5-2016

Financial Performance in Upstream, Downstream, and Integrated Oil Companies in Response to Oil Price Volatility

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FINANCIAL PERFORMANCE IN UPSTREAM, DOWNSTREAM, AND INTEGRATED OIL COMPANIES IN RESPONSE TO OIL PRICE VOLATILITY

GRADUATION THESIS

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May 2016.

Executive Summary

This paper investigates the relation between crude oil price volatility and stock returns among oil companies using a three-part methodology, by using the West Texas Intermediate (WTI) as oil price benchmark. I asses the various indicators that set signals for oil price volatility and the interpretation of each (PMI, S&P500, DJIA, and World Crude Oil Output). This research also focuses on the relation between different types of companies in the oil industry (integrated, upstream, and downstream) and how each type of company will be assessed in a particular way to predict abnormal returns, based on market data and statistical analyses results and interpretation.

1. Introduction

An investor's objective will always be to maximize risk-adjusted return in a manner consistent with their goals, time horizon, risk tolerance, liquidity needs, and tax status. Taking that premise as a starting point to formulate an effective strategy, you should be weary of over-investing in the oil industry owing to the high commodity price volatility and thus risk that has been associated with this industry over time. However, it would make sense for each investor to include some portion of their portfolio in assets closely linked to the industry in order to maintain diversification in their portfolios, and thus to reduce overall portfolio risk. The price of crude oil has been broadly analyzed, but factors that affect crude and related markets over time remain somewhat mysterious.

In this paper, I investigate the relation between crude oil price volatility and stock returns among oil companies using a three-part methodology. First, I measure crude oil price volatility, using West Texas Intermediate (WTI) as the most appropriate U.S. oil price benchmark, versus different indicators that will set signals for periods of price reversals and high volatility (PMI, S&P500, DJIA, and World Crude Oil Output). Second, I assess how oil company financial performance is related to crude oil price volatility, including differences between upstream, downstream, and integrated oil companies. Third, I assess how oil price volatility is related to the total returns of different types of oil companies. I report univariate summary statistics, bivariate correlation analysis, and multivariate regression results.

Many direct and indirect factors determine oil prices and volatility. These factors include intra-industry (production and consumption, operational costs, logistics and transportation, etc.) variables that directly affect oil prices, and external (political affairs, currency strength, economic growth, etc.) variables whose effect is indirect. Given that many factors are in play, it is difficult to predict how oil prices will fluctuate during a given period of time. This means that as an investor, one will need an "optimal" analysis of the market to prepare a healthy portfolio with a strong risk-adjusted return on investment.

There are three major findings in this paper. First, it proves the validity of trend signals for oil price movements, and that these relations follow a particular fashion depending on the type of analysis being made. Second, it demonstrates the action-reaction movements that exist between crude oil prices and integrated, upstream, and downstream companies. Third, it finds the most statistically significant variables to be considered as effective indicators for oil stocks performance.

With this research I expect to find different market signals that will give investors a real and optimal methodology that can serve as a guide on how to allocate their investments

during a certain period of time, considering historical trends on the market. Since there are many direct and indirect factors that play an important role into defining the price for which oil is traded in the market, this paper will not try to predict future prices or forecast for great volatility periods, but instead will try to prove that the market itself has the same trends characteristics and these trends are fractal as explained in Kirkpatrick & Dahlquist "Technical Analysis" book (2007).

This paper makes three contributions to the literature on the determinants of oil company performance. First, it gives a trend analysis methodology that serves as a first indicator of both oil prices, and oil company's stock return levels. Second, it provides a guide on understanding the oil industry and its different reactions to crude oil volatility. Finally, this paper demonstrates the timely movements and the significance of these fluctuations on oil stock returns. With this paper I expect to give the reader a clear explanation of the relation between oil price volatility and the financial and stock return performance of different types of oil companies during different time periods. I also anticipate highlighting findings that suggest signals to look for when interpreting data or searching for relevant variables for predicting investment performance.

The rest of the paper proceeds as follows. Section II describes the relevant literature and test the proposed hypothesis. Section III discusses sample selection and methodology. In Section IV I report the empirical results from my findings. Finally, Section V is a brief discussion and final conclusions of this paper.

2. Literature Review

When crude oil prices began to decline in July of 2014, nobody expected them to go into freefall from a price that broke the $100 mark per barrel to less than $30, severely affecting the energy sector in particular and equity and debt markets in general. Now we know how prices were driven down is such fashion due to Chinese economic slowdown and lower (unexpected) oil consumption, and the non-slowdown in production from OPEC countries and the US which has damaged many of the players in the oil industry.

Analyst Matt Egan (2016) wrote in his article for CNN Money, "When economies are booming, they consume lots of oil – and vice versa. That's why Wall Street is worried that the drop in energy prices suggests the global economy is slowing down". Oil commodity has shown the same downfall trend when it fell roughly by the same amount during the '07-'09 recession. It also showed the same behavior during the early 1980's downturn. For these periods, Glassman (2015) suggests previous declines were triggered by significant global slowdowns and thus a considerable decrease in demand.

As shown in Fig. 2.1, the oversupply of oil that flooded the market has been a determining factor in the reverse of oil prices. Moreover, it is readily apparent that this trend of economic slowdown/low consumption resembles that of 2007-2009. This analysis becomes even more important when we consider Murphy (2004)'s statement that three of four recent downturns in the U.S. (1974, 1980, and 1990) were accompanied by surging oil prices.

