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Universitetet
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FACULTY OF SOCIAL SCIENCES,
UIS BUSINESS SCHOOL

MASTER'S THESIS

STUDY PROGRAM:	THESIS IS WRITTEN IN THE FOLLOWING SPECIALIZATION/SUBJECT:
Master in business administration	Economic Analysis
	IS THE ASSIGNMENT CONFIDENTIAL? (**NB**! Use the red form for confidential theses)

TITLE: Investment Catering in the Oil and Gas Industry

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Abstract

This thesis study investment decisions in the oil and gas industry, assuming market inefficiency and the potential presence of less-than rational investors that may influence the stock price. That is, testing the theory of investment catering to study how stock prices deviations from firms' fundamentals might influence managers' investment decisions. The analysis is conducted using a dynamic panel data set in with two-step system Generalized Method of Moments estimator with Windmeijer correction and principal component analysis. The results show positive relation between cash flow and investment, consistent with established research. And, the proxy for mispricing, discretionary accruals are statistically significant and positively related to investment, suggesting that firms increase investment level when overvalued and inversely for undervalued firms. In addition, the proxy for investment premium is significant, implying presence of investor sentiment concerning firm investment.

Acknowledgements

This master thesis is conclusion of a Master's degree of Business Administration at the University of Stavanger Business School. The process of writing the thesis has been tough yet truly awarding.

I would like to thank everyone who played a role in making this all possible.

Acknowledgements

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Introduction and Motivation

The objective of this chapter is to introduce the area of research, the research questions and the motivation for pursuing these questions. And lastly, the question of 'why?', the relevance of this study.

Research Topic and Research Question

Contrary to other industries, the petroleum industry is commodity dependant. Profits and prospects are somewhat determined by an exogenous, comparatively deterministic factor, in which is subject to stochastic shifts. Empirically proven to affect the industry to great extent[1]. Entering the 2nd millennium, the petroleum industry experienced substantial lasting growth. Admittedly, a considerable factor for the long-lasting prosperity is subordinate to the development of the oil price. Inherent to the oil and gas industry, corporate investment projects exhibit distinctive characteristics. The foremost resource of the industry is of scarce, non-renewable art.

Source: Thomson Reuters Datastream
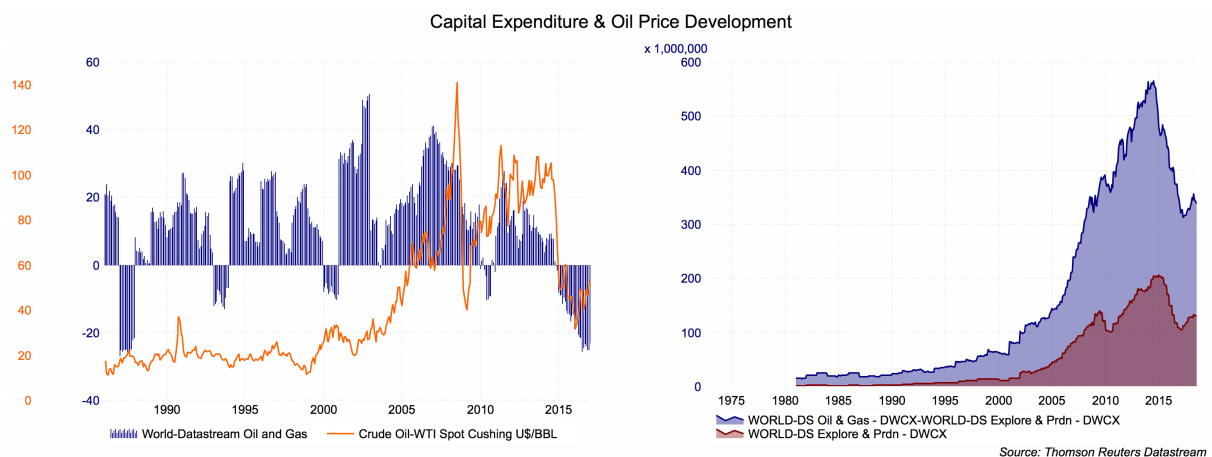
In short, profits, prospective expectations and perceived risk are all closely correlated to oil price developments, thereby firm decisions. However, the correlation is not absolute, neither stock price nor revenue did accompany the extent of the development in the oil price, suggesting presence of inferior distortionary forces.

