
Oil & gas company investments: Impact of oil price fluctuations

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Agenda

- About the authors
- Investments in the oil&gas industry
- The impact of volatile oil and gas prices
- Cash flows, investments, dividends, and financing
- Research question
- Theory & Methodology
- Data
- Results
- Conclusions & further work

About the authors

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- Associate Professor, University of Stavanger Business School
- PhD in Industrial Economics
- 10 years experience from the energy industry
- Senior Analyst and Advisor for Equinor ASA



○ Petter Osmundsen

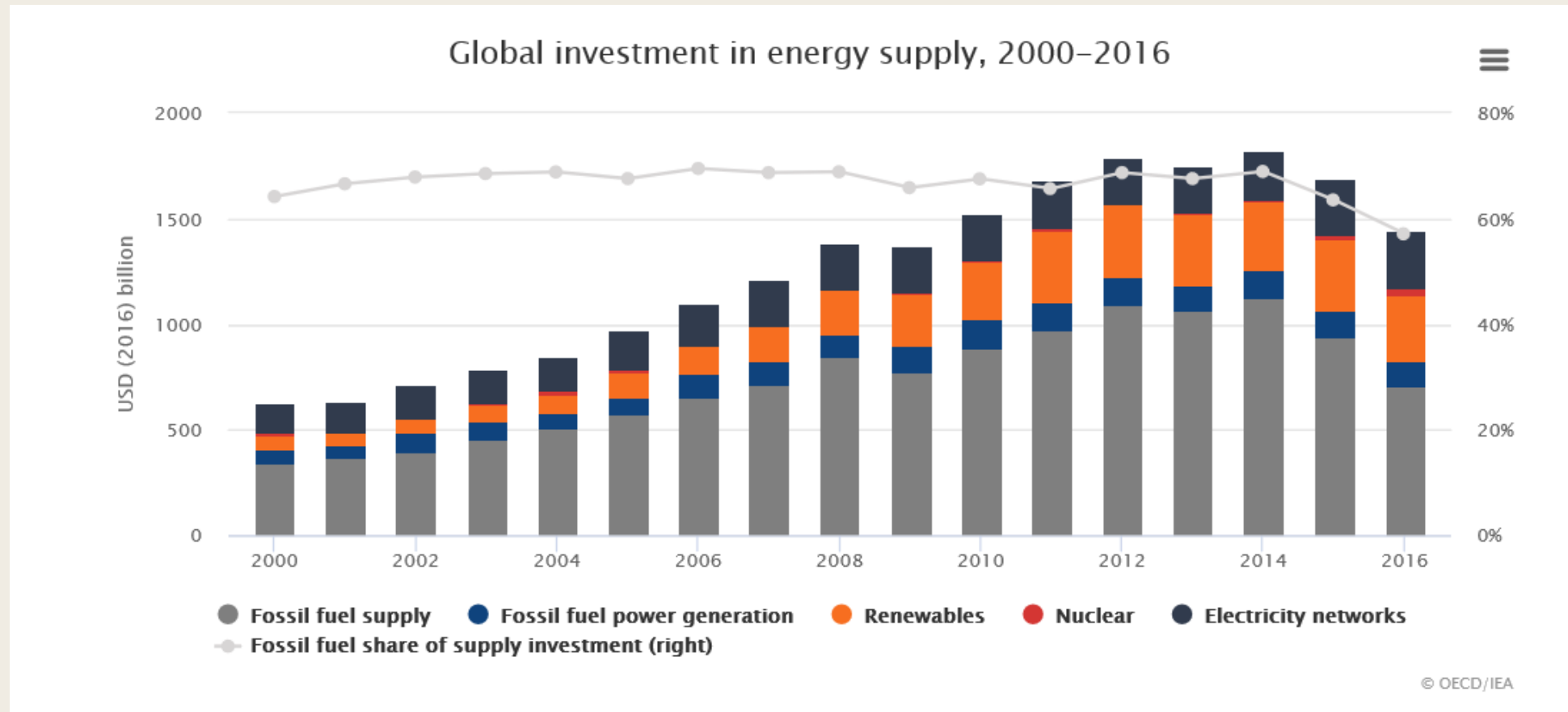
- Professor of Petroleum Economics, University of Stavanger
- PhD in Economics from Norwegian School of Economics and Administration and MIT



