

EXPLORING VALUATION DIFFERENCES IN THE  
UPSTREAM AND MIDSTREAM SECTORS OF  
THE U.S. OIL AND GAS INDUSTRY

by

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## ABSTRACT

This thesis has proven to be one of the biggest challenges I have ever faced. I would not have been able to complete this without the support of my family and friends, as well as, my supervising professor, Dr. Steven Mann and my external department chair Dr. Ken Morgan. I cannot thank you all enough for the commitment to my project and the unconditional support throughout the past year. My love for the U.S. Oil and Gas industry is what drove me to explore this topic and I truly believe I have learned something interesting and hope that the people who read this learn a little more about valuation in this industry. Thanks again to everyone who was involved in my Senior Honors Thesis as I am extremely proud of what I have accomplished.

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## INTRODUCTION

Over the past fifteen years, the United States has experienced an energy renaissance unlike ever before. The discovery of shale oil and gas extraction using hydraulic fracturing and horizontal drilling saved an industry that was in rapid decline. Investment in the U.S. onshore oil and gas industry has brought tremendous opportunities to investment managers, hedge funds, as well as individual investors (Bryan 2012). Drilling wells and producing (Upstream) hydrocarbons is highly capital intensive, but opportunities have also been found in the transportation (Midstream) sector of the industry. The oil industry tends to be very cyclical, a boom and bust kind of business, which requires investors to know the importance of how these companies are valued.

The Upstream and Midstream businesses are very different. Therefore their valuation must differ. Upstream companies depend on commodity price to drive top-line revenue growth. “Investments in Exploration and Production companies are essentially commodity plays. Their market prices are highly correlated to the price expectations of the commodities they sell” (Howard & Harp, 2009). Midstream companies act as a toll road from producers to consumers. Various risk factors affect the valuations of these companies. Commodity price volatility plays a major role in the operations of companies in both parts of the business. The key pricing metrics used to value companies in this industry are Enterprise value/proved reserve quantity, EV/daily production, and EV/EBITDAX (Howard & Harp, 2009).

This paper examines valuation within the upstream and midstream sectors in the U.S. onshore oil and gas industry and why they differ. It will also use a data driven study analyzing the risk associated with each sector through debt analysis before and after the most recent oil crisis. Investors that put their money to work in this industry must recognize the variations in risk

between the two business models and also take into account the valuation methodologies for how their stocks are priced in the open market. When there is an oil price crash in this cyclical industry, it is interesting to analyze what happens to these different businesses and how their valuations are affected.

### LITERATURE REVIEW

The population of the world is expected to increase to 8.3 billion by the year 2030. The world needs more energy each year to power its moving parts. Energy consumption is expected to be 36% greater in 2030 than the year 2011 (Valcic et al., 2013). With the increase in consumption being so substantial, there will need to be a massive increase in energy production. This highlights the importance of the oil and gas (O&G) industry (Valcic et al., 2013).

The oil and gas industry is extremely complex and has many different components to the O&G business. There are three essential streams within the value chain in this business. Upstream is the exploration and production of the natural resource. These are the companies that are prospecting the land using geologists and seismic technology to predict where oil and gas might be trapped in a reservoir beneath the earth. The midstream portion of the business is the transportation of the natural resource from the producers to the refiners. The refiners are the downstream component of the industry which formulates the end product of the oil and gas. Valuation within the energy market has been faced with various complex challenges. The volume of transactions has increased led by record highs in mergers and acquisitions. Commodity price volatility, as well as an increase in the cost of capital, have also provided valuation trouble. “No segment of the energy industry is immune to the new realities of the marketplace or to the complications they impose on valuation” (McNulty, 2014, 1).

The oil and gas industry is constantly under scrutiny and is highly regulated. There are two cultures to the business: the corporate office and the field. The industry provides tremendous opportunity not just for the companies, but also investors. It is extremely important to understand how these companies are valued compared to other industries. “A company is valued for many reasons—to determine its ideal corporate structure, to gauge its appropriate level of capital funding, or to determine its appropriate price when it is part of a merger or acquisition transaction” (Bryan, 2012, 11). Proper valuation is important because it assesses how well the company handles debt, establishes an expected return on investment, and approximates its market value compared to competitors (Bryan 2012).

Valuation can be tricky and challenging in the oil and gas industry. “Valuing a company is sometimes more art than science, and many factors can affect value” (Bryan, 2012, 13). Predicting the future in any industry is extremely challenging and often-times wrong. This sector can be especially hard due to the cyclical boom and bust nature of the business. “A new shale discovery or advancements in production technology can ultimately lead to higher valuations due to optimism about potential future earnings” (Bryan, 2012, 13). The shale revolution has brought massive amounts of capital to the oil and gas sector. This stresses the importance of understanding valuation within this industry. “Individuals and firms often look at many different methods when valuing a company, so they do not rely too heavily on any one method because of the uniqueness of each situation and each company” (Bryan, 2012, 13).

One of the main sectors is the upstream exploration and production business that produces the actual resource. The other main sector is the midstream transportation business which moves the resource from producer to consumer. “Each of the mentioned sectors of the O&G industry has its specificities that affect planning of future costs and revenues, which in turn

influences determining the company's value” (Valcic et al., 2013, 1167). Upstream company valuation differs from other industries and various aspects must be taken into account.