Given the extensive timespan of investment projects, following neoclassical theory and the irrelevance theorem by (Modigliani & Miller), the trend in capital expenditure should be

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[1] See (Hamilton, 2003) for empirical examples related to oil price fluctuations.

relatively consistent. This follows the perception that short-term fluctuations are somewhat insignificant in the long-run and, thus should not greatly affect the expenditure level. Moreover, (James Ahn, 2006) presents information of systematic overinvestment in major oil and gas companies during the peak of a business cycle.

The objective of this thesis is to examine the nature of investment in the oil and gas industry, departing from the neoclassical school of investment. Particularly, on the distortionary forces influencing firm investment decisions.

Research question:
> *Is overinvestment a systematic time-dependent feature of the aggregate oil and gas industry and if so, can a catering theory of investment explain observed deviation from neoclassical investment theory?*

This study is similar to those who study the effect stock market mispricing on firm decisions. Concretely, the most motivating paper for this thesis is *'The Stock Market and Corporate Investment: A Test of Catering Theory'* by (Polk & Sapienza, 2009). The departing premise for this study is the potential presence of less than-rational investors who can affect the stock price and, that mispricing is observed by firms' managers. The intention is to study managerial reaction to mispricing due to investor sentiment. An extensive amount of literature covers the aspects of the relationship between investors and managers, some of which will be elaborated in later chapters[2]. The hypothesis is that, granted presence of market imperfections, managers are inclined to cater to investors demand. Failing to cater would potentially impose a market penalty, and inversely for meeting the demand, following the notion of (Baker & Wurgler, 2004).

To illustrate, if the period ranging from 2000 to 2014 exhibited mispricing dependent on firms' investment levels, then managers could be inclined to overinvest- which in this situation is synonymous to catering to investor sentiment- resulting in short-term increase in the stock price. Thus, firms with extensive holdings potentially have incentives to initiate negative net present value projects to increase the short-term stock price. For instance, oil majors. As some of the potential losses is equated by the mispricing. And, undervalued firms potentially refrain positive net present value projects, as the effective NPV is reduced by the

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[2] See (Baker, Ruback, & Wurgler, 2004) for a comprehensive survey.

amount of mispricing. In conclusion, this theory seems fitting for the preliminary narrative of the recent development in the oil and gas industry.

The results of the analysis suggest presence of mispricing- and that it affects investment decisions. And, that the investment premium related to mispricing is time dependent. Further, that firm cash flow and equity issuance are important determinates for firm investment. Lastly, mispricing is captured through a proxy, discretionary accruals which is an accounting measure of earnings quality, which yields explanatory power concerning investment.

Energy in general is a major cornerstone in all societies and it has been so for long and will continue to constitute a vital element regarding future welfare and economic growth. Currently, the industry is at a threshold that may reshape the energy industry. A significant challenge concerning the entire energy sector is the Paris Climate Agreement[3]. The prime object of the agreement is to reduce CO_2-emission on global scale. However, at present day fossil fuels remains as prime energy source, combined accounting for more than 50% of the global energy supply, in which oil alone stands for more than 32%[4]. However, the recent decrease in investment levels following the decrease in the oil price suggests future challenges regarding supply, as the timespan is of extensive nature. Understanding the fundamental concepts driving decisions in such large-scale decisions could be of interest to most individuals, as it has the potential to influence to global economy.

Method

The methodology of the study is a quantitative correlational analysis of the population in the petroleum industry. The approach follows the two-step system Generalized Method of Moments estimation of dynamic panel data. This approach enables studying multiple individual firms simultaneously over a defined period. Additionally, controlling for individual heterogeneity, which is likely to be present due to the fact that the population is aggregated on global basis. And, this approach is well suited to study the dynamics of processes, for example investment projects in the oil and gas industry.

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[3] ("United Nations Climate Change," 2018)
[4] (Council, 2016)

Disposition

The study is structured over seven chapters. The first chapter present information concerning the research topic- and questions, including the relevance and background of the study and the motivation behind the study. The second chapter presents a brief overview of relevant theories of investment. Chapter four reviews contributions concerning the research topic. Chapter five describes the quantitative approach, and a short review of alternative estimators. Chapter six provide a descriptive review of the data, and the methods utilized in the process. Chapter seven presents the results, interpretation and discussion of the analysis. Chapter eight provides a short summary.