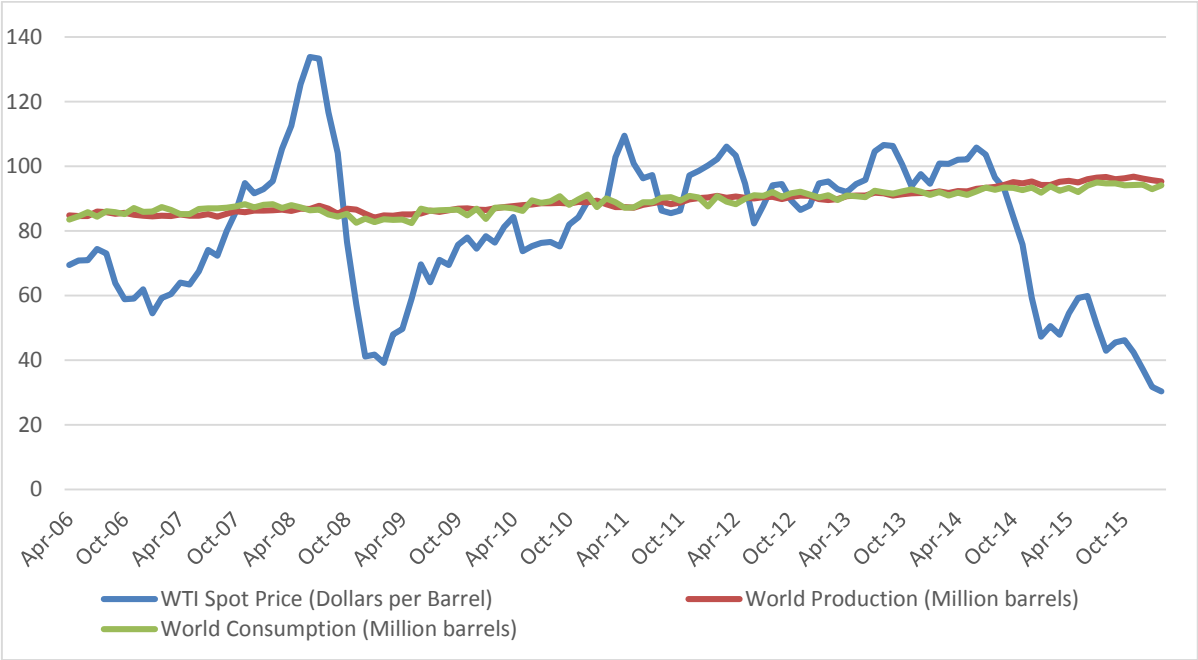

Figure 2.1 WTI historical price compared to total world's production and consumption of oil. Source: EIA.

The association of increasing oil prices and thus growing oil price volatility with macroeconomic slowdowns can be further explored by comparing spot oil prices to the Purchasing Managers' Index (PMI), as oil prices have historically trailed index performance based on the five major macroeconomic indicators of new orders, inventory levels, production, deliveries, and the employment environment. Figure 2.2 shows how the PMI moves in tandem with oil prices.

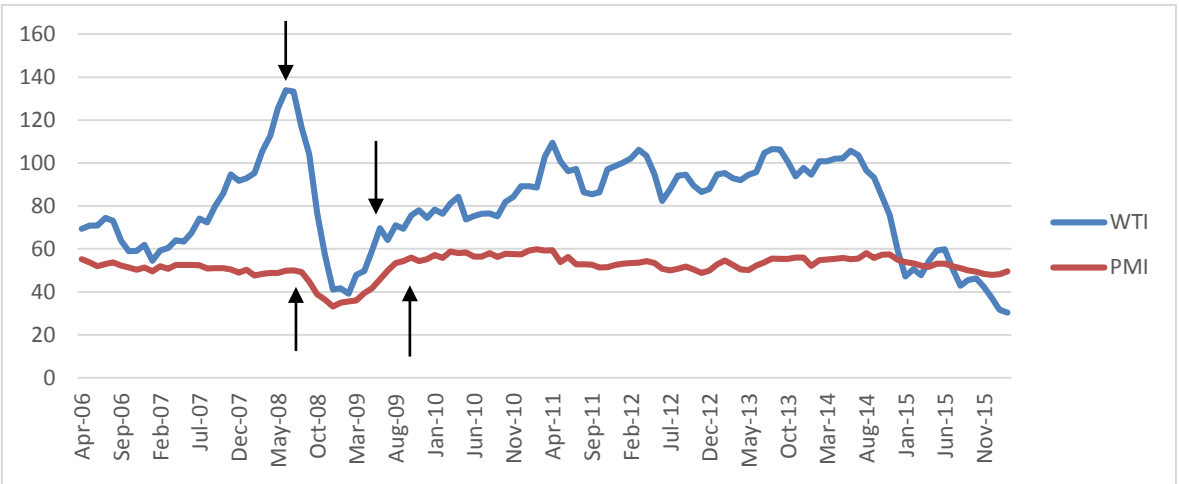

Figure 2.2 WTI historical price compared to PMI levels form April 2006 to March 2016.

Oil price also has a great impact on financial markets globally as it has historically trended in an opposite fashion from the market, which means that an oil price rise is correlated to a market tumble (and vice versa). Murphy (2004) analyzed this situation by

studying the rise in oil prices during the summer of 1990 and found that the inflationary impact of rising oil took a bearish toll on equity prices around the globe. After this increased volatility period "oil became the dominant commodity during that year and demonstrated in dramatic fashion how sensitive bond and stock markets are to action in the commodity sector."

Figure 2.3 illustrates how the WTI trends in opposite direction with the market and trails changes in direction of index levels depending on the oil price swing. This paradigm is criticized in Jones and Kaul (1996) when they state: "given the importance of oil to the world economy, it is surprising that little research has been conducted on the effects of oil shocks on the stock market."