“Exploration and production companies are very capital intensive and rely heavily on their existing reserves, their ability to replace depleting reserves, and the price of natural resources” (Bryan, 2012, 12).

E&P companies rely on commodity price markets to drive their revenue. “They may vary their production and capital expenditures based on current and future price expectations and can hedge their reserves by utilizing the futures market” (Howard & Harp, 2009, 32). When prices fall, this directly affects their revenue and vice versa when prices rise. The midstream sector acts as a toll road for natural resources where producers pay for the transportation. The resource can be transported by pipeline, rail, truck or boat. “The most important differences between these company types arise from the fact that O&G industry is very cyclical and dependent on commodity prices. One of the most frequent characteristics of E&P companies, but often present in other O&G sectors as well, relates to the inability to control revenues” (Valcic et al., 2013, 1167).

The way that these companies are valued depends on their operations. With regards to E&P’s, “Investors will likely want to know the current and estimated future value of a producer’s reserves, which are depleting and subject to commodity price risk” (Bryan, 2012, 12). The main goal of a successful company in this industry is measured by their “ability to replace diminishing reserves with cost-effective new reserves and resources in hopes of sustaining both production and cash flow growth” (Bryan, 2012, 12). Valuators must look “at the company’s operations as well as anticipated future financial performance when compared to the metrics of peers” (Bryan, 2012, 13).



“Business valuation of companies in the oil and gas industry can be described as specific and difficult in many aspects within existing methodology and currently used approaches in appraisal process” (Valcic et al., 2013, 1167). There has to be adjustments in the way that O&G companies are valued due to the above reasons. The valuation of these companies is based on three conventional approaches. They are the Market, Income and Asset approach. The Market approach values companies compared to the competition. The Income approach predicts future cash flows and discounts them back to present day value. The Asset approach bases valuation on the potential of that asset to create revenues.

### MARKET APPROACH

“The primary method we use to value E&P firms is the Market Approach because of the availability of reliable pricing and operating data” (Howard & Harp, 2009, 32). We do not typically use the Income approach because the reserve report is essentially the same thing. The other reason is that it is highly difficult to model corporate level income taxes. The asset approach uses the balance sheet and is marked to market using the reserve report (Howard & Harp 2009).

“Due to the characteristics of processes in cash flow, shortcomings of the most popular Discounted Cash Flow (DCF) method in valuating such companies make this method almost inapplicable, when used exclusively” (Valcic et al., 2013, 1168). The Market approach applies the most common method of comparable company analysis and precedent transactions. However, in the E&P industry there are some adjustments that must be taken into account. Due to some differences in accounting in this industry, cash flows can be more reliable than earnings when looking at valuation decisions (Johnston 1992). However, many do still use earnings

multiples and these have to be altered as well. Instead of comparing earnings before interest, taxes, depreciation and amortization (EBITDA), one must compare proved reserves or daily production. The common metrics must be altered as well. When valuing this industry, it is useful to use EBITDAX (earnings before interest, tax, depreciation and depletion, amortization, and exploration expenses) (Valcic et al., 2013).

When using the Market approach, choosing appropriate guideline companies is very important. Howard & Harp (2009) discusses five main criteria for a company to be chosen as comparable. The first is size. This can be relative size of the market capitalization or reserve volumes. The second is the mix of resources in their reserves. You analyze the percentage of natural gas reserves versus oil reserves. The third is the reserve life. To calculate reserve life, you take proved reserves divided by last or current year production. The fourth criteria is the Proved-undeveloped (PUD) to total proved reserve ratio which indicates how much of the reserve base is generating the EBITDAX. The fifth criteria is based on geographical location. The area/basin that the company is operating is very important when comparing companies.

Once the criteria is satisfied and a comparable company is picked, that's when you start to compare the various metrics. Three of the most popular ways to value companies in this industry is Enterprise value/proved reserve quantities, EV/daily production, or EV/EBITDAX. EBITDAX represents EBITDA before exploration costs. This should be used due to the "frequency of reserve acquisitions and divestitures among the publicly traded E&P companies that could distort valuation indications. Developing forward or current-year metrics often requires a time-consuming review of press releases" (Howard & Harp, 2009, 34).

Another important aspect that should be taken into account when valuing these firms is growth potential. "E&Ps that can find and develop oil and gas assets at lower costs than peers

will be able to grow their reserves bases quicker, boost production, deliver higher cash flow growth and record incrementally higher returns” (Valuation Framework, 2007, 68). The companies with superior growth are assumed to have a higher multiple. Investors should not care where the growth is coming from, but that it will continue on into the future. Whether it is inorganic growth or not should be irrelevant. Investors should be concerned with the increase in debt adjusted production and cash flow (Valuation Framework, 2007).

