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The Impact of Oil Price Shocks on Investment Returns

Bobby Sharma '21 – (Sponsor: Professor Zhenyang Tang)



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Background

- Oil is an important raw material in the daily maintenance and production of a functioning economy. On a daily average 20.54 million barrels are consumed in the United States. Therefore, a drastic and sudden change in the price of oil can contribute to business cycle asymmetries and can be an indication of larger problems to come such as recessions.
- Investors pay attention to these price shocks of the commodity and make investment decisions based on their expectations of the direction of the market, firms, and the overall economy. Their outlook and decisions are reflected in stock prices and analyzing the relationship between oil prices and stock market returns can be insightful to make future investment decisions.
- Four events are analyzed and were chosen based on previous literature.
- The study analyzes the relationship between oil price shocks and individual stock returns using an event study and regression model.
- The study focuses on the industry-level returns of the oil producing, oil consuming, and neutral sectors. The divisions in sector is described in the table below.

Oil Producing	Oil Consuming	Neutral
Energy	Auto	Communications
Oil	Aviation	Consumer Discretionary
	Industrials	Consumer Staples
		Utilities

Economic Theory

Microeconomic Theory – Demand & Supply

- The supply and demand of a firm's product is impacted by price shocks.
- In the scenario of a positive price shock, an oil consuming company will face an increase to the cost of producing a good, as oil is an input to production. This reduces the supply of the good that can be produced, leading to an increase in price, and a decrease in quantity demanded resulting in lower levels of profit.
- For an oil producing firm in the same scenario, assuming a steady or inelastic supply, a global supply shock of oil will increase the demand for oil from the individual firm. This leads to a sharp increase in prices that will yield large profits for the firm.
- It is expected a neutral firm's supply and demand will be unaffected as oil is not a significant input into their costs of production.
- A rational thinking investor will opt to reallocate their investments according to the shock into firms that are expected to be profitable. The opposite is true during a negative shock, and we can expect a similar result at the industry-level.

Macroeconomic Theory – Aggregate Demand & Supply

- The macroeconomic outlook for an oil importing country can be modeled by aggregate demand (AD) or $Y=C+I+G+X-M$, where Y is GDP, C is consumption, I is investment, G is government spending, and X-M represents net exports.
- The impact of the change in price of oil on the stock returns is relevant using this models as stock returns are representations of an investor's outlook on the direction of the firm, sector, market, and the economy.
- The total output (Y) is the country's gross domestic product, and most countries experienced a negative relationship between oil price increases and GDP growth.
- As an oil importing country, the US will have a negative net exports figure resulting in a loss of GDP when oil prices increase. This overall loss in GDP will negatively impact the investor's outlook of the economy. Therefore, leading to losses in the stock market across all firms, as investors reallocate their funds.
- Changes in macroeconomic variables, such as consumption and investment shifts the AD curve and output in the direction of an expansion or contraction.

Purpose

- Using the theory, the potential macroeconomic and microeconomic impact of an oil shock on stock prices is understood. The contribution of this study will be to understand the sensitivity of the relevant industries to oil price shocks through their outperformance or underperformance against the expected returns of the stock market.
- This will help investors, including individuals, analysts, wealth managers, pension fund managers, etc. to understand, communicate, and mitigate risks associated with oil price shocks.

Data and Methodology

The abnormal returns were collected from the WRDS event study tool, while firm level characteristics were collected from its CRSP and Compustat database.

To find the abnormal return of each firm I used the Fama-French model to calculate expected returns. By subtracting the expected return from the actual return, the abnormal return of the security, AR_{it} , can be found using the following equation.

$$AR_{it} = R_{it} - [a_{it} + R_{ft} + \beta_1(R_{Mt} - R_{ft}) + \beta_2SMB_t + \beta_3HML_t]$$

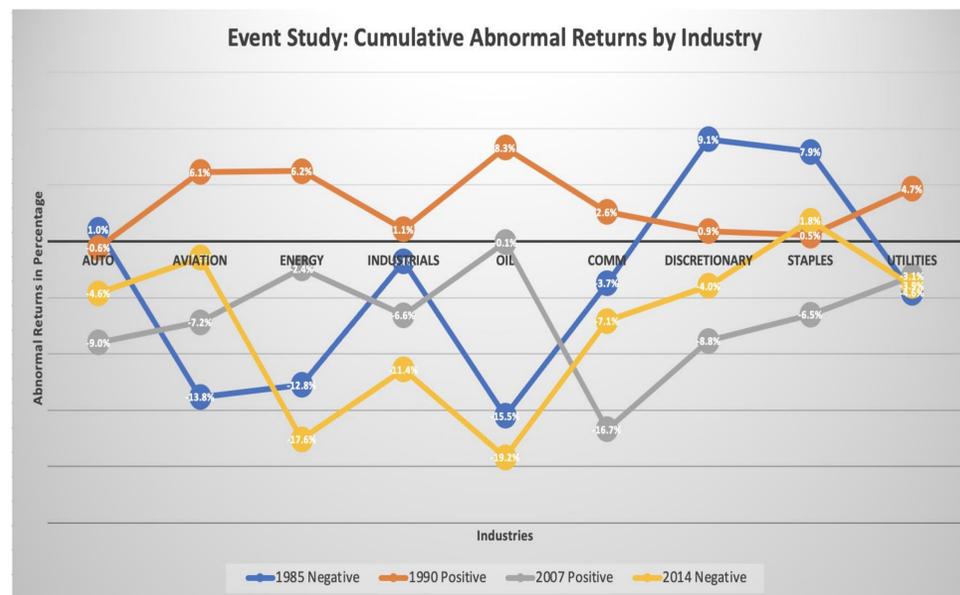
The sum of the abnormal returns of the firm during the event horizon is called the cumulative abnormal return (CAR).