Theoretical Chapter

Neoclassical Theory

Empirical models of finance and investment have long relied on strict assumptions of nature rational preferences, utility maximizing and full information. (Modigliani & Miller, 1958) theorized a market with efficient capital distribution, in which the marginal product of capital is balanced over the aggregate projects in the market. However, this theory relies on the assumption of a 'perfect world' with frictionless capital markets—a narrative that disregards the distortionary forces that constitute a considerable aspect of the market mechanisms.

Later contributions abandon former assumptions in favour of a more nuanced interpretation, establishing the field of behavioural finance, which is a social science relating psychology and sociology to finance. This field is motivated by the evidence of limited explanatory power of efficient market models and aims to represent actualities more accurately (Shiller, 2003). Some attributions are: (Greenwald, Stiglitz, & Weiss, 1984; Myers & Majluf, 1984a, 1984b) deemed managers as biased towards investors, favouring current investors at the cost of new investors. Their theory was the cost of equity finance, which involves only issuing new equity when the stock is overvalued. Central to the cost of equity finance is the adverse selection problem, first described by (Akerlof, 1970) and symmetrically applied to debt markets. (Stiglitz & Weiss, 1981) and others described scenarios in which firms become unable to obtain debt financing as a result of credit rationing. (Myers, 1977) described the *ex post* dilemma of debt, forgoing new investments financed by issues junior to current debt. Implying two implications; *ex post* and *ex ante*. Leveraged firms are inclined to underinvest, and firms become more reluctant to raise debt.

Models of behavioural finance can be divided in two schools—the biased investor and the biased manager (Baker et al., 2004), which will be elaborated more in later sections. In brief, behavioural models represent two groups: the assumption of biased investors or the assumption of biased managers.

The markets

The current mainstream body of economic knowledge encompasses neoclassical economics with the neoclassical synthesis, later including the Keynesian Approach, originating from the

work of Adam Smith and David Ricardo, see (Stigler, 1957) for a concise representation of early contributions in economics. Neoclassical economics confide in the mechanism of supply and demand—utility maximization under constraints—and are structured under assumptions of rationality, utility maximizing and complete information, and establishing a fundament for comparable economic analysis. This is coupled with Neo-Keynesian economics and macroeconomic theories of the short run representing the fundamentals of the mainstream body of economics.

The benchmark market follows (Fama, 1970) the efficient-market hypothesis, in which asset prices perfectly reflect all available information. Furthermore, the theorem is separated in three distinct portrayals of the market, concerning stock price sensitivity to information. The weak version alleges that prices on traded assets reflect all *ex post* information. The semi-strong version continues the weak version by adding the allegation that changes in price instantly reflect new public information. The strong version alleges that prices instantly reflect non-public information. This implies that all price movements are established homogeneously by the aggregate assumptions on all information, ranging from public to non-public. Generally, the theorem insinuates a scenario containing large numbers of market participants in which possess no market power. Participants are to be understood as the aggregate group of suppliers and consumers. All suppliers operate under the same condition, given by a set of assumptions. Optimality refers to quantity and price, which equates the suppliers' marginal cost- a market equilibrium.

The oil industry compromises a large number of participants on a global basis. As a consequence of the oil cartel, OPEC and the oil majors, market power is present and unequally distributed over a narrow sample of the population. The product is not homogenous *per se* because the industry incorporates other sub-industries. To simplify, the sub-industries provide homogenous products, within a hierarchy where the supply of products serve aggregate end products. In essence, the petroleum industry exhibits oligopolistic conditions accompanied by cartel creations[5]. Opposed to a perfect market with optimal resource allocation scenarios like this yields a sub-optimal solution. In which compose an abnormally high price and low quantity, relative to the benchmark scenario.