### INCOME AND ASSET APPROACH

Aside from the market approach which is the main valuation methodology, there is also the Income approach and the Asset Approach. The Income approach attempts to estimate future cash flow that a company expects to generate. One of the main tools used in this approach is the Discounted Cash Flow Model (DCF). “A DCF model starts with determining a company’s free cash flow, which is calculated as earnings before interest and taxes (or  $1 - \text{tax rate}$ ) + depreciation and amortization – increase in working capital – capital expenditures” (Bryan, 2012, 11). Next, the cash flow is projected for a certain period of time, such as 5 years. The cash flow is then discounted back to a present value to account for inflation and risk. The last part is to determine the Terminal value of the company using a multiple and then discount that value back to the present. “ultimately, you want to get a handle on the present value of anticipated future cash flow the company expects to generate as well as market trends for similar companies” (Bryan, 2012, 11).

The goal of the DCF is to find the present value of all of the future cash flows of the company. This is important because a dollar of earnings tomorrow is worth less than a dollar of

earnings today. This also helps show how the company handles debt and how much cash will be available for growth and distribution (Bryan 2012).

The Asset approach is a much simpler form of valuation that is not used as often as the other two. This approach analyzes the fair market value of the company's tangible assets minus their liabilities (Bryan 2012). "The asset approach often generates a value that is less than other methodologies, and it can fail to adequately account for intangible assets" (Bryan, 2012, 11). This objective idea is that a rational investor will pay less than the replacement value of assets (Bryan 2012).

### CASH FLOW

Valuation Framework (2007) says Investors in this industry should care about three things. Cash flow generated per barrel, reinvestment price, and current valuation multiple and what it signifies. If an E&P takes on no additional debt, it will have a fixed amount of reinvestment opportunity from its cash flow per barrel. Their cash flow is typically invested in three ways. They can buy back shares, grow inorganically or organically. "By keeping the reserves to production ratio broadly flat, we can assume that the production growth rate is directly correlated to reserves growth and is therefore driving cash flow growth" (Valuation Framework, 2007, 69).

When analyzing valuation, cash flow based multiples have always been the standard metric. However, with the increase in price to cash flow spread, many have moved to NAV calculations. Regarding the study in Valuation Framework (2007, 71) "The range in results using all the metrics is very wide among the E&P group, and therefore no single measure can be used to justify valuations. In fact, on the basis of P/E's and price-to-cash flow multiples, some of the classic value traps."

Within the E&P industry, companies who have been operating for a while find it hard to maintain their competitive advantage as all of the companies have equal chances to unlock the resources. They end up seeing their stock valuations suffer because of it. This isn't true for all of the companies, but for the industry as a whole the valuations continue to deteriorate after a while (Valuation Framework, 2007).

Quirin, Berry and O'Brien (2000) argue that there are four fundamental variables that need to be taken into account when analysts look at companies. The first is cash flow. "Analysts view discretionary cash flow as an accurate measure of the amount of cash flow actually available for the firm" (Johnston, 1992, 54). The second is production efficiency. A company that produces more efficiently than the competition is able to compete better in the marketplace. The third is stock price appreciation potential. The last of the four is growth. Typically, the analysts will look at reserve and production growth rates (Quirin, Berry and O'Brien, 2000).

### RESERVES

"Market capitalization for large independents is strongly correlated with reserves for oil producers" (Kaiser & Yu, 2012). Oil and natural gas reserves can either be currently producing or nonproducing. Reserves that are producing generate EITDAX as discussed earlier. This is similar to EBITDA, but exploration costs are neutralized. Nonproducing reserves are not generating EBITDAX, however, they are expected to generate future cash flow eventually (Bryan 2012). "When valuing an E&P company, it is important to get an idea about the estimated life of its proven reserves as well as estimates regarding nonproducing reserves" (Bryan, 2012, 13).

As discussed earlier, the multiple EV/EBITDAX is the common metric to value an oil and gas firm. This allows for market participants to be compared to each other through comparable company's analysis. Bryan (2012) mentions other metrics used to value companies such as Net Asset Value and barrels produced per day. The Hottelling Valuation Principle (HVP) is another way to analyze valuation. "HVP suggests that the value of reserves in any mineral property depends solely on the current price of the mineral net of extraction costs" (Crain & Jamal, 1991, 755).

An example of how comparable company data is "if you were to analyze a set of 10 comparable companies and the current EV/EBITDAX multiples for the set range from 2.25x to 2.75x, you can establish a range as a starting point to determine the subject company's value" (Bryan, 2012, 13).

### CHALLENGES

Recently, the price of oil and gas has decreased significantly. "Oil has already sunk this year to its lowest level since 2004. Executives think it will be years before oil returns to \$90 or \$100 a barrel, a price that was pretty much the norm over the last decade" (Krauss 2016). The price is seemingly unpredictable in the current marketplace. The 100 largest US Oil companies ranked volatile oil prices as the number one risk factor (Weinman 2011). Mergers and acquisitions have peaked in recent years, but the commodity price assumptions that were used when valuing deals are likely much different than the current market (McNulty 2014). This shows how difficult it is to fairly value these companies in the energy industry.

McNulty (2014) goes on to list the main challenges when dealing with valuation in this sector. The first is synergies. When large volumes of goodwill are reported on balance sheets for

these companies, synergies are the justification for the entry. However, this industry is extremely technical with many advancement in technology, so it is harder to claim synergies. “For example, because technology solutions commonly diminish the number of professionals required for workflow, traditional synergies caused by human capital redundancies are becoming harder to support in an acquisition”(McNulty, 2014, 2).