Investment behaviour in the oil&gas industry

- Investments in energy projects and assets are important part of global growth
- Energy investments represent 2-3% of global GDP (IEA)
- Substantial increase from 2000-2014 (3x real terms)

Energy investments 2000-2016

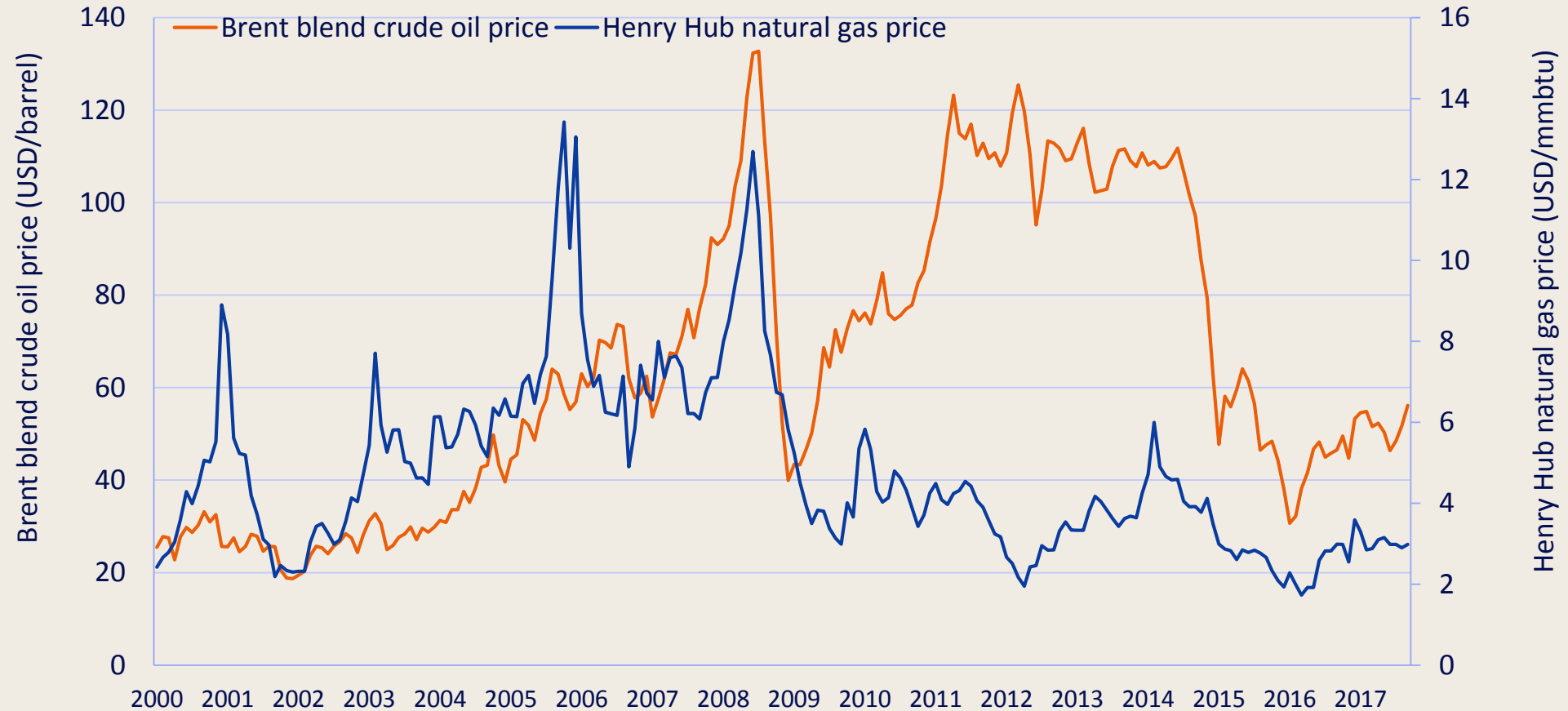


Since 2016 investments have stabilized

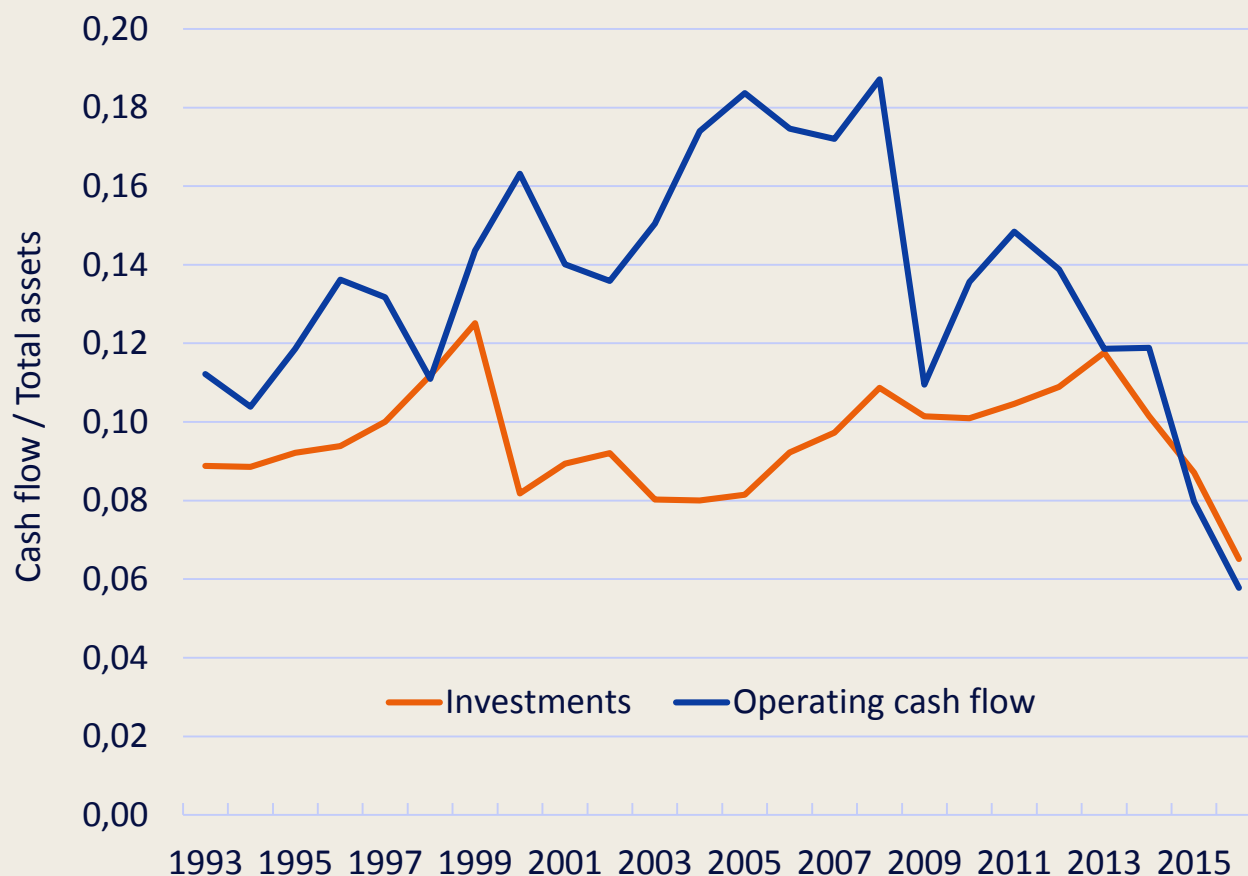
Some interesting developments....