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[5] Market characterized by relatively homogenous products, limited number of suppliers and presence of market power. A cartel defines the situation where distinct and independent individuals collaborate aiming to influence the market price. (Brems, 1951).
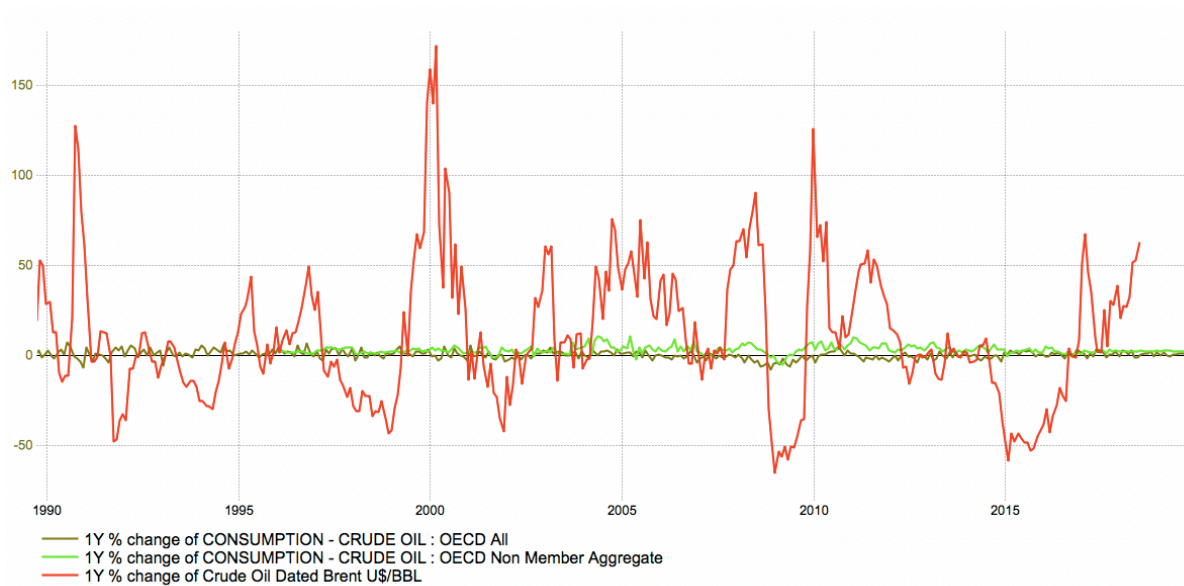
Figure 1: Oil price fluctuations and aggregate consumption. Illustrating the inelasticity of consumption to price change.
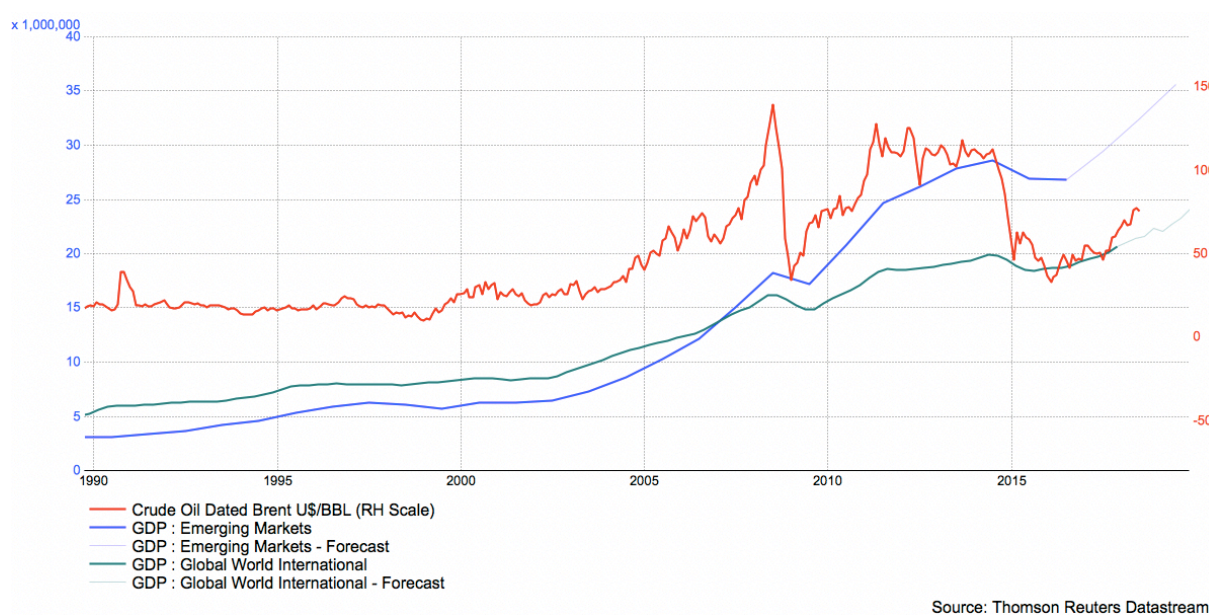

Figure 2 Possible drivers for the systematic increase in the oil price, subsequent to 2000.