The next challenge regarding valuation is the cost of capital. Following the financial crisis in 2008-2009, the government helped aid businesses with low capital costs due to their quantitative easing program. They were essentially pumping money into the system to keep interest rates near zero. However, this program has come to an end and the Federal Reserve is expected to raise rates in the very near future. Rising interest rates mean lower present values for new transactions. This will also directly affect impairment testing. The rise in capital costs will have a major effect on how these companies are valued (McNulty 2014).

Another key challenge deals with market participants. In fair value work, one of the most critical assumptions is determining the most appropriate market participants. These participants not only affect the comparable company’s analysis method of valuation, but also the discounted cash flow or income models of valuation. The main factors that must be taken into account are the geography, size, operator vs. non-operator status, hedging strategies, and proved vs. unproved reserves (McNulty 2014).

Next, one must take into account intangible assets which include far more than goodwill. An example of an intangible asset would be brand names or patents. “Due to the physical nature of the Oil & Gas business, intangibles are often analyzed improperly or given inadequate attention in the deal process” (McNulty, 2014, 3). Most of the time, intellectual capital is undervalued in a transactions. Goodwill does not amortize, therefore it remains on the left side of

the balance sheet. This results in the company needing capital on the right side to support the goodwill and other tangibles (McNulty 2014).

Valuation can also be affected by depletion calculations and taxation. Calculating depletion can be difficult due to the complexity of the internal revenue code and involves predictions. Each company has their own tax position where depletion plays a major role in determining cash taxes. This is often oversimplified when valuing these companies (McNulty 2014).

Valuators often face challenges when analyzing the risk of reserves. “Most reserve reports are “black boxes,” from the perspective of valuers, and it is sometimes difficult to discern the key inputs used since reserve reports are comprised of the output data from very large and complex simulation models” (McNulty, 2014, 3). The goal when analyzing financial reports with reserve reports is to avoid double counting. The reserve reports are modeled out like discounted cash flow models. They are valued by taking the mean of hundreds and thousands of scenarios. “Additional risking by a financial valuator has to be carried out carefully so as not to artificially depress a valuation that has already incorporated significant risking” (McNulty, 2014, 3).

Commodity prices play a major role when valuing in this industry because companies sell their oil and gas at the market price which drives its’ top line revenue. They are hard to forecast and are extremely volatile. “Price volatility is inherent to the nature of the commodity and consistent with conditions that affect the industry cyclically” (McNulty, 2014, 4). In order to handle this challenge, valuers use a forward pricing curve which is calculated using forward prices in the reserve report. “In many ways, commodity prices play the central role in all Oil &



Gas valuations, but are often not rigorously analyzed or challenged by valuation professionals” (McNulty, 2014, 3).

The last challenge valuers face involves hedging. Hedging is a common strategy used by oil and gas companies in order to limit their commodity price risk. In order to value a company, hedging analysis must be done at the valuation date. There is also a need for “analysis of their impact on value beyond amounts stated on the balance sheet at the time of the deal” (McNulty, 2014, 3).

All of these challenges make valuation in this industry complex and difficult. Volatility in this industry makes it a unique opportunity to invest. “Throughout volatile periods as well as times of stable pricing and steady growth, the Oil & Gas companies that make wise and well-informed valuation choices will be best equipped to minimize risk, exceed regulatory requirements, and reinforce value for shareholders” (McNulty, 2014, 4). Investors must be aware of these challenges and should educate themselves on the different risk factors involved in the oil and gas industry.

### MASTER LIMITED PARTNERSHIPS

Master Limited Partnerships (MLP) are publicly traded partnerships that are taxed differently than public corporations. “MLPs have become attractive structures to hold midstream assets, including pipelines, gathering systems, processing and fractionation facilities, storage facilities, and marine transportation assets” (Maresca, Kad, Sheikh, Lasky, 2013, 3).

In order to be taxed as an MLP, the company must satisfy the requirements to operate as one. “In 2008, Congress expanded the “qualifying income” definition for the first time since 1987. Now, assets relating to biofuels, biodiesel, ethanol, methanol, liquefied petroleum gas, and

even industrial-sourced carbon dioxide may qualify for MLP structuring” (Schulte, 2012, 1). This allowed for the midstream oil and gas sector to take advantage of the taxation rules for MLP’s.

After looking at the Exploration and Production side of the O&G industry, next is to move down the value stream to midstream industry. The midstream industry consists of a number of Master Limited Partnerships. “MLPs now own significant assets in the midstream oil and gas industry, and a number of midstream oil and gas corporations have yet to transfer permitted assets into more tax-efficient MLP structures and as a result have been mentioned as possible takeover targets” (Schulte, 2012, 1). Understanding how MLP’s are valued is very important to comprehend when analyzing key differences from the upstream sector. MLP’s are focused on the key value proposition of total return: growing cash flow yield + stock price appreciation. (Maresca et al., 2013, 53) believes to “treat them as true growth vehicles, rather than a fixed income substitute, as yield-based analysis has historically implied. More specifically, valuing MLPs based solely upon relative yield or yield estimates ignore the total return nature of MLPs.”

