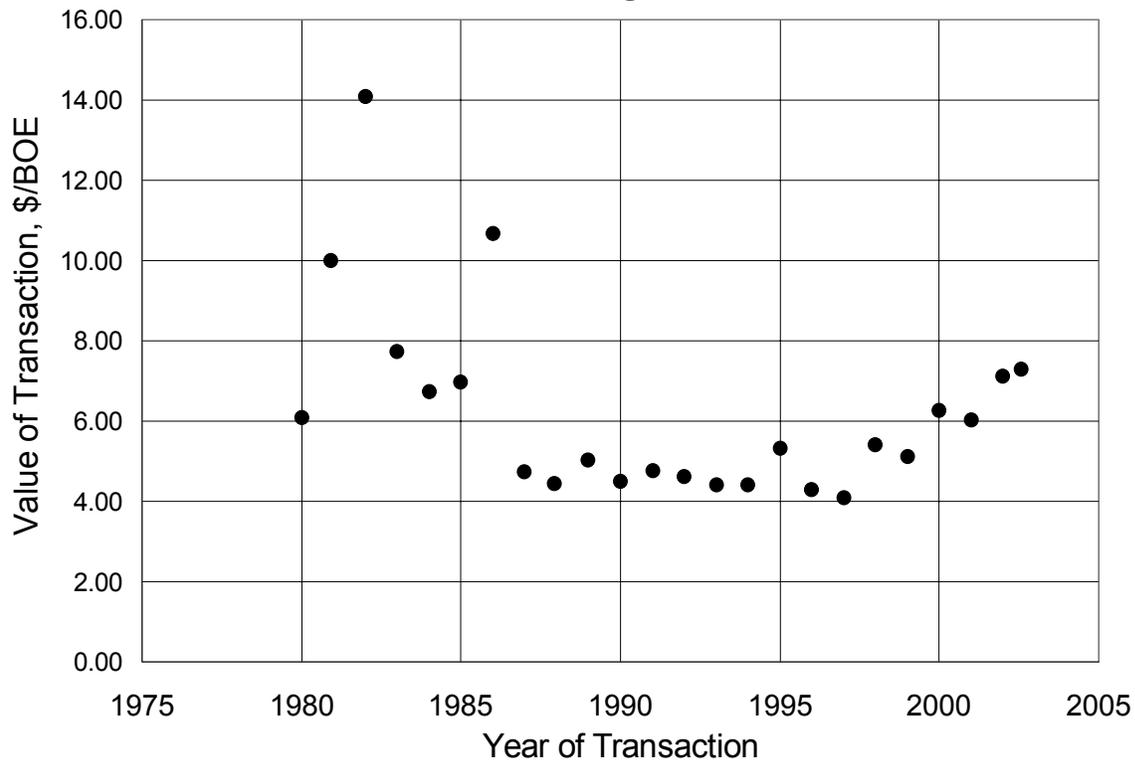
**FIGURE 9: West Texas Intermediate Posted Price**



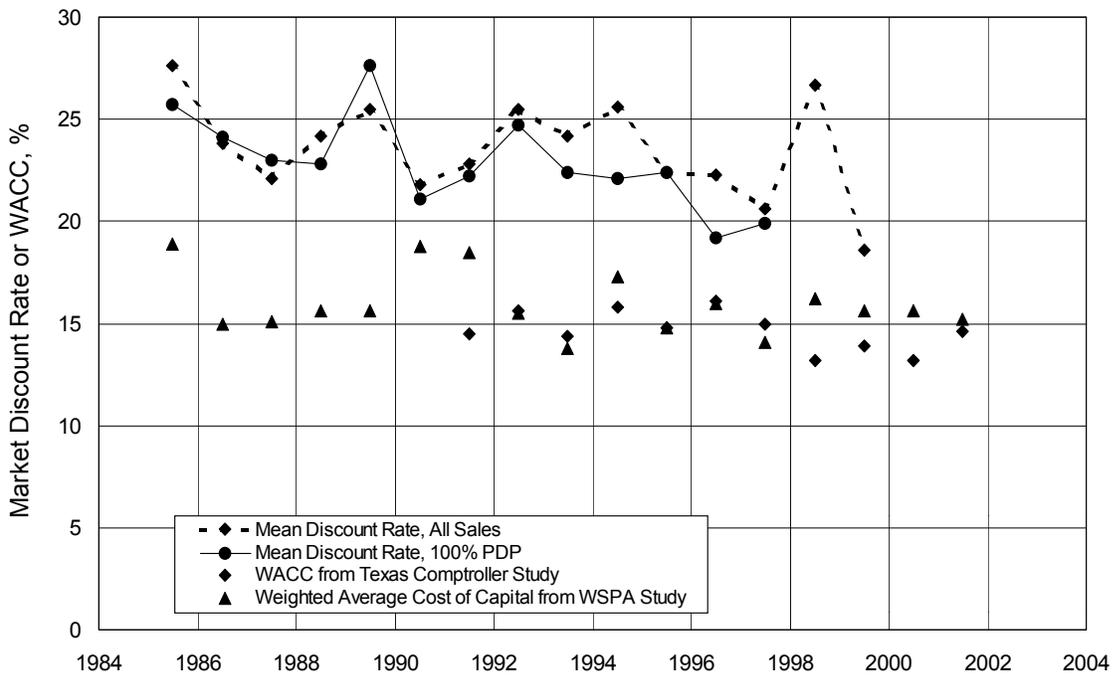
**FIGURE 10: Return on Common Equity  
Comparison of Petroleum Industry to Other Industry**



**FIGURE 11: Annual Average Transaction Value**



**Comparison of Average Annual MarketDerived BFIT Discount Rate and Before Tax Weighted Average Cost of Capital**



**FIGURE 12**