As shown above, oil price is subject to frequent fluctuations that vary in magnitude and originate from diverse sources. There are changes in aggregate demand due to increased consumption in emerging and developing countries. Disruptions in supply led to unforeseen structural changes, cartel market manipulation or speculation (Caldara, 2016; Ellen & Zwinkels, 2010). Following a microeconomic model, fluctuations can be deduced to demand and supply side shocks. As the oil price is driven by aggregate global conditions, the drivers can be deduced using macroeconomic theory, differentiating cyclical movements and trends. The cyclical component is interpreted as demand driven, while the trend component represents

the supply side. The major difference is the duration, as a supply side shock is said to be a structural shock yielding long-lasting consequences (Gottfries, 2013). Figures 1 and 2 exhibit the global trend, which is an aggregate stable increase in GDP and production. Emerging and developing countries have experienced a more intense increase, which may be one of several driving forces for the exponential increase in the oil price.

As a measurement of sensitivity to change, oil price elasticity measures the sensitivity of supply and demand to changes in the oil price. This yields information on market characteristics regarding short- and long-run behaviour. Short-run elasticity of oil supply counts to 0.1, while inversely the demand accounts to -0.1, a symmetric inverse relationship implying inelastic relationships. This can be interpreted as short-run capacity limitations of production and that petroleum is a necessity to consumers, with weak substitutes. The long-run elasticity of oil demand equals .08 and supply equals .02 (Kumhof & Muir, 2012). Moreover, the oil supply shocks are the major driving force of market movement, accounting for more than half of oil price volatility. Volatility is a measurement of variation, namely, the degree of dispersion. In addition, disturbance of global conditions describes approximately 35 per cent of oil price volatility (Caldara, 2016). Hence, as illustrated in Figure 2, the exponential development in emerging and developing countries accounts for 35 per cent of the historical increase in oil price, subsequent to third millennium.

In short, both long- and short-run elasticity are inelastic, implying weak substitutes in both horizons and, that oil is a good necessary for society. In addition, utilizing storage capacity decreases the supply short-run sensitivity, as this enables smoothing of supply. Furthermore, the fact that the process of making petroleum products is capital intensive and stretches over a long horizon implies something.

Investment

This section covers the aspects of capital budgeting, a diverse field containing numerous methods. To limit this section, I choose to elaborate on methods that are frequently used in practice, based on the extensive survey by (Graham & Harvey, 2001). This section covers capital budgeting, cost of capital and capital structure, which are all areas that affect firms' investment decisions.

Capital Budgeting

Decisions to invest, what to invest in, duration of investment, and risk and return are questions covered in the process of capital budgeting. As investments in the petroleum industry commonly have a long horizon, combined with capital-intensive characteristics, distant cash flows, and regional and global uncertainty, the process of capital budgeting is crucial. This section covers the three most common capital budgeting methods, following (Graham & Harvey, 2001).

Internal Rate of Return

Similar to the NPV method, the IRR calculates the rate at which the sum of future cash flows from a project equates to zero. (Graham & Harvey) find that 75 per cent of respondents always or almost always use IRR as part of capital budgeting. This method is also known as the annualized effective compound interest rate. It discards all external factors and yields only the effective annualized return on the investment. However, the cash flows of a pending investment are often unknown and therefore are estimated based on a set of assumptions that enable the inclusion of external factors. As one of the attributes, this model enables quantification and comparison of time preferences. In addition, rather than comparing absolute values, this model yields a per cent return, which often is more intuitive to compare than absolutes.

$$0 = NPV = \sum_{n=0}^{N} \frac{CF_t}{(1 + IRR)^n}$$

The formula for IRR is symmetrical to the standard NPV formula, except that the rate is unknown, and the function is solved at zero. The function itself becomes a series of unknowns at rate n and thus is calculated digitally. Similar to most models, IRR has some drawbacks: different duration and initial investment yields different rates, which halt comparisons, and cash

flows ranging from negative to positive values yield multiple IRRs. A common assumption when applying this method is reinvestment of all cash flows until resolution. Like other assumptions, it represents the risk of oversimplification and, hence not representing actualities. As a consequence, IRR risk yielding an abnormally positive representation of the effective investment rate.