MLP’s tend to generate returns through income distributions and through capital appreciation. They also place an emphasis on long term cash flow stability. This will drive the stock value due to the fact that investors will pay for the models that are the most stable (Maresca et al., 2013). Another way to analyze valuation for MLP’s is through dividend yield comparison. Historically, investors have viewed MLP’s as income distributions in order to make an investment decision. However, it is argued that “a higher relative dividend yield characterizes companies believed to be riskier; a lower dividend yield can suggest growth in the company as the higher stock prices reflects the expected future growth” (Maresca et al., 2013, 53).

When analyzing the dividend yield, it will give relative insights to the value of the MLP, but it remains incomplete when viewing the overall valuation. “Ultimately this relative measures remains incomplete as it may omit both industry and idiosyncratic factors that can misconstrue the valuation conclusion” (Maresca et al., 2013, 53).

Morgan Stanley (2013) believes that the regular multiples of Enterprise Value/EBITDA and Price/Earnings are a good way to gauge the valuation of the MLP’s. This shows the difference between the discussions earlier regarding upstream company valuation. The MLP industry doesn’t have to take into account exploration costs, therefore, there is no need to use EBITDAX. “We looked at how EV/EBITDA, P/DCF, dividend yield, and the 10yr treasury spread correlated with stock returns over the last 5 years. We found that dividend yield was the “best predictor” on an R-squared basis” (Maresca et al., 2013, 54)

They were able to conclude by finding multiples for each stock that were averaged to obtain a theoretical group. They found these multiples using forward-looking metrics. “Finally, we ran a regression against the average six-month forward stock returns to determine which multiple is “best” at predicting stock returns” (Maresca et al., 2013, 54). They concluded that the base of value on MLP’s is just like any other industry outside of the O&G business. The value is the risk of the future cash flows that the investor will receive.

Overall, MLP’s can be difficult to value. “The issue for MLP management is how to obtain, for a reasonable cost, a valuation that accurately reflects the current value of the assets, maximizes the tax benefits for all unitholders, and withstands IRS scrutiny” (Schulte, 2012, 4). One solution is for the management team of the MLP to work alongside with a third-party valuation expert that periodically updates the asset values that they own. Schulte (2012, 4) also believes that “such periodic updates can be further supported and substantiated by the

completion of a full independent appraisal on a regular basis (such as annual or biennial, or other periods).”

### CAPITAL STRUCTURE

“The capital structure of a company refers to the combination of securities employed (debt and equity) to raise and maintain the capital assets required to conduct business” (Kaiser & Yu, 2012).

“Considerable variation exists in the capital structure of oil and gas companies and their D/E ratio” (Kaiser & Yu, 2012).

“A high debt ratio signifies a high risk for payment problems which can impede business growth and lead to liquidation. High indebtedness may prevent a company from obtaining additional financing to fund future working capital, capital expenditures, acquisitions, or other general corporate requirements” (Kaiser & Yu, 2012).

### METHODS AND RESULTS

Now that we have analyzed how these companies are typically valued and the various challenges that arise during valuation, this paper will now explain the methods and results that were reached in the following tests. The experimental tests were run using data from the Bloomberg Terminals that supply current and historical market data for the Market Capitalizations, Bond Yields, Betas, and Total Debt to Equity. The methods are as follows:

The idea is to examine the data regarding two separate time periods. The first being a pre-crisis date of December 31<sup>st</sup>, 2013. The second being the current time period of March 1<sup>st</sup>, 2016. These two time periods were selected in order to understand what happened to the data when oil

prices began to fall in 2014. It is interesting to view the numbers before and after a crisis to get a sense of how each sector reacts when things go badly and prices crash.

Eight companies were selected in the upstream sector, and eight companies were selected in the midstream sector. They were chosen based on their operations of being a pure play company within their respective sectors. The Upstream companies only operate in the E&P space and the Midstream companies only operate in the transportation space. There is no overlap with these companies because the goal is to see how each sector will be effected and then compare the numbers. These are also the ten largest by Market Capitalization. The list is in the following table collected from the Bloomberg Terminal:

NAME	TICKER	CURRENT MARKET CAP
<b>Upstream</b>		
EOG RESOURCES INC	EOG	\$ 36,880,678,967
PIONEER NATURAL RESOURCES CO	PXD	\$ 21,402,606,796
ANADARKO PETROLEUM CORP	APC	\$ 21,689,992,681
APACHE CORP	APA	\$ 15,860,134,594
HESS CORP	HES	\$ 14,781,617,620
NOBLE ENERGY INC	NBL	\$ 13,302,725,215
CONCHO RESOURCES INC	CXO	\$ 12,510,209,956
DEVON ENERGY CORP	DVN	\$ 10,981,528,709
<b>Midstream</b>		
ENTERPRISE PRODUCTS PARTNERS	EPD	\$ 47,964,578,679
KINDER MORGAN INC	KMI	\$ 41,573,887,833
TRANSCANADA CORP	TRP	\$ 25,585,779,714
SPECTRA ENERGY CORP	SE	\$ 20,091,288,078
MAGELLAN MIDSTREAM PARTNERS	MMP	\$ 15,858,115,517
PLAINS ALL AMER PIPELINE LP	PAA	\$ 8,654,626,364
ENERGY TRANSFER EQUITY LP	ETE	\$ 7,553,821,990
ONEOK INC	OKE	\$ 5,371,536,807

The following Data tables show the Current 2016 and the December 31<sup>st</sup>, 2013 data for the upstream and midstream sectors. The data collected consisted of Total Debt, Total Equity,

Debt to Equity Ratio, and the Betas for each of the eight companies in each space. This gives us a good idea as to what these company's cap structures are at the specific dates selected and indicates their relative risk to the market.