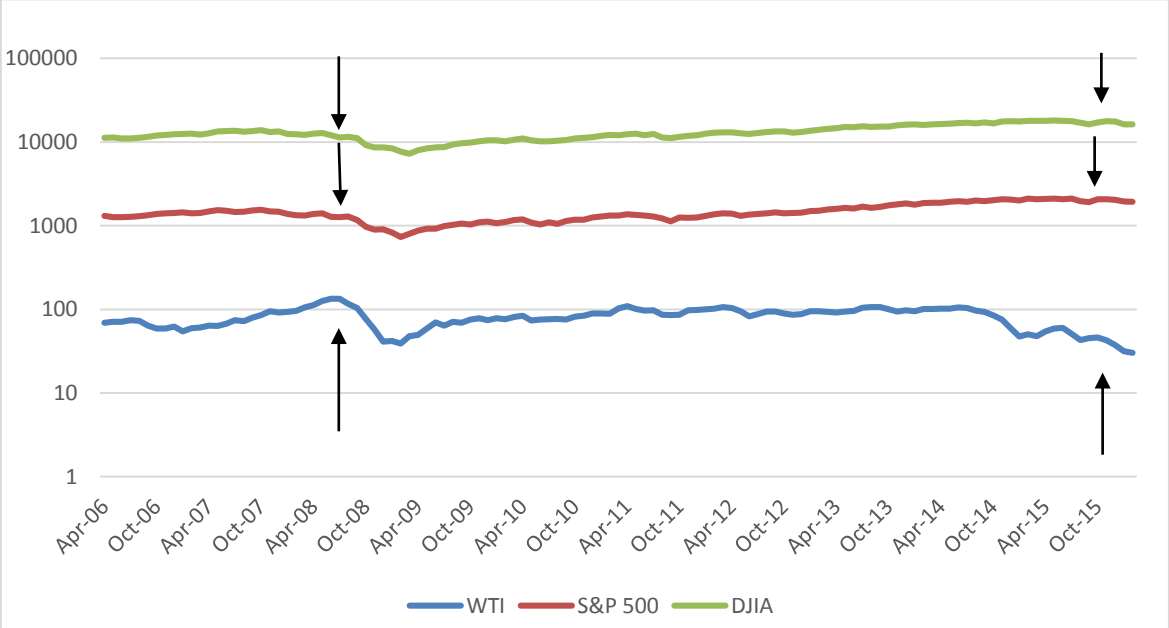

Figure 2.3 WTI historical price compared to S&P500 and the Dow Jones Industrial Average levels form April 2006 to March 2016.

Oil-related stocks are also largely dependent on the trend of oil. It has been studied that a sharp rise in the price of the commodity sends an early warning to stock traders. When oil-related stocks and WTI prices start to diverge, this is usually an early signal of a trend change. Murphy (2004) adds that "stocks usually change direction ahead of their commodity. This makes energy shares a leading indicator for oil."

In this paper, I analyze the three types of oil companies (upstream, downstream, and integrated), but each type responds differently to swings in oil prices. For example, upstream company's stock prices are especially vulnerable to oil price changes, and move in tandem with the trend of the commodity. Conversely, downstream company's stock prices move in an opposite way in response to changes in oil price. Integrated companies react differently since they make money from both types of operations - these types of companies would have higher upstream and lower downstream profits if oil prices experiment a rise.

Figures 2.4, 2.5, and 2.6 show a comparison between WTI historical daily prices compared to a stratified selected sample of companies for each type of business operation

within the industry. The sample selection will be covered in Section III of this paper. The graphics show how each type of company reacts to changes in oil prices, which affects stock returns directly. This different reactions among industry companies demonstrate the relation between oil price volatility and stock returns among oil companies, which validates the main focus of this research of finding an optimal methodology to approach risk-adjusted investments in the oil industry that accounts for volatility factors as the ones already presented previously.

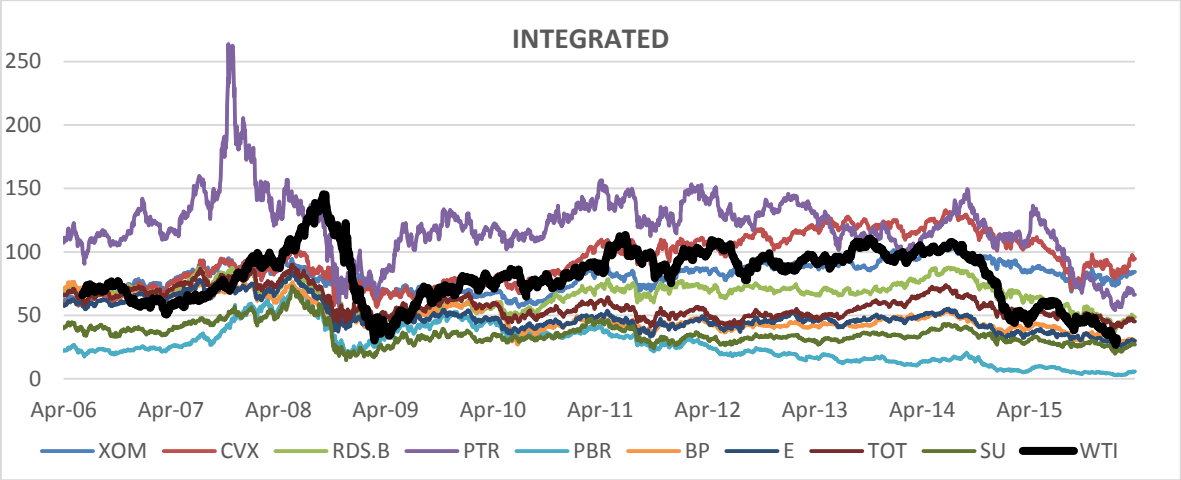

Figure 2.4 WTI historical price compared to historical stock prices of Integrated oil companies for the April 2006 – March 2016 period.

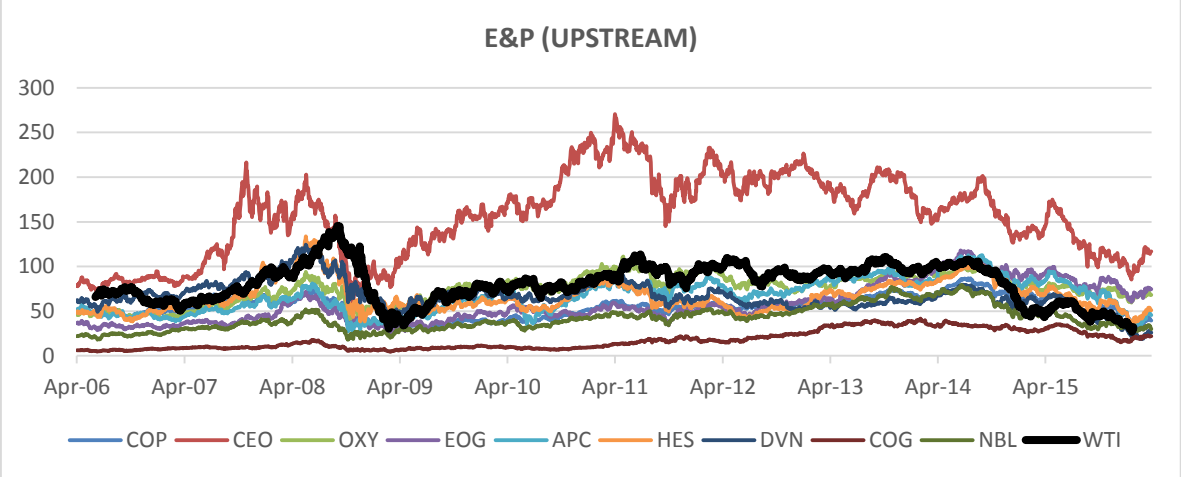

Figure 2.5 WTI historical price compared to historical stock prices of Upstream oil companies for the April 2006 – March 2016 period.