Coping with the limitations of IRR, the modified IRR (MIRR) accounts for the re-investment rate and investment returns. To determine a suitable rate of return as benchmark to IRR, hurdle rate is frequently used. This method composes several factors into one aggregate rate. For example, the foundation can be WACC (weighted average cost of capital). For export-exposed companies, one could add an exchange rate risk, while for commodity-based firms, one could add a commodity risk. This would incorporate additional risk aspects, relative to only default risk and systematic risk.

Net Present Value

Along with IRR, the NPV method is the most frequently used method for capital budgeting, especially by large firms. The concept is to estimate the current value of future cash flows by discounting estimated future values:

$$NPV(i, N) = -I + \sum_{t=0}^{N} \frac{CF_t}{(1 + i)^t}$$

In contrast to IRR, NPV yields absolute values, dependent on initial investment I and subsequent cash flows. The discount rate is independently estimated using various methods. Interestingly, (Graham & Harvey, 2001) discovered that close to half of all participants applied the NPV method inaccurately; specifically, they failed to differentiate discount rates, and thus applied company-wide discount rates on specific projects. In accordance, the results become biased because they do not represent the risk of the given project, such that the value can be either over- or undervalued.

The discount rate represents the cost of capital, meaning the cost of risk exposure and of time preferences. It is the minimum return expected of applied capital; hence, it is a benchmark. A discount rate can be obtained by several procedures, most commonly through the capital asset pricing model (CAPM), WACC, arithmetic average return and multi-beta CAPM. The objective is that the discount rate represents the alternative cost of the expenditure, which is the

best available investment in a market, given equal risk and duration. The most frequent used method is CAPM, which estimates the required return of expenditure and represents explicitly the cost of equity. As most projects consist of a composition of debt and equity, the method of WACC yields more concise estimates. The required return of debt is given by the risk-free rate and additional credit default risk, corrected by tax, as debt commonly is deductible:

$$(1)\ K_D = (r_f + Credit\ risk\ rate)(1 - T)$$

The CAPM accounts for the sensitivity to systematic risk and consists of risk free rate and beta multiplied with the risk premium, in which the last section represents the risk specific compensation:

$$(2)\ E(r_i) = r_f + \beta_i\big(E[r_m] - r_f\big)$$

Beta is an indicator of volatility of investment against the market, given by the covariance of the return on the asset and benchmark divided on the variance of the benchmark:

$$(3)\ \beta = \frac{Cov(r_a, r_b)}{Var(r_b)}$$

The two methods tend to yield different rates, with a higher discount rate on capital than on debt. WACC is the weighted average of the two above methods, given by the ratio of debt and equity:

$$(4)\ WACC = \frac{D}{K}K_d + \frac{E}{K}K_e$$

where K equals the sum of capital and debt, and K_d and K_e represent the cost of debt and capital, respectively.

Capital Structure

The irrelevance proposition of capital structure introduced by (Modigliani & Miller, 1958) has long been crucial in the field of corporate finance. In short, the proposition is that the capital structure used to finance investments is irrelevant, as earning power and underlying assets determine a firm's market value, which is independent of financing. Levered and unlevered firms operate under the same circumstances. The statements are only valid given an ideal

situation, following predefined assumptions (*no tax, no transaction costs, no bankruptcy cost, etc.*).