## UPSTREAM

Current 2016					December 31st, 2013			
TICKER	TOTAL DEBT	TOTAL EQUITY	DEBT TO EQUITY	BETA	TOTAL DEBT	TOTAL EQUITY	DEBT TO EQUITY	BETA
EOG	\$ 6,660	\$ 12,943	51.46	1.195	\$ 5,913	\$ 15,418	38.35	0.928
PXD	\$ 3,655	\$ 8,375	43.64	1.119	\$ 2,653	\$ 6,615	40.11	1.095
APC	\$ 15,751	\$ 15,457	101.90	1.551	\$ 13,565	\$ 23,650	57.36	0.979
APA	\$ 8,777	\$ 4,228	207.59	1.405	\$ 9,725	\$ 35,393	27.48	0.954
HES	\$ 6,630	\$ 20,401	32.50	1.445	\$ 5,798	\$ 24,784	23.39	0.984
NBL	\$ 8,134	\$ 10,370	78.44	1.463	\$ 4,824	\$ 9,184	52.53	0.974
CXO	\$ 3,332	\$ 6,943	48.00	1.298	\$ 3,667	\$ 3,757	97.58	1.264
DVN	\$ 13,113	\$ 10,989	119.33	1.553	\$ 12,022	\$ 20,499	58.65	0.844

## MIDSTREAM

Current 2016					December 31st, 2013			
TICKER	TOTAL DEBT	TOTAL EQUITY	DEBT TO EQUITY	BETA	TOTAL DEBT	TOTAL EQUITY	DEBT TO EQUITY	BETA
EPD	\$ 22,691	\$ 20,501	110.68	1.051	\$ 17,351	\$ 15,440	112.38	0.748
KMI	\$ 41,453	\$ 35,403	117.09	1.233	\$ 36,193	\$ 28,285	127.96	0.711
TRP	\$ 35,224	\$ 18,155	194.02	1.041	\$ 25,770	\$ 20,136	127.98	0.662
SE	\$ 14,656	\$ 9,871	148.48	0.974	\$ 14,717	\$ 10,581	139.09	1.002
MMP	\$ 3,440	\$ 2,022	170.13	0.963	\$ 2,685	\$ 1,647	163	0.834
PAA	\$ 11,374	\$ 7,939	143.27	1.159	\$ 7,828	\$ 7,703	101.62	0.725
ETE	\$ 36,837	\$ 23,646	155.79	1.689	\$ 23,199	\$ 16,311	142.23	0.908
OKE	\$ 8,981	\$ 3,766	238.44	1.519	\$ 8,330	\$ 4,845	171.93	0.782

We can see from the data that there are some obvious shifts in leverage and risk when oil prices collapse. The next Data that was pulled from Bloomberg was the changes in their ten year bond yields. Bonds were selected from each time periods and the yields were analyzed to indicate their change in risk. The average yields were also calculated.

10 yr bond	2014	Current	Change
EOG	2.55	2.955	0.405
PXD	1.65	3.032	1.382
APC	2.469	4.11	1.641
APA	1.975	3.64	1.665
HES	2.36	4.24	1.88
NBL	2.54	4.765	2.225
CXO	4.77	5.83	1.06
DVN	2.379	5.697	3.318
		<b>AVG YIELD</b>	<b>1.697</b>

10 yr bond	2014	Current	Change
EPD	2.93	3.8	0.87
KMI	1.55	2.73	1.18
TRP	1.76	1.464	-0.296
SE	2.29	3.62	1.33
MMP	2.637	2.949	0.312
PAA	2.752	4.305	1.553
ETE	4.799	8.86	4.061
OKE	4.731	7.67	2.939
		<b>AVG YIELD</b>	<b>1.494</b>

The above data was then condensed into a summary table to analyze the changes in Yields, Betas, and Debt to Equity to show how much the price drop affected these measures. The changes for each sector are hard to analyze with the naked eye and the most effective way to determine if there is a correlation in the data is to analyze a T-Statistic to see if there is a significant statistical difference between the two sets of Data. The T-Statistic is used by taking the two sets of data (Change column) in a two tailed distribution to find a value that will indicate if there is a significant difference between the two sets of Data. After taking the T-statistic, a P-value is then calculated using that t distribution. In this case we selected a t-value of 2 or greater to indicate significant change, as well as, a P-value of 10% as a threshold to indicate significant change.