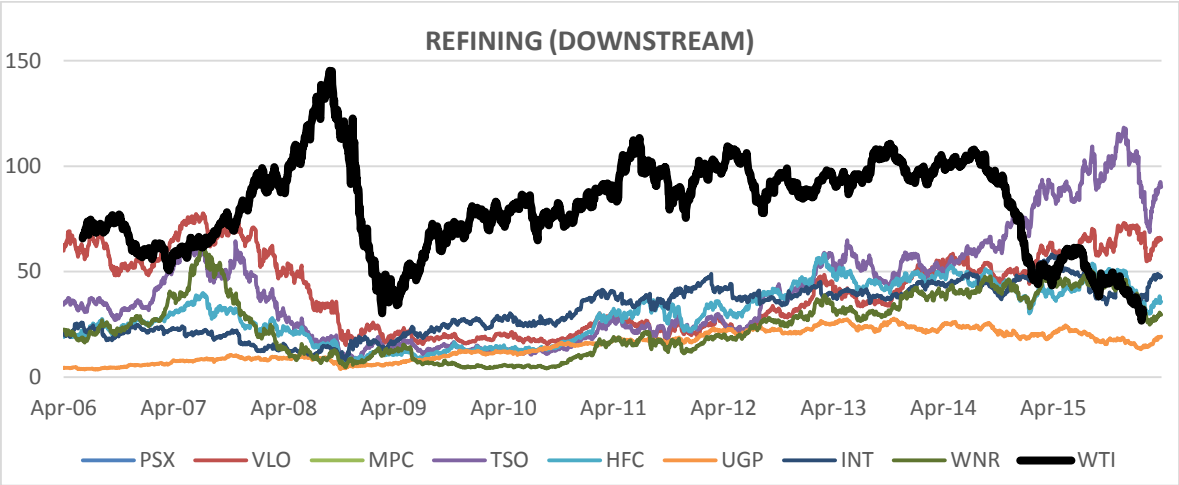

Figure 2.6 WTI historical price compared to historical stock prices of Downstream oil companies for the April 2006 – March 2016 period.

This approach of studying oil-related portions of the stock market is relevant if we accept that security prices do not always reflect all available information. It is known that there exists an equilibrium degree of disequilibrium in the market – think an efficient amount of inefficiency - as demonstrated by Grossman and Stiglitz (1980), whose research of market inefficiencies concludes that prices reflect the information of the informed individuals (arbitrageurs) but only partially, so that those who expend resources to obtain information do receive compensation.

To study oil prices historically stating that past behavior can be a good indicator for oil stock company's returns, and that price divergences exist due to market inefficiencies, would suggest a departure from Fama's Efficient Market Hypothesis (1970). Even though my research focuses on a technical approach to identify market trends in different time periods, it does not mean that the market should be approached in one solely particular way, because in finance one indicator is not enough to identify optimal performance. Instead it is important to revisit Lo (2005)'s Adaptive Market Hypothesis (AMH), that states investment strategies undergo cycles of profitability and loss in response to changing business conditions, competitors, and available profitable opportunities in the market.

Finally, Jones and Kaul (1996) research on oil and the stock markets supports the case built in this paper by stating that "Any correlation between stock returns, long real stock returns, and lagged oil price variables would be direct evidence of market inefficiency," and "The evidence of statistically significant lagged effects of oil prices on stock returns suggests that either (a) oil shocks induce some variation in expected stock returns, or (b) the stock markets are inefficient."

3. Sample Selection and Methodology

To evaluate the relation between oil price volatility and oil company's stock returns, I will report univariate summary statistics, bivariate correlation analysis, and multivariate regression results. I will focus my study on the period between April 2006 and December 2015. This 10-year period of representative data, where global economies experienced big fluctuations between economic recessions and expansions. The companies selected include

a balanced stratified sample by market capitalization levels, and type of company within the industry of Integrated, Exploration and Production (upstream), and Refining (downstream) oil companies, as evidenced by Figures 3.1, 3.2, and 3.3.

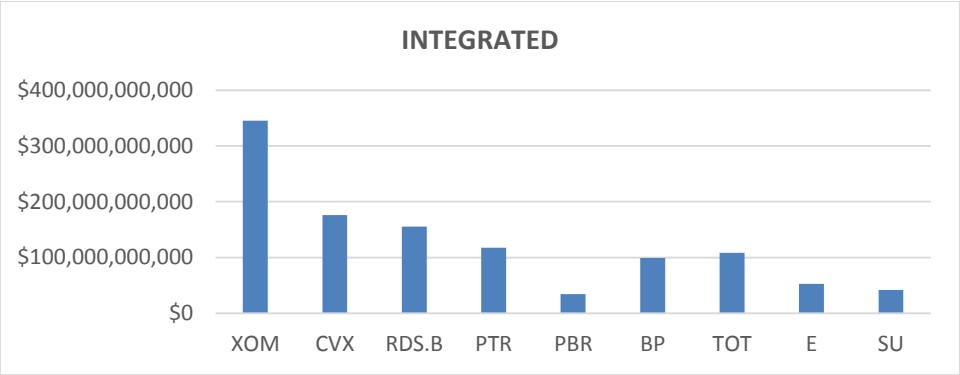

Figure 3.5 Integrated sample companies' market capitalization.

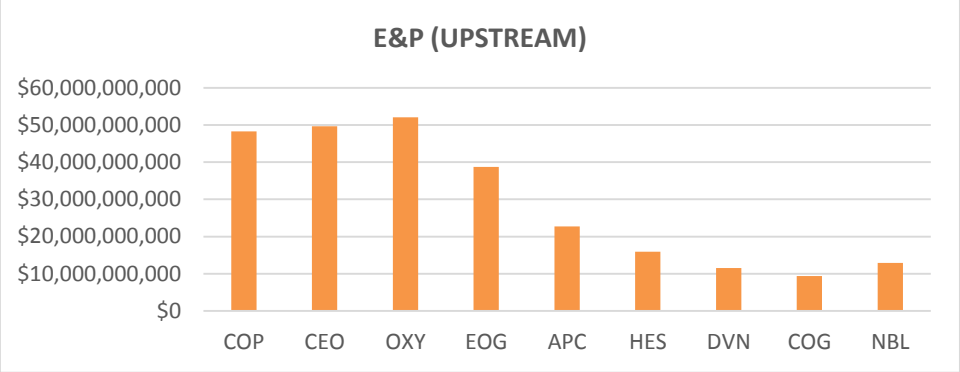

Figure 3.6 Upstream sample companies' market capitalization levels.