(Kraus & Litzenberger Robert, 1973; Myers & Majluf, 1984b; Scott James, 1977) and others established and developed the trade-off theory, balancing the benefits and disadvantage of debt. (Jensen & Meckling, 1976) introduced the agency theory, whereby managers serve as shareholders' agents and act in their best interest, distorted by imperfect alignment of interests. (Myers & Majluf, 1984b) introduced an extended version of the pecking order theory, describing the hierarchy of financing; internal finance, debt finance and equity issues as last resort. However, (Graham & Harvey, 2001) found that managers deem financial flexibility, credit rating, risks, insufficient funds, interest rates and tax savings as major determinants for the capital structure.
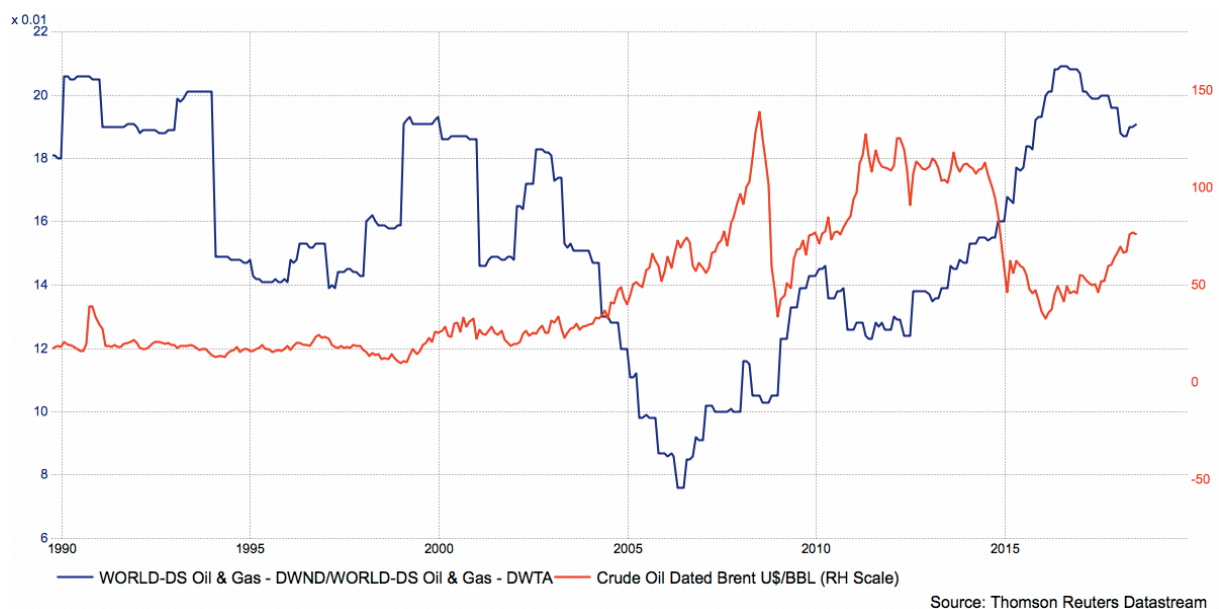
Figure 3: Aggregate industry leverage and oil price development

Financial flexibility refers to the ability to raise capital in times of need. Highly levered firms may have a hard time raising additional debt in times of distress, thereby limiting their possibilities of financing. Hence, managers may be reluctant to finance new investment through debt in good times, as a means to prepare for the foreseeable future. Credit rating is complementary to other theories of investment and revolves around to benefits and costs of downgrading or upgrading of credit rating (Kisgen, 2006). Coherent with the findings of (Graham & Harvey, 2001), the oil and gas industry reduces leverage in expansive periods and increases leverage in periods of recession, as shown in Figure 3.

Tobin's Q

Tobin's q is a measure of value creation in a company and is the measurement of the market value of equity and liabilities over the replacement cost, measured as the book value of equity and liabilities. Hence, there is a relative measure of over- and undervaluing. The interpretation suggests that firms with a *q*-value greater than 1 should invest more, as the market values added instruments greater than its price, and inversely for values beneath 1, which are interpreted as undervalued.

First introduced by (Kaldor, 1966) and later recognized by (Tobin & Brainard, 1976), the original approach has been subject to several modifications and approximations to improve ease of use and limiting needed variables. (Chung & Pruitt, 1994) created an approximation of (Lindenberg & Ross, 1981) modified *Q*, to improve availability of data (Hayashi, 1982).

Accruals

Accruals is an accounting measure of the quality of earnings, representing the alignment of earnings and the fundamental cash flow generating them. It follows that earnings have a direct impact on stock value and hence establish the motive of temporarily inflating earnings over cash flows. Large positive accruals indicate that earnings exceed the underlying cash flow. Accounting standards leave managers some discretion regarding timing and magnitude of costs and revenue, thereby enabling temporarily inflation.

(Chan, Chan, Jegadeesh, & Lakonishok, 2001) provided evidence that a broader set of financial statements may have rich predictive power for stock returns. They found a reliable negative association between accruals and future stock returns. Furthermore, they decomposed accruals into discretionary and nondiscretionary accruals. The discretionary component reflects managerial choice, while the nondiscretionary reflects impacts of business conditions. Accruals is measured as the change in non-cash current assets subtracted from the change in current liabilities and depreciation. All variables are scaled by total assets, as the items vary across the size of the firm's balance sheet.