- Substantial increase during 2000-2014
- 2000-2014: Broad increase across energy types
 - Total energy ~3x
 - Renewable >4x
 - Fossil >3x
- 2014-2016: Greatest impact on fossil fuel investments
 - Massive cuts, 99% of energy investment cuts from fossil fuels
 - **-24%** in total energy, but **-37%** fossil fuel investments
 - Some companies have cut more (Equinor: -50%)
- 2016-: Slight growth in investments
 - 4% increase in upstream spending in 2018

Explained by fall in oil prices

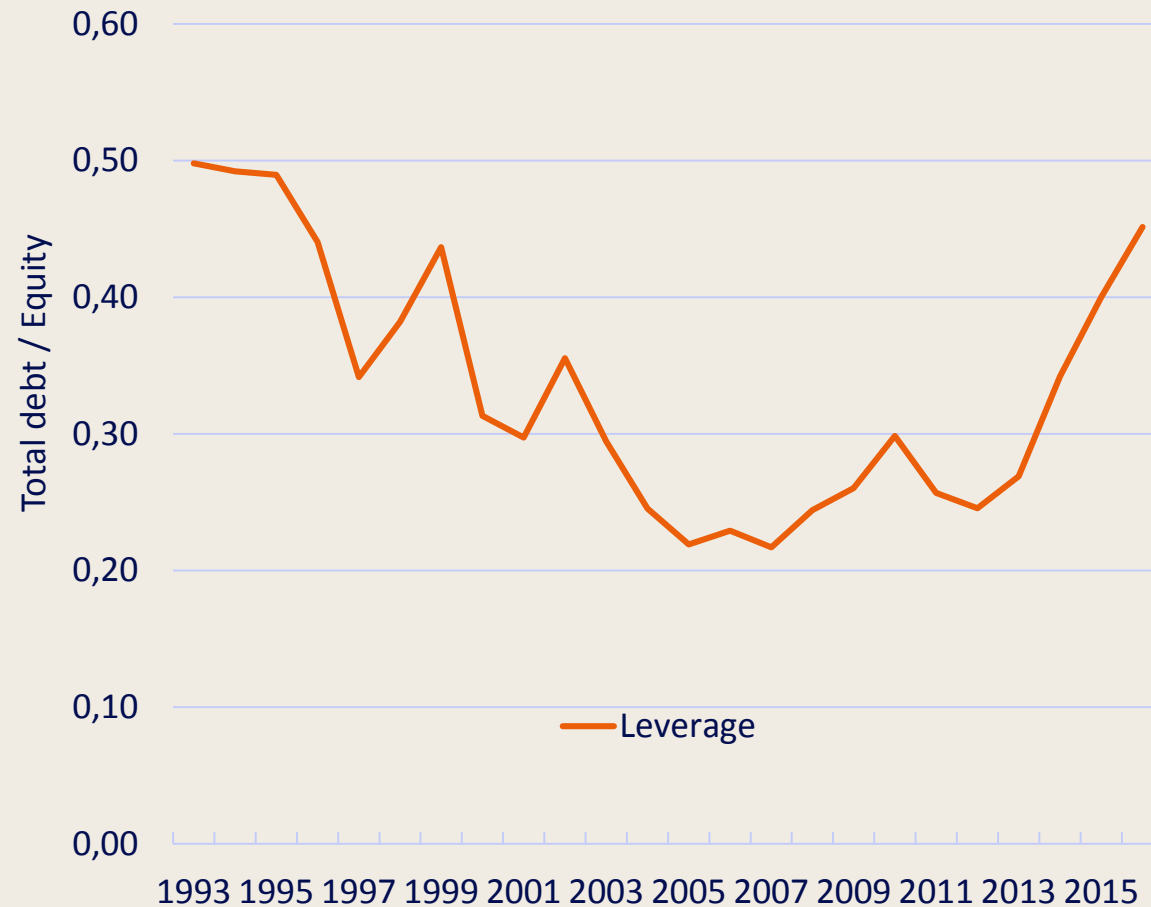


Cash flows – Oil majors



- Operating cash flow increased between 2000 – 2008
- Cash flows been on a decline since 2008
 - Credit crisis 2007-2009
 - Shale oil flood 2014-
- Investments fell in the late 1990s (oil prices <10 \$/bbl)
- Fell again after 2014
- Very small impact from the financial crisis