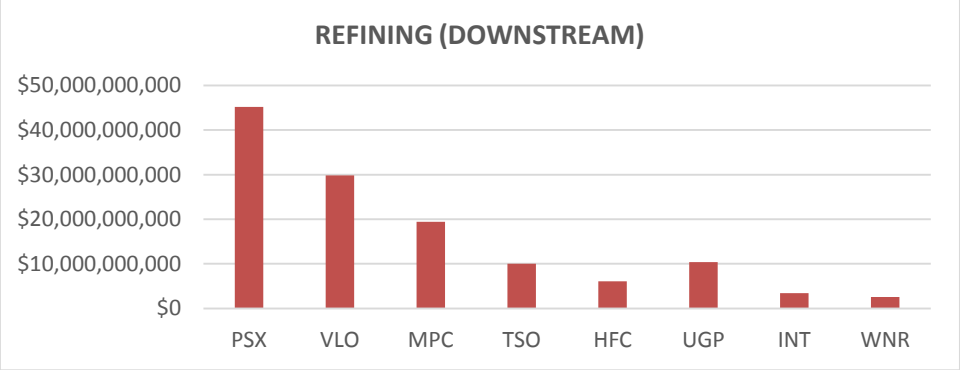

Figure 3.7 Downstream sample companies' market capitalization levels.

I follow a three-part methodology. First, I measure crude oil price volatility, using West Texas Intermediate (WTI) as my oil price benchmark compared to the different trend indicators studied in Section II, by performing descriptive statistics and correlation analyses to historical data. I have divided these analyses in two parts:

1. Correlation and descriptive data analyses of the WTI's prices vs. production indexes, world output (production & consumption), and major financial indexes (DJIA and S&P 500).
2. Descriptive statistics and correlation analysis of a 12-month trailing standard deviation of WTI daily prices, market risk premium, including Fama and French (1993) Small-Big (SMB and High-Low (HML).

Second, I assess oil company historical stock price daily data related to WTI price volatility, including differences between upstream, downstream, and integrated oil companies. For this analysis I selected a number of companies from each sector, varying in their capitalization levels to get the full spectrum of small, medium, and large companies. To establish this relationship I will compare the different trends in daily stock prices for each type of company, to the movements in WTI daily price data using descriptive statistics and correlation analyses. The purpose of this analysis is to evidence that each type of company behaves in a different manner depending on the movement of oil prices, and that divergences between oil prices and stock of oil companies can trigger early signals for oil price reversals, thus future financial performance of stock returns.

Third, I assess how oil price volatility is related to the total returns of oil companies, including upstream, downstream, and integrated. In doing so, I report multivariate regression results using variables and results selected from previous test performed. I also analyze the robustness of stock returns using daily price data for each stock, and calculating the level of "abnormal returns" by comparing these returns to indicators of value-weighted returns for large-cap companies, and equal-weighted returns for small-cap companies.

4. Empirical Results

In this section, I report results of univariate and bivariate statistics and multivariate regressions. Table 4.1 shows descriptive statistics of test and control variables. Variables WTI, PMI, Production and Consumption (and thus Output Production minus Consumption), and the mean value of the S&P 500 are not normally distributed, but I will assume normal distribution throughout the rest of my analysis and leave non-parametric analysis for further research.

	WTI	*PMI*	*Production*	*Consumption*	*Differential (P-C)*	*S&P 500*	*DJIA*
Mean	80.384	51.992	89.160	89.015	0.146	1452.921	13072.582
Standard Error	2.005	0.468	0.329	0.295	0.135	32.296	252.081
Median	84.250	52.600	88.550	88.920	-0.050	1397.910	12631.480
Mode	94.510	51.400	85.310	87.270	-0.270	#N/A	#N/A
Standard Deviation	21.873	5.109	3.587	3.222	1.472	352.309	2749.884
Sample Variance	478.414	26.104	12.869	10.378	2.167	124121.683	7561859.842
Kurtosis	-0.391	3.607	-0.771	-0.968	-0.616	-0.711	-0.747
Skewness	-0.204	-1.644	0.545	-0.068	0.223	0.341	0.182
Range	103.560	26.800	12.600	12.530	6.770	1372.300	10889.240
Minimum	30.320	33.100	84.150	82.470	-2.630	735.090	7235.470
Maximum	133.880	59.900	96.750	95.000	4.140	2107.390	18124.710
Sum	9565.730	6187.100	10610.060	10592.740	17.320	172897.549	1555637.210
Count	119	119	119	119	119	119	119

Table 4.1 Descriptive statistics for the WTI vs. selected indicators.

Correlation analysis results shown in Table 4.2 shows a strong but less than perfect correlation between WTI and PMI, reflecting a positive but relatively low (38.0%) relation between Producer Manufacturing (think industrial demand) and WTI prices. These results suggest an association between oil prices volatility and industrial performance, as the index move in tandem with the WTI. Also, noteworthy is a positive but low relation between the Dow and WTI, likely related to the concentration of large energy companies in the Dow, but the negative low correlation with the S&P500 supports the claim that the markets move in a different fashion than oil prices.

	WTI	*PMI*	*Production*	*Consumption*	*Differential (P-C)*	*S&P 500*	*DJIA*
WTI	1						
PMI	0.380	1					
Production	-0.086	0.265	1				
Consumption	0.044	0.386	0.912	1			
Differential	-0.304	-0.198	0.441	0.034	1		
S&P 500	-0.062	0.324	0.814	0.807	0.219	1	
DJIA	0.006	0.343	0.829	0.834	0.195	0.990	1

Table 4.2 Correlation analysis for the WTI vs. selected indicators.

Descriptive statistics for variables used in Fama French (1993) analysis are reported in Table 4.3. They also show that none of the variables used in this paper are perfectly normally distributed.