Upstream	Ticker	Δ Bond Yield	Δ BETA	Δ Debt/Equity
	EOG	0.405	0.267	13.108
	PXD	1.382	0.024	3.532
	APC	1.641	0.572	44.542
	APA	1.665	0.451	180.112
	HES	1.880	0.461	9.108
	NBL	2.225	0.489	25.908
	CXO	1.060	0.034	-49.583
	DVN	3.318	0.709	60.678
<b>AVERAGE</b>	1.697	0.376	35.926	
Midstream	Ticker	Δ Bond Yield	Δ BETA	Δ Debt/Equity
	EPD	0.870	0.303	-1.700
	KMI	1.180	0.522	-10.871
	TRP	-0.296	0.379	66.038
	SE	1.330	-0.028	9.385
	MMP	0.312	0.129	7.132
	PAA	1.553	0.434	41.647
	ETE	4.061	0.781	13.555
	OKE	2.939	0.737	66.513
<b>AVERAGE</b>	1.494	0.407	23.963	

Next we will look at three different hypotheses to test if there is significant statistical differences in the upstream and midstream sectors with regards to bond yields, market risk, and capital structure.

**HYPOTHESIS 1:**

**Null:** There is no significant difference between the changes in bond yields.

**Alternate:** There is significant difference between the changes in bond yields.

The results from the T-test:

Comparison	
t-Test	0.733
P Value	0.474
Upstream	
t-Test	5.613
P Value	0.001
Midstream	
t-Test	3.009
P Value	0.020

When compared to each other, we can see the resulting t-stat of 0.733 and a p-value of 0.474. The Upstream and Midstream boxes were run against a value of zero to indicate that there was a significant change that they both occurred. This is proven by the data with their t-stat being greater than 2 and a p-value less than our 10% threshold. However, when you look at the comparison box we can see that 0.733 is less than 2 and 0.474 is greater than .10 indicating there is no significant difference between the upstream and midstream bond yield changes. We would then FAIL TO REJECT THE NULL HYPOTHESIS.

**HYPOTHESIS 2:**

**Null:** There is no significant difference between the changes in beta.

**Alternate:** There is significant difference between the changes in beta.



Results from the T-test:

Comparison	
t-Test	0.816
P Value	0.426
Upstream	
t-Test	4.300
P Value	0.004
Midstream	
t-Test	4.143
P Value	0.004

When compared to each other, the upstream and midstream changes in Beta do not reflect a statistical significant difference. The T-stat of 0.816 is less than 2 and the P-value of 0.426 is greater than the 0.10 threshold. Again, this indicates that there is no significant difference and we would FAIL TO REJECT THE NULL HYPOTHESIS.

HYPOTHESIS 3:

**Null:** There is no significant difference between the changes in Debt/Equity.

**Alternate:** There is significant difference between the changes in Debt/Equity.

Results from the T-test:

Comparison	
t-Test	0.654
P Value	0.522
Upstream	
t-Test	1.523
P Value	0.172
Midstream	
t-Test	2.247
P Value	0.059

Yet again, we see no significant difference between the two data sets after running the T-test. The t-stat of 0.654 is less than 2 and the p-value of 0.522 is greater than 0.10. After calculating this data we will FAIL TO REJECT THE NULL HYPOTHESIS.

## DISCUSSION

After analyzing each hypothesis, it has been concluded that there is no statistical significant difference between the upstream and midstream sectors with regards to their change in bond yields, betas, and debt/equity. The t-test provided us with the answer that these companies don't really differ when oil price collapses. We saw increases in bond yields and betas, as well as, changes in capital structures that were similar. It is strange to find that even though they have different business models, they react similarly when times get bad in the industry.

The true question is why do these companies respond the same way? Upstream companies rely on oil prices to drive their revenue. Midstream companies have contracts and essentially act as a toll road. Two separate business models that make money in different ways, however they may not be so different after all. This anomaly could be further researched in order to find out why this occurs. Investors should be aware that when times get bad, it is not just the E&P's who suffer. One could look further into the downstream sector as well and see how it reacts. This study excluded the major integrated oil companies like Exxon Mobile who do it all. It could be interesting to continue to look at those companies as well.

There were many limitations to this study where the data could be somewhat sparse, but Bloomberg only provides a certain amount of data. Time is also a limitation that cannot be ignored. If the study were to expand and analyze every company in each sector as well as the downstream and integrated oil companies, then the limitation of data could be ignored. These companies are the largest and seem like a representative group, but the more data that could be collected would be better.

The next steps to this project would be to add more data and analyze valuations before and after other oil price crash time periods. I think it would be interesting to look at the history of other crashes and see if these companies acted the same way. This can seem strange that they act similarly during bad times. It might also be interesting to look at how quickly their measures recover when oil goes back up. There are many different studies that could go along with this topic, but I think more data and more tests would make this an overall better study.

### IMPLICATIONS

The relevance of this study pertains to investors who are interested in learning more about the industry as a whole. The oil and gas business is cyclical in nature due to supply and demand. Therefore, it is relevant to those who want to understand how these two sectors are affected when the downfall of oil and gas prices hit.

Industry professionals, investment professionals, and aspiring oil-men can use the information in this study as a way to think about how the operations within the two sectors are different, yet sometimes the outcome is the same for both. They can question why this is happening and how it could be avoided. It would also be interested to analyze if these certain companies hedge the price of oil for downside risk.

I think it would be valuable for these midstream companies to analyze why their valuations are dropping alongside the upstream even though they don't rely on oil price for revenue. The business models are different and they operate separately, but the data shows that they might not be so different. I think some good advice would be to dig deeper into these issues and find out why this occurs. Looking at historical data could be effective as well.

