Statistical Programming Languages (SPL): United States Oil Company Analysis

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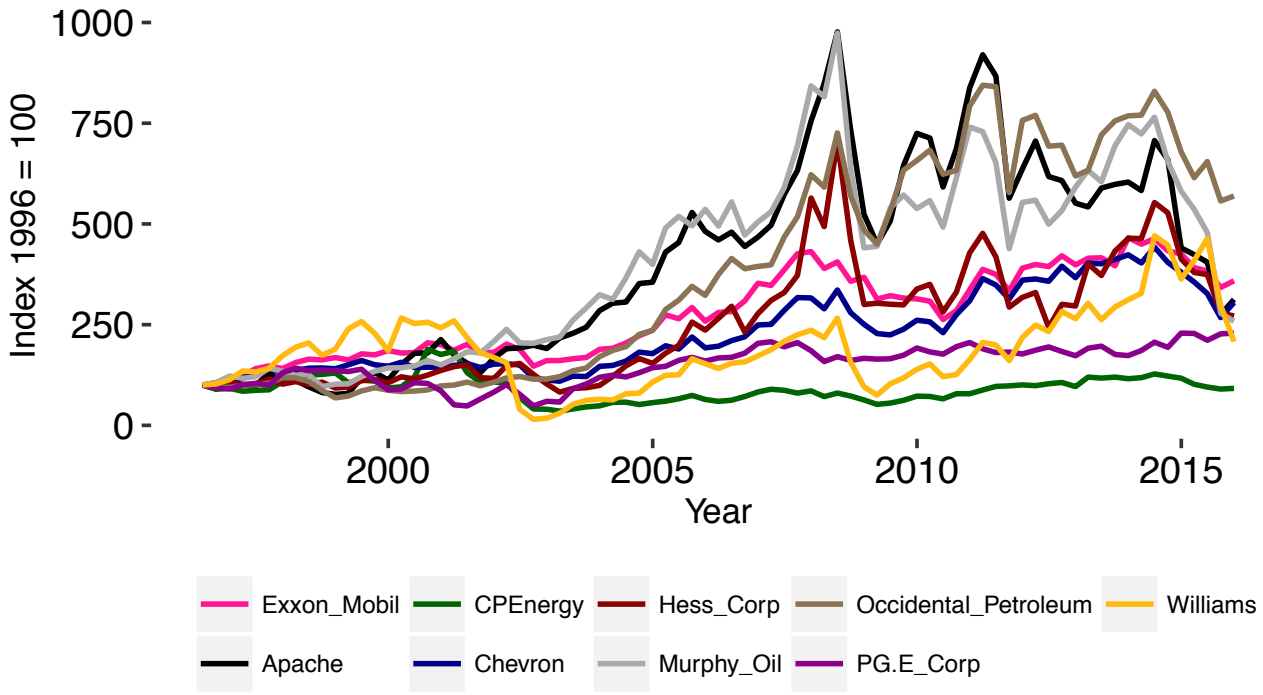
Outline

1. Introduction
2. Dataset Transformations
3. Exploratory Analysis: Plots & Graphics
4. Panel Data Regression & Results
5. Applications
   - Firm Types
   - Further Applications
6. Literature

Stock Returns: US Oil-Companies



Companies in the Sample

Company	Remark
Chevron	
Exxon Mobil	
Apache	
Hess Corp	
Occidental Petrolium	
Murphy Oil	
CPEnergy	(*)
PGE Corp	(*)
Williams Cos, Inc.	(**)

note: (*) utility sector; (**) EDA-Case

Table 1: Sample Companies

Model Environment

- Bianconi/Yoshino (2014), Boyer/Filion (2006)
  - framework adaptation
- Theory: Capital Asset Pricing Model (CAPM)
  - assumptions include frictionless (financial) markets & symmetric information
- Model: Panel Data Regression

$$R_{it} = \beta_0^{oil} + O'_{it}\beta_1^{oil} + B'_{it}\beta_2^{oil} + M'_{it}\beta_3^{oil} + E'_{it}\beta_4^{oil} + \varepsilon_{it} \quad (1)$$

- Data source: Bloomberg

Data Source [raw]: Bloomberg

- Data source [raw]: Bloomberg
- Dataset issues addressed:
  - class of data variable-dependent (e.g. date, returns)
  - common data vary over time
  - specific data vary over both time & company

Transformations applied on Variables

Table 2: Variables by Transformation Mode

log return	z-score	log
Stock	NI	A.MCAP
Oil	BVE.MCAP	D.MCAP
Gas		
Market(*)		
EX(**)		

(*): Dow Jones Industrial Average (DJI)

(**): USD wrt. EUR, GBP, ...