	WTI Price	*WTI StDev*	*Mkt Ret*	*RF*	*Mkt-RF*	*SMB*	*HML*	*Mom*
Mean	80.531	10.889	0.033	0.004	0.029	0.000	-0.003	0.003
Standard Error	0.439	0.155	0.027	0.000	0.027	0.012	0.012	0.021
Median	82.860	7.793	0.089	0.000	0.080	0.010	-0.010	0.060
Mode	74.380	5.454	0.280	0.000	-0.100	0.030	0.030	0.160
Standard Deviation	21.934	7.720	1.324	0.007	1.324	0.598	0.615	1.049
Sample Variance	481.103	59.600	1.753	0.000	1.753	0.358	0.378	1.100
Kurtosis	-0.360	2.990	8.884	0.562	8.880	4.232	7.668	9.715
Skewness	-0.177	1.823	-0.134	1.504	-0.132	0.067	0.355	-0.818
Range	119.120	34.224	20.304	0.022	20.300	8.110	7.580	15.270
Minimum	26.190	3.813	-8.950	0.000	-8.950	-3.760	-3.590	-8.220
Maximum	145.310	38.037	11.354	0.022	11.350	4.350	3.990	7.050
Sum	200764.810	27145.552	82.730	10.090	72.640	0.390	-6.410	6.730
Count	2493	2493	2493	2493	2493	2493	2493	2493

Table 4.3 Descriptive statistics for the WTI, standard deviation, risk premium (Expected Return on the Market - Risk Free Rate), and Fama French (1993) Small - Big (SMB) & High - Low (HML).

Correlation analysis for Fama French (1993) variables is shown in Table 4.4. None of these variables are highly correlated with WTI Price, but are of necessary study to construct a proper oil industry company's analysis.

	WTI Price	WTI StDev	Mkt Ret	RF	Mkt-RF	SMB	HML	Mom
WTI Price	1							
WTI StDev	-0.339	1						
Mkt Ret	0.008	-0.004	1					
RF	-0.128	-0.207	-0.009	1				
Mkt-RF	0.009	-0.003	1.000	-0.014	1			
SMB	0.010	0.028	0.199	-0.020	0.199	1		
HML	0.028	0.000	0.384	0.012	0.384	-0.048	1	
Mom	0.045	-0.077	-0.386	0.011	-0.386	-0.007	-0.582	1

Table 4.4 Correlation analysis for the WTI, standard deviation, risk premium, and Fama-French SMB & HML.

Descriptive statistics and correlation analyses for individual Integrated, Upstream, and Downstream oil companies are reported in Tables 4.5-4.7. Again, variables are less than perfectly normally distributed as shown in each descriptive statistics analysis. Correlation analyses performed to the different sectors in the industry validate the initial claim that each type of company moves in a particular way in relation to crude oil prices. As shown in Table 4.5 integrated companies would move in tandem and trailing a movement in oil prices. Table 4.6 shows higher positive correlation values for upstream companies evidencing their vulnerability to oil price changes and movement in the direction of the trend of crude oil. Conversely, downstream company's stock prices move in an opposite way in response to changes in oil price as shown in Table 4.7.

	WTI Price	XOM	CVX	RDS.B	PTR	PBR	BP	TOT	E	SU
Mean	80.188	80.904	93.178	66.279	120.461	26.889	49.525	58.641	49.205	35.422
Standard Error	0.442	0.213	0.388	0.212	0.504	0.297	0.240	0.213	0.236	0.171
Median	82.660	82.390	92.120	68.390	120.520	24.220	45.650	55.920	46.820	33.800
Mode	60.010	84.220	111.730	72.030	111.300	22.400	42.020	49.740	45.230	31.590
Standard Deviation	22.181	10.688	19.432	10.641	25.274	14.896	12.034	10.680	11.811	8.548
Sample Variance	492.002	114.242	377.593	113.239	638.756	221.886	144.825	114.060	139.490	73.072
Kurtosis	-0.393	-0.753	-1.141	-0.428	4.431	-0.085	-0.681	-0.342	-0.136	1.781
Skewness	-0.182	-0.165	0.097	-0.385	0.689	0.601	0.629	0.718	0.674	1.019
Range	119.120	47.810	78.390	50.960	209.650	72.290	52.680	49.730	59.140	58.290
Minimum	26.190	56.570	56.460	36.960	54.050	2.900	27.020	40.210	25.000	14.660
Maximum	145.310	104.380	134.850	87.920	263.700	75.190	79.700	89.940	84.140	72.950
Sum	201512.810	203311.700	234155.970	166558.790	302719.560	67571.590	124455.090	147364.050	123652.680	89016.380
Count	2513	2513	2513	2513	2513	2513	2513	2513	2513	2513

	WTI Price	XOM	CVX	RDS.B	PTR	PBR	BP	TOT	E	SU
WTI Price	1									
XOM	0.429	1								
CVX	0.525	0.864	1							
RDS.B	0.657	0.652	0.553	1						
PTR	0.588	0.342	0.268	0.712	1					
PBR	0.446	-0.258	-0.366	0.097	0.477	1				
BP	0.225	-0.047	-0.349	0.490	0.486	0.547	1			
TOT	0.360	0.228	-0.101	0.624	0.525	0.530	0.895	1		
E	0.403	0.111	-0.190	0.587	0.577	0.605	0.925	0.931	1	
SU	0.607	0.253	0.057	0.666	0.655	0.636	0.732	0.862	0.833	1

Table 4.5 Descriptive statistics (top) and correlation analyses (bottom) between WTI daily prices and integrated oil companies daily stock prices.