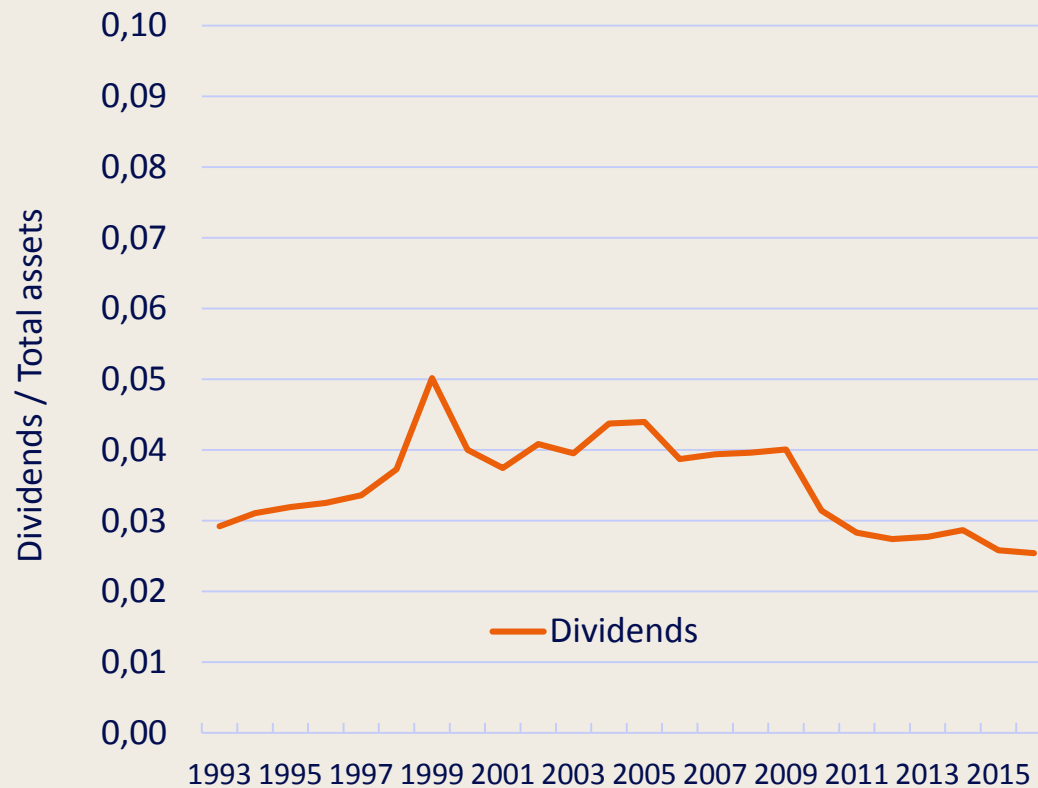
Funding – Oil majors



○ Leverage fell between 1993 - 2007

○ Been on the rise since the financial crisis

Dividend payments – Oil majors



- Dividend payments fairly stable, low variation
- Several oil companies have stated that they are committed to their dividend payment schemes

Financial flexibility or constraints?

- An important priority is to cover the committed dividends from free cash flow
- Instead of using financial flexibility in response to oil price reduction, i.e. cut dividends and increase debt to sustain investment levels
- They cut investments and uphold dividend levels
 - Some companies have turned to scrip dividends
- Pro-cyclical instead of counter-cyclical investment patterns
 - «Buy high, sell low»?
 - Amplify the peaks and troughs in oil prices and investment cycles?