$$CAR_i(t_1, t_2) = \sum_{t_1}^{t_2} AR_{it}$$

This is the basic regression model used in the regression approach to observe the determinants of the CAR of industries:

$$1) CAR = \beta_0 + \beta_1 Book\ to\ Market + \beta_2 Net\ Profit\ Margin + \beta_3 Debt\ to\ Equity + \beta_4 Interest\ Coverage + \beta_5 \log(Market\ Cap) + \beta_6 \left(\frac{Net\ Income}{Assets}\right) + \beta_7 Shock + \beta_8 \left(\frac{R\&D\ Expense}{Assets}\right) + \beta_9 Neutral + \beta_{10} Oil\ Producer + \epsilon$$

Event Study Results



- Returns of oil and energy firms' stocks are positively correlated with the type of shock.
- The Consumer staples industry was the most stable, usually outperforming the expected return. This may be due to the necessary nature of the goods provided by the industry for consumers.
- Interestingly, the utilities sector is observed to have a significant abnormal return across all events despite not being directly related.
- Oil price shocks in either direction cause abnormal returns in sectors according to the context of each event. Therefore, for an investor to make a rational decision in their investment, they must consider the context of the shock.

Summary

- The 1985 negative shock event yielded a CAR that is significant for all sectors except the communications, auto, and industrials.
- The 1990 positive shock event yielded a CAR that is significant for only the utilities, energy, and oil sectors.
- The 2007 positive shock event yielded a CAR significant for all industries except for oil and energy.
- The 2014 negative shock event yielded a CAR significant for all sectors except the auto, aviation, consumer staples and discretionary industries.

Regression Results

- Firms that are considered value (share prices are lower relative to earnings), those with higher book to market ratio values, outperform growth companies, which have lower book to market ratios.
- For every additional percentage increase in market capitalization, the firm will underperform expected returns by 1%.
- Furthermore, the profitability measured by the net income/assets mattered significantly to yield positive abnormal returns.
- Neutral firms outperform oil producers and consumers.
- Specifically for each industry, we find that consumer discretionary, staples, and the utilities sectors observe significant and positive abnormal returns compared to the rest of the industries.

	(1)	(2)
Book/Market	0.0293***	0.0284***
Profit Margin	-0.000346	-0.000322
Debt/Equity	0.000849	0.00106
Interest Coverage Ratio	0.0000374	0.0000342
Log(Market Capitalization)	-0.0105***	-0.0105***
Net Income/Assets	0.0720***	0.0721***
R&D Expense/Assets	-0.00211	0.0471
Shock	0.0160	0.0166
Neutral	0.0489***	
Oil Producer	-0.0200	
Consumer Discretionary		0.0783**
Consumer Staples		0.0683**
Communication		0.00779
Utilities		0.0591*
Aviation		-0.0227
Energy		-0.00817
Industrials		0.00888
Oil		-0.0151
cons	0.0485	0.0399
N	6028	6028
R ²	0.016	0.018

* p < 0.10, ** p < 0.05, *** p < 0.01

- Among industries, the size of the individual firms or the number of assets it holds is insignificant in outperformance against expectations.
- Positive oil shocks significantly contribute to outperformance for the oil and energy industries, while contributes to underperformance for the consumer discretionary and communications industries.
- Negative oil shocks significantly contribute to outperformance for consumer staples and discretionary industries, while contribute to underperformance for the oil industry.
- Firms within the consumer discretionary, staples, aviation, and industrials sectors with higher book to market ratios, meaning their assets are worth more than their market capitalization, see outperformance compared to their peers.
- Oil firms with higher current ratios, meaning more short-term assets compared to short-term debts, underperform compared to their peer firms within the industry.
- Oil producers which can cover their interest expense with their earnings outperform compared to their expected returns.

Conclusion

- Based on the event study analysis of past investor behavior in the event of an oil price shock in order to manage risk, it is important to understand the context of the shock; what kind of a shock it is, how it impacts the macroeconomic and microeconomic environment, and the time of uncertainty that is expected to follow after the shock.
- We find that industries orientated around necessities are not as dramatically impacted as others.
- Based on the regression analysis, we find that it is best to invest in firms that are profitable, under-valued, and are not directly related to oil, which reiterates the results from the event study.
- To investors who want to understand and or mitigate risk during events of oil price shocks can use these results to predict how much their portfolio may be impacted given the industry and firm characteristics of their portfolios.