	WTI Price	*COP*	*CEO*	*OXY*	*EOG*	*APC*	*HES*	*DVN*	*COG*	*NBL*
Mean	80.188	54.682	156.142	74.692	57.739	66.889	66.155	66.966	17.709	42.003
Standard Error	0.442	0.245	0.919	0.314	0.434	0.367	0.341	0.322	0.211	0.276
Median	82.660	55.270	162.440	77.140	51.940	67.750	61.190	64.640	14.690	39.750
Mode	60.010	51.190	203.000	81.550	46.100	73.370	58.780	60.710	8.460	47.230
Standard Deviation	22.181	12.270	46.084	15.732	21.749	18.415	17.098	16.138	10.585	13.848
Sample Variance	492.002	150.559	2123.700	247.491	473.011	339.103	292.337	260.448	112.044	191.755
Kurtosis	-0.393	-0.393	-0.898	-0.727	-0.376	-0.722	1.037	1.999	-1.027	-0.256
Skewness	-0.182	0.015	-0.125	-0.414	0.779	0.139	1.039	0.557	0.642	0.671
Range	119.120	59.980	214.600	71.960	95.180	85.520	99.420	105.710	37.070	61.270
Minimum	26.190	26.780	56.040	39.060	22.800	27.170	34.380	18.650	4.540	17.960
Maximum	145.310	86.760	270.640	111.020	117.980	112.690	133.800	124.360	41.610	79.230
Sum	201512.810	137416.270	392384.150	187700.240	145096.990	168091.590	166247.600	168286.290	44503.820	105554.500
Count	2513	2513	2513	2513	2513	2513	2513	2513	2513	2513

	WTI Price	*COP*	*CEO*	*OXY*	*EOG*	*APC*	*HES*	*DVN*	*COG*	*NBL*
WTI Price	1									
COP	0.549	1								
CEO	0.685	0.390	1							
OXY	0.623	0.506	0.866	1						
EOG	0.176	0.705	0.311	0.618	1					
APC	0.551	0.765	0.668	0.830	0.797	1				
HES	0.652	0.696	0.404	0.540	0.522	0.593	1			
DVN	0.636	0.360	0.271	0.181	-0.108	0.131	0.678	1		
COG	0.249	0.691	0.364	0.590	0.876	0.816	0.377	-0.243	1	
NBL	0.590	0.773	0.648	0.801	0.796	0.918	0.596	0.082	0.861	1

Table 4.6 Descriptive statistics (top) and correlation analyses (bottom) between WTI daily prices and upstream oil companies daily stock prices.

	WTI Price	*PSX*	*VLO*	*MPC*	*TSO*	*HFC*	*UGP*	*INT*	*WNR*
Mean	80.188	68.037	40.727	36.600	40.749	30.151	15.022	31.654	24.547
Standard Error	0.442	0.501	0.367	0.343	0.514	0.262	0.138	0.234	0.284
Median	82.660	74.160	38.970	39.620	35.140	30.370	15.830	35.100	23.410
Mode	60.010	86.090	18.000	42.850	13.200	10.940	22.180	40.010	6.700
Standard Deviation	22.181	15.824	18.400	11.864	25.744	13.140	6.902	11.707	14.229
Sample Variance	492.002	250.403	338.567	140.749	662.770	172.652	47.635	137.051	202.473
Kurtosis	-0.393	-0.323	-1.385	-1.120	0.052	-1.222	-1.360	-1.111	-1.024
Skewness	-0.182	-0.809	0.200	-0.310	0.890	0.001	-0.023	-0.070	0.273
Range	119.120	64.330	63.660	45.810	111.440	52.920	24.170	50.470	61.050
Minimum	26.190	29.350	14.050	13.530	6.800	5.510	3.560	7.810	4.110
Maximum	145.310	93.680	77.710	59.340	118.240	58.430	27.730	58.280	65.160
Sum	201512.810	67833.200	102347.450	43846.970	102402.900	75770.460	37750.310	79547.180	61685.540
Count	2513	997	2513	1198	2513	2513	2513	2513	2513

	WTI Price	*PSX*	*VLO*	*MPC*	*TSO*	*HFC*	*UGP*	*INT*	*WNR*
WTI Price	1								
PSX	-0.430	1							
VLO	-0.229	0.924	1						
MPC	-0.506	0.891	0.931	1					
TSO	-0.346	0.797	0.771	0.900	1				
HFC	0.129	0.457	0.517	0.719	0.768	1			
UGP	0.332	-0.229	-0.045	0.152	0.422	0.776	1		
INT	0.000	0.544	0.102	0.526	0.573	0.738	0.863	1	
WNR	-0.166	0.862	0.795	0.958	0.866	0.832	0.419	0.502	1

Table 4.7 Descriptive statistics (top) and correlation analyses (bottom) between WTI daily prices and downstream oil companies daily stock prices.

Multivariate regression analyses results of total monthly returns data for the three different types of oil companies in the industry (dependent variable) versus WTI price standard deviation, market premium, SMB, HML, and UMD (independent variables) are reported in Tables 4.8-4.10 for integrated, upstream, and downstream oil companies respectively. It is important to mention that two different regressions were performed for downstream oil companies, in which MPC, PSX, and UGP's data was taken from June 2012.

Intercept	-0.008**
WTI Std Dev	0.001
Excess Return on the Market	1.219***
Small-Minus-Big Return	-0.637***
High-Minus-Low Return	-0.067
Up-Minus-Down Return	0.016
Adjusted R Square	0.328
Observations	1053
F	103.583
Significance F	7.317E-89

Table 4.8 Multivariate regression analysis results of total returns of integrated oil companies sample selection vs. WTI Std. Dev., Mkt-Rf, SMB, HML, and UMD. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Intercept	0.002
WTI Std Dev	-4.041E-05
Excess Return on the Market	1.173***
Small-Minus-Big Return	-0.175
High-Minus-Low Return	0.075
Up-Minus-Down Return	0.062
Adjusted R Square	0.280
Observations	1053
F	82.675
Significance F	3.036E-73

Table 4.9 Multivariate regression analysis results of total returns of upstream (E&P) oil companies sample selection vs. WTI Std. Dev., Mkt-Rf, SMB, HML, and UMD. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Intercept	0.026***	Intercept	0.003
WTI Std Dev	-0.002**	WTI Std Dev	0.001
Excess Return on the Market	1.056***	Excess Return on the Market	0.917079***
Small-Minus-Big Return	0.505**	Small-Minus-Big Return	0.001132
High-Minus-Low Return	-0.818***	High-Minus-Low Return	0.297552
Up-Minus-Down Return	-0.322***	Up-Minus-Down Return	-0.48325
Adjusted R Square	0.186	**Adjusted R Square**	0.150885
Observations	585	**Observations**	129
F	82.675	***F***	5.549053
Significance F	3.04E-73	***Significance F***	0.000121

Table 4.10 Multivariate regression analysis results of total returns of downstream (refining) oil companies sample selection vs. WTI Std. Dev., Mkt-Rf, SMB, HML, and UMD. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Every analysis performed show a weak adjusted R-Square value, meaning a poor fit to the data. This event can also be explained to the claim presented in Section 2 of this paper, in which explicates that oil company's stocks trail WTI and market price changes. It is noteworthy also that every small Significance F confirms the validity of the regression output. It is important to notice that downstream companies returns resulted to be a great predictor for volatility in WTI's standard deviation, most likely due to its opposite movement to the benchmark.