Research topic

- Need to better understand the investment behaviour of oil & gas companies, and especially the impact of oil prices
- Examine the impact on investments in oil and gas companies of:
 - Liquidity / cash flow
 - Leverage
 - Vertical integration
 - Dividends
- When oil and gas prices increase or fall (**interaction effects**)

Hypotheses

1. Sensitivity to financial constraints: companies with high debt levels will show higher sensitivity to oil price fluctuations
2. Sensitivity to financial constraints: companies with high dividend payment levels will show higher sensitivity to oil price fluctuations
3. Sensitivity to vertical integration: companies with lower levels of vertical integration will show higher sensitivity to oil price fluctuations

Theory

- Theories on investment behaviour under uncertainty
 - Neoclassical theory of producer behaviour (Oi, 1961; Hartman, 1972; Abel, 1983)
 - Uncertainty will increase the value of investments carried out now
 - Real options theory (Cukierman, 1980; Bernanke, 1983; McDonald and Siegel, 1986)
 - Uncertainty increases the value of a waiting option (option to defer investment to the future). This will reduce current investments
 - Compound options / basket options (Kulatilaka and Perotti, 1998; Sarkar, 2000; Henriques and Sadorsky, 2011)
 - Complex relation between uncertainty and investment

Literature

- The literature paints an unclear picture about the uncertainty – investment relation
- E.g.
 - Carruth et al., 2000
 - Mohn and Misund, 2009
 - Henriques and Sadorsky, 2011

Our approach

- Previous literature based on volatility as uncertainty measure
- What about the directional effect?
 - Increase and decrease (Andrén and Jankensgård, 2015)
 - Leverage effect
- What about interaction effects?
 - Financial constraints
 - Vertical integration

Methodology: Tobin's Q

- Tobin (1969) capital formation theory relates investment to the ratio (q) of market value of capital to its replacement value
- The theory implies that Tobin's q is an exhaustive model for investment behaviour

$$\frac{I}{K} = a + \frac{1}{b} Q_{it} + e_{it}$$

- However, empirical studies have found several additional variables that explain investment behaviour (e.g. cash flows, uncertainty)

Methodology: Our approach

- Augment with additional variables
- Interaction between explanatory variables and the oil price change
- Examine interaction effects

$$\frac{I}{K} = a + \frac{1}{b} Q_{it} + cX_{it} + cX_{it} \times \Delta OP + e_{it}$$

Methodology

$$\frac{I_{it}}{TA_{i,t-1}} = \beta_0 + \beta_1 q_{it} + \beta_2 \frac{CF_{it}}{TA_{i,t-1}} + \beta_3 V_{it} + \beta_4 DIV_{it} + \beta_5 LEV_{it} + \beta_6 \Delta OP_t + \delta_1 \frac{CF_{it}}{TA_{i,t-1}} \times \Delta OP_t + \delta_2 V_{it} \times \Delta OP_t + \delta_3 DIV_{it} \times \Delta OP_t + \delta_4 LEV_{it} \times \Delta OP_t + \varepsilon_{it}$$

I = Investments

TA = total assets

q = Tobin's q = ln(Enterprise value / total assets)

CF = Cash flow from operations

V = upstream assets / total assets

DIV = dividend / net income

LEV = leverage = total debt / total equity

ΔOP = change in oil price

Panel data model, fixed effects, with HACSE (Arellano, 1987)

Dataset

- IHS Herold database
- ~780 oil and gas companies
- 1992-2016
- Market variables (Market capitalization)
- Accounting data (income statement, balance sheet and cash flows)
- Operational (oil and gas costs, investments, reserves, production)

Results

	Full sample
ΔOP	0.166(0.061)
CF	1.874(<0.001)
CF \times ΔOP	-1.255(0.003)
V	0.186(0.001)
V \times ΔOP	0.101(0.095)
LEV	0.014(0.138)
LEV \times ΔOP	0.005(0.828)
DIV	-0.308(0.604)
DIV \times ΔOP	0.101(0.935)

- Companies with low levels of liquidity will tend to invest pro-cyclically
- Companies with good liquidity / profitability will tend to invest more counter-cyclically
- E&P: Investments are more sensitive to oil price fluctuations than vertically integrated companies

Conclusions

- Vertical integration leads to lower responsiveness to oil price changes
- Substantial impact of cash flows on investments, and companies with good liquidity/profitability are able to invest more countercyclically
- Dividend levels are not significantly affected by oil price changes
- Leverage does not significantly impact investments (consistent with separation principle)

Further work

- Asymmetry?
- Cash flow not appropriate measure for liquidity?
- More complex dynamics?
- Climate change?



” Thank you for your attention!

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