

# CRUDE OIL STOCKS

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Financial Frontline Society  
Carnegie Mellon University

Fall 2013

# OVERVIEW OF PROJECT

- Quantify the relationship between changes in WTI oil prices and changes in crude oil stock returns
  - Construct a long/short strategy
  - Back-test our strategy (next semester)
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# THE OIL INDUSTRY

- Upstream
  - Searching for potential underground or underwater crude oil
  - Crude oil extraction
- Downstream (+ midstream)
  - Building pipelines for oil transportation
  - Oil refining

# CAPITAL ASSET PRICING MODEL

- Systematic return VS idiosyncratic return
- Capital asset pricing model

$$r_i - r_i^f = \alpha + \beta_i(r^B - r_i^f) + e_i$$

# STOCK SELECTION

- Upstream stocks

Stocks	Market Capitalization
Devon Energy	25.48B
Anadarko Petroleum Corporation	45.65B
Apache Corp	37.13B
Marathon Oil Corporation	25.73B
Linn Energy	6.92B
Occidental Petroleum	78.11B

# STOCK SELECTION

- Downstream stocks

Stocks	Market Capitalization
HollyFrontier Corporation	9.13B
Western Refining	2.97B
Tesoro Corporation	7.55B
Hornbeck Offshore Service	1.80B
Genesis Energy	4.43B

# OUR MODEL

- Benchmarks

S&P 500

AGG (Barclays' aggregate)

GSCI (Goldman Sachs Commodity Index)

- Our model

$$\text{Return} = \beta_1 * \text{AGG} + \beta_2 * \text{GSCI} + \beta_3 * \text{S\&P} + \alpha + e$$

$$\text{Systematic return} = \beta_1 * \text{AGG} + \beta_2 * \text{GSCI} + \beta_3 * \text{S\&P}$$

$$\text{Idiosyncratic return} = \alpha$$

$$\text{Randomness} = e$$

# OUR RESULTS

Upstream stock	$\beta_1$	$\beta_2$	$\beta_3$	$\alpha$
Devon Energy	0.00639	0.31345	0.32615	38.333
Anadarko Petroleum Corporation	0.04762	0.28722	0.38752	50.530
Apache Corp	-0.04642	0.35132	0.39425	55.102
Marathon Oil Corporation	-0.03562	0.21972	0.45543	66.063
Linn Energy	0.03421	0.21409	0.30486	82.109
Occidental Petroleum	-0.04134	0.27538	0.41071	65.079

# OUR RESULTS

<b>Downstream stock</b>	<b><math>\beta_1</math></b>	<b><math>\beta_2</math></b>	<b><math>\beta_3</math></b>	<b><math>\alpha</math></b>
Holly Frontier Corporation	-0.04545	0.12376	0.25482	121.211
Western Refining	0.00399	0.07662	0.22200	0.0128
Tesoro Corporation	-0.06206	0.15682	0.22479	124.751
Hornbeck Offshore Service	-0.09901	0.29373	0.35902	80.768
Genesis Energy	0.00639	0.31345	0.32615	38.334

# IDIOSYNCRATIC RETURN AND WTI PRICES

- $\alpha + e = \beta \text{ wti} + \text{intercept}$
- Downstream  $\beta_1 -0.04994$   $\beta_2 0.19136$   $\beta_3 0.33449$   $\beta_{\text{wti}} = -0.05920$
- Upstream  $\beta_1 -0.01430$   $\beta_2 0.34858$   $\beta_3 0.49821$   $\beta_{\text{wti}} = 0.06422$

# OUR STRATEGY

- If WTI price goes up :
  - Long 1 share of upstream stocks we have selected
  - long  $\beta_{1 \text{ upstream}}$  shares of AGG
  - Short  $\beta_{2 \text{ upstream}}$  shares of GSCI
  - Short  $\beta_{3 \text{ upstream}}$  shares of S&P 500
  - Short 1 share of downstream stocks we have selected
    - long  $\beta_{1 \text{ downstream}}$  shares of AGG
    - short  $\beta_{2 \text{ downstream}}$  shares of GSCI
    - short  $\beta_{3 \text{ downstream}}$  shares of S&P 500

# OUR STRATEGY

- If WTI price goes down :
  - Short 1 share of upstream stocks we have selected
  - Short  $\beta_{1 \text{ upstream}}$  shares of AGG
  - Long  $\beta_{2 \text{ upstream}}$  shares of GSCI
  - Long  $\beta_{3 \text{ upstream}}$  shares of S&P 500
  - Long 1 share of downstream stocks we have selected
  - long  $\beta_{1 \text{ downstream}}$  shares of AGG
  - Short  $\beta_{2 \text{ downstream}}$  shares of GSCI
  - Short  $\beta_{3 \text{ downstream}}$  shares of S&P 500

# EXPLANATION OF OUR STRATEGY

- WTI oil futures price is positively correlated with idiosyncratic return of upstream stocks and is negatively correlated with idiosyncratic return of downstream stocks
  - WTI price goes up, idiosyncratic return of upstream stocks goes up.
  - WTI price goes up, idiosyncratic return of downstream stocks goes down.
  - Long and short certain shares of AGG, S&P and GSCI to get rid of market risk
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# LIMITATIONS

- Need adequate data
  - For some upstream companies we select, they have downstream business, although it is a very small part of their business
  - Noises in data
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