5. Robustness Tests

To assess the validity of the analyses performed in Section IV, I perform a robustness test by using the Brent Crude standard deviation as my benchmark. To perform this analysis, I will test the same sample selection to get a significant representation of every sector in the industry and to give a higher validity degree to the analysis

This robustness analysis looks to support the empirical findings reported in Section IV, by comparing re-examining the same variables to another crude oil benchmark. The Brent Crude is highly correlated to the WTI, as they both measure sweet light crude oil, with the difference that the Brent crude is the leading global price benchmark for Atlantic basin crude oils, and the WTI is listed in Cushing, Oklahoma. The WTI is said to also be "lighter" and "sweeter" than the Brent crude, referring to specific gravity and sulfur content respectively. Tables 5.1-5.3 shows the results for the multivariate regression analysis using the Brent crude as robustness benchmark.

Intercept	-0.008
WTI Std Dev	0.000
Excess Return on the Market	1.219***
Small-Minus-Big Return	-0.635***
High-Minus-Low Return	-0.063
Up-Minus-Down Return	0.015
Adjusted R Square	0.328
Observations	1053
F	103.498
Significance F	8.427E-89

Table 5.1 Multivariate regression analysis results of total returns of downstream (refining) oil companies sample selection vs. Brent Crude Std. Dev., Mkt-Rf, SMB, HML, UMD. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Intercept	0.002
WTI Std Dev	0.000
Excess Return on the Market	1.173***
Small-Minus-Big Return	-0.175
High-Minus-Low Return	0.075
Up-Minus-Down Return	0.062
Adjusted R Square	0.280
Observations	1053
F	82.675
Significance F	3.04E-73

Table 5.2 Multivariate regression analysis results of total returns of upstream (E&P) oil companies sample selection vs. Brent Crude Std. Dev., Mkt-Rf, SMB, HML, UMD. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

Intercept	0.025***
WTI Std Dev	-0.002**
Excess Return on the Market	1.056***
Small-Minus-Big Return	0.498**
High-Minus-Low Return	-0.833***
Up-Minus-Down Return	-0.316***
Adjusted R Square	0.184
Observations	585
F	27.363
Significance F	6.82E-25

Table 5.3 Multivariate regression analysis results of total returns of downstream (refining) oil companies sample selection vs. Brent Crude Std. Dev., Mkt-Rf, SMB, HML, UMD. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

The results obtained from the multivariate regression analyses support the findings on Section IV by confirming a low R-Square value, thus supporting the claim that stocks trail crude oil prices, and react in different ways depending on the type of company. The analysis also shows a very small Significance F which confirms the validity of the regression analysis practiced. Finally, downstream companies confirm their significance as a reliable predictor for benchmark volatility due to the statistical significance of the results obtained in Table 5.3.

6. Discussion and Conclusion

With the analyses performed and the methodology and sample selection used in this paper, I evidence and explain the relation between oil price volatility and the financial and stock return performance of different types of oil companies during different time periods. I also recommend signals to look for when interpreting data or searching for relevant variables for predicting investment performance such as the Purchasing Manager's Index (PMI), market indexes (S&P500 and DJIA), world's crude oil output, and oil stock movements depending on the type of company being evaluated.

This paper makes three contributions to the literature on the determinants of oil company performance. First, it gives a trend analysis methodology that serves as a first indicator of both oil prices, and oil company's stock return levels. Second, it provides a guide on understanding the oil industry and its different reactions to crude oil volatility. Finally, this paper demonstrates the timely movements and the significance of these fluctuations on oil stock returns.

There are three major findings in this paper. First, it proves the validity of the trend signals discussed for predicting swings in oil prices, and that the relations between these indicators and the benchmark selected (WTI) monitor a particular tactic depending on the type of analysis being made. Second, it demonstrates the action-reaction movements that exist between crude oil prices and integrated, upstream, and downstream companies and the approach to take in analyzing each type of company independently. Third, it finds the most statistically significant variables to be considered as effective indicators for oil stocks performance, in this case, downstream companies resulted to be the most statistically significant variables to predict abnormal returns in comparison to crude oil price volatility and market indicators.

Lastly, it is noteworthy that the methodology proposed in this paper is an examination of financial historical data, and many direct and indirect factors which also play an important role on determining oil prices and volatility have been left out of this study, and it's a matter of further research. Given that many factors are in play, it is difficult to predict how oil prices will fluctuate during a given period of time, but the methodology recommended in this paper serves as a good strategy to approach oil markets.

References

Kirkpatrick, Ch., Dahlquist, J. 2007. Technical Analysis, p. 9.

Egan, M. 2016. Why you should worry about cheap oil. CNN Money. http://money.cnn.com/2016/01/21/investing/oil-crash-fallout/index.html

Glassman, J. 2015. Smart Energy Investing when Oil is Cheap. Kiplinger's Personal Finance. http://www.kiplinger.com/article/investing/T052-C016-S002-smart-energy-investing-when-oil-is-cheap.html

Murphy, J. 2004. Intermarket Analysis: Profiting from Global Market Relationships. Wiley, p. 17-40.

Jones, Ch., Kaul, G. 1996. Oil and the Stock Markets. The Journal of Finance, 51(2), 464-483.

Grossman, S., Stiglitz, J. 1980. On the Impossibility of Informationally Efficient Markets. The American Economic Review, 70(3), p. 393-399.

Fama, E. 1970. Efficient Capital Markets: A review of Theory and Empirical Work. The Journal of Finance, 25(2).

Lo, A. 2005. Reconciling Efficient Markets with Behavioral Finance: The Adaptive Market Hypothesis. Journal of Investment Consulting, 7(2), p. 18-24.

Fama, E., French, K. 1993. Common Risk Factors in the Returns of Stocks and Bonds. The Journal of Financial Economics, 33, p. 3-56.

Patton, M. 2016. How much do oil prices affect the stock market? Forbes Magazine. http://www.forbes.com/sites/mikepatton/2016/02/29/how-much-do-oil-prices-affect-the-stock-market/#46e109f67b67.