## CONCLUSION

The oil and gas business is cyclical in nature and has always been important to the U.S. economy. The world needs energy to power itself and this industry has serviced that need for a very long time. As the population continues to expand and the demand for energy continues to increase, the U.S. will remain a dominant power in the energy market as we push towards energy independence.

The Energy renaissance that we have been experiencing in the last decade has brought a tremendous amount of wealth to entrepreneurs and investors. However over the past two years we have seen oil and gas prices come tumbling down and sending the industry into a tailspin. This brings my question to the forefront of how the various sectors within the oil and gas industry are affected valuation-wise. The upstream sector is the producers who drill for the oil and make their money based off of the price of oil in the market. The midstream sector are the transporters of the oil who make their money based off of a contract price with the other companies.

This thesis tested the valuation changes before and after the oil price collapse within the upstream and midstream sectors in the oil and gas industry. The following measure were tested using statistical analysis: 10 Year Bond Yields, Beta, and Debt/Equity. T-statistics and p values were calculated in comparison to evaluate if there was a significant statistical difference in the two data sets of the changes from pre-crisis to current data.

The bond yield data showed that there were significant changes in both the upstream and midstream sectors, however, there was no significant difference between the two when compared. This was the same result for the changes in beta and debt/equity. In all three tests we failed to reject the null hypothesis indicating there is no difference in the data sets.

This was interesting to find out because of the different business models and operations of the two sectors. This begs the question why do these sectors react similarly? Are midstream companies entering bad contracts? Or, are they building infrastructure at the wrong time? I think further research is required to answer these questions. The data set is too small for the ultimate goal and I think that expanding the lists of companies and looking at historical data could be efficient in supporting this thesis. Limitations of good data and time have also been a concern.

The results were interesting in finding no significant difference in either of the three tests. Bond yields, betas, and debt to equity ratios might have shifted a substantial amount, but when compared to each sector there was nothing that indicates a major difference. Midstream companies should look more closely at this fact because one might think that E&P's would be hurt more from a price collapse due to their reliance on the price of the commodity.

Overall, this has been an interesting topic with some results that require further research. I think the findings were sufficient and raise more questions about this industry. Oil and gas should continue to play an important role in society for some time. History predicts that eventually there will be a rebound in price and then another collapse. This study can be seen as relevant to those companies in the midstream sector that don't rely on commodity price to figure out why their risk and financial stability falters when times get bad in the oil patch. It is my hope that this industry continues to adapt to the changing times and hopefully the next price collapse won't be as detrimental to these companies.

## References

- Brlecic Valcic, S.; Crnkovic-Stumpf, B.; Katunar, J., (2013) Business valuation in oil&Gas industry: New challenges. *Information & Communication Technology Electronics & Microelectronics*, 1167-1172.
- Bryan, Robert. (2012). Company Valuation: Oil and Gas vs. other Sectors. *Gulfstar Group Economist Corner*. 8, (3), 11-13.
- Crain, John L., & Jamal, A. M. M. (1991). The Valuation of Natural Resources: Evidence from Oil and Gas Pure Plays. *Journal of Business Finance and Accounting*, 18, 755-761.
- Howard, A.W., Harp, A.B. (2009). Oil and Gas Company Valuations. *Business Valuation Review*, 28 (1), 30-35.
- Johnston, D. (1992), Oil Company Financial Analysis in Non-Technical Analysis. *Tulsa, OK: Penwell Publishing*.
- Kaiser, M. J., & Yu, Y. (2012, February 1). Part 1: Oil and gas company valuation, reserves, and production. Retrieved from <http://www.ogfj.com>
- Kaiser, M. J., & Yu, Y. (2012, March 1). Part 2: Oil and gas company valuation, reserves, and production. Retrieved from <http://www.ogfj.com>
- Krauss, Clifford. (2016, February 16). Oil Prices: What's behind the drop? Simple Economics. The New York Times. Retrieved from <http://www.nytimes.com>
- Maresca, Stephen, J., Kad, Robert S., Sheikh, Shaan, Lasky, Brian. (2013) Morgan Stanley Midstream Energy MLP Primer. *Morgan Stanley Research*, 53-55.
- McNulty, Thomas. (2014). Valuation Issues in the Oil and Gas Industry. *Navigant Consulting*. Retrieved from [www.Navigant.com](http://www.Navigant.com).

Moore, C. R. K. (2009). Perspectives on the valuation of upstream oil and gas interests. An Overview. *Journal of World Energy, Law and Business*. Vol 2, 1. 24-42

Quirin, J. J., Berry, K. T. and O'Brien, D. (2000), A Fundamental Analysis Approach to Oil and Gas Firm Valuation. *Journal of Business Finance & Accounting*, 27: 785–820.

Schulte, Robert. (2012). MLP Asset Valuations. *Midstream Business*, May 2012 issue, 1-4.

Valuation Framework. (2007). Black Book - Cost-o-philia in the Oil Patch, 68-76.

Weinman, E. (2011, May 24). Volatile Oil and Gas Prices are #1 Risk to U.S. E&P Industry, According to BDO USA Report. Retrieved from <http://www.businesswire.com>