Distress Case, Firm 9: Williams

Firm 9: *Williams*	μ	σ	Min	Max
Stock	23.39	12.05	1.85	58.21
A.MCAP	3.01	4.63	0.80	30.73
BVE.MCAP	0.66	0.70	0.13	4.96
D.MCAP [%]	151.40	58.77	85.06	337.28
NI	68.53	350.20	−1263.00	1678.00

Table 3: Exploratory data analysis - event detection

```
# Summary statistics of company-specific variables
SumSpecF = describeBy(data[,2:7], group = "Company",
                      mat = TRUE, digits = 2,
                      trim = 0, type = 1)
```


Distress Case, Firm 9: Williams

- Williams close to bankruptcy around 2002-2003

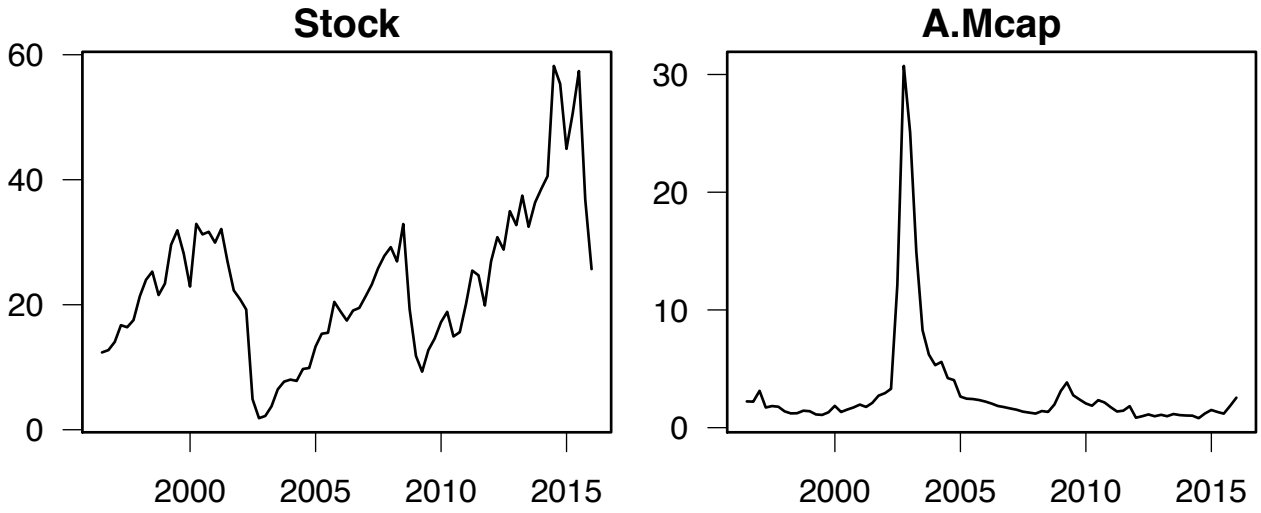


Figure 1: Financial Distress Case of C9: Williams

Panel Regression: Main Results

Table 4: Panel Data Regression: Random Effects Model

Variable	β	
(Intercept)	0.01	
NI	0.01	**
BVE.MCAP	−0.04	***
D.MCAP	0.00	
Oil	0.26	***
Gas	0.07	***
Market	0.72	***

note: *p<0.1; **p<0.05; ***p<0.01

adj. $R^2 = 0.40$

Random Effects Model: Regression Output

- Oil and gas price have robust positive effect on stock prices
  - higher prices indicate presence of a profitable environment for oil companies
- Exposure of stock prices to the U.S. DJI market premium is robustly priced and positive
  - energy consumption is related to overall economic situation
- Non-systematic risk factors are robustly priced

Application Result: By Company Type

- A comparison of the impact of common factors on:
  - Oil-/ Gas-producing
  - Electricity-producing

$$R_{it} = \beta_0^{oil} + O'_{it}\beta_1^{oil} + B'_{it}\beta_2^{oil} + M'_{it}\beta_3^{oil} + E'_{it}\beta_4^{oil} + \varepsilon_{it} \quad (2)$$

$$R_{it} = \beta_0^{elec} + O'_{it}\beta_1^{elec} + B'_{it}\beta_2^{elec} + M'_{it}\beta_3^{elec} + E'_{it}\beta_4^{elec} + \varepsilon_{it} \quad (3)$$

$$R_{it} = \beta_0 + O'_{it}\beta_1 + [...] + D^{elec}\beta_5 + D^{elec}O'_{it}\beta_6 + [...] + D^{elec}E'_{it}\beta_9 + \varepsilon_{it} \quad (4)$$

Random Effects Models: Company Types

- $\beta^{(1)}$: Oil-based Model
- $\beta^{(2)}$: Utility-based Model

Table 5: Random Effect Model depending on Company type

Variable	$\beta^{(1)}$		$\beta^{(2)}$	
(Intercept)	0.02	***	0.01	
Oil	0.31	***	−0.10	*
Gas	0.07	***	0.10	**
Market	0.68	***	0.60	***
EURUSD	0.03		−0.02	
	adj. $R^2 = 0.32$		adj. $R^2 = 0.14$	

note: *p<0.1; **p<0.05; ***p<0.01

Further Applications

- Seasonality Effects
- Impact of the financial crisis around 2008
  - subsample and dummy test performed

Bibliography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Common and fundamental factors in stock returns of Canadian oil and gas companies
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