Relevant Literature

The early empirical consensus of corporate investment and stock price regard the market value of capital as inadequate to analyse investment. Opposing the current consensus and q-model of investment, (Barro, 1990) showed that change in stock prices yields significant explanatory power for the growth rate of investment. The limited predictive power of q on investment follows as inaccurate measures of components of q, relative to stock market prices. He interpreted the predictive power of stock prices on investment as exogenous disturbances simultaneously accompanied by increased stock price and profits- and lagged expansion of corporate expenditure. An exogenous disturbance may be interpreted as increased prospect on the rate of return on capital.

(Blanchard, Rhee, & Summers, 1993) asked whether managers should consider market signals when considering investment decisions, even if the signals contradict the managers' perception of fundamentals—and if they did do. Their study builds on prior work on limited arbitrage, bubbles and fads (Shiller, 1980). Early perception of the stock market is that it follows firm's fundamentals. Aligned with this perception is the notion by (Bosworth, 1975) that managers should disregard market-driven signals and only respond to firm fundamentals. He suggests that managers should invest to the point where the marginal product of capital equals the risk-free rate, equivalently where q equates one. Contradicting this notion, (Blanchard et al., 1993) argued that disregarding market signals is viable only under a pair of strict assumptions: (1) the market only evaluates existing projects and (2) all shareholders are static. Stating that the assumptions are invalid—that firms share issues dependent on market perception and that shareholders may, at own discretion, realize capital gains—enables the proposition that market valuation is relevant for investment decisions.

By differentiating firms by the ease of raising equity, they propose that firms financing investments through retained earnings or debt issues should act based on their concern about investors. Investment decisions would eliminate, or reduce, the opportunity to issue dividends, rendering investor return solely dependent on realization of stock. Hence, managers should consider the shareholder horizon and, the degree of mispricing with its estimated reversion pace. They conclude that market valuation composes a limited role in determining investment decisions, based on aggregate data.

On an opposing extreme, (Fischer & Merton, 1984) argued that investment decisions should exclusively comply with stock market valuation, disregarding managers' valuation and invest and issue shares to the point where q equals one. This maximizes existing shareholder wealth. (Gilchrist & Himmelberg, 1995) studied models of capital imperfections to determine the extent to which cash flow possesses predictive power on investment decisions. Models of finance market imperfections built on a propagation mechanism- contractionary shocks reduces firm value thus, deteriorate credit conditions which in turn reduces investment expenditure (S. M. Fazzari, R. G. Hubbard, & B. C. Petersen, 1988). Presenting evidence supporting (S. Fazzari, R. G. Hubbard, & B. Petersen, 1988) the effect of cash flow on investment. By differentiating firms based on credit availability, public and private firms find that the effect is stronger for firms with restricted access to credit, such as private companies.

In contrast to (Modigliani & Miller, 1958) is the traditionally efficient capital markets. (Baker & A. Wurgler, 2002) provide empirical evidence disregarding 'the efficient market'. They presented evidence of robust and persistent effects of previous market valuation and capital structure. This supports the conception that the capital structure is, to some extent, conditional on temporarily fluctuations in market valuation because stochastic fluctuations can permanently change capital structure. This in turn introduces the theory of capital structure as result of cumulative timing attempts. As they considered their findings incoherent with existing theories; Trade-off theory anticipates that temporary disturbance has temporary effects, while their findings indicated enduring effects. (Myers & Majluf, 1984b) introduced the pecking order theory, which suggested increased investment over a course advances leverage. As the hierarchy ranks external debt financing second to internal capital, subsequent external equity. Disregarding the theory of managerial entrenchment by referring to studies of earnings management suggesting exploitation of new, rather than existing investors.

Confronting the traditional notion of the correlation between investment and stock prices, stock prices soundly display the marginal product of capital (Tobin, 1969). (Baker, Stein, & Wurgler, 2003) suggested that the level of equity dependence determines the sensitivity of investment to stock prices. Contributing to the field of inefficient markets, limited arbitrage and irrational investors, (Baker & Stein, 2004) developed a simplistic model representing the notion of market liquidity as a sentiment indicator. Their model is limited by two strict assumptions: (1) short-sale constraints and sentiment-sensitive investors are more inclined to underreact to certain

news. Their model predicts decreased consecutive returns due to increase in current market liquidity.

Attempting to determine the stock markets effect on the real economy, (Morck, Shleifer, & Vishny, 1990) estimated the effect the stock market has on investments. They proposed four theories in explaining the observed correlation between stock market returns and investment: (1) the stock market is a passive predictor of future activity, disregarded by the managers regarding investment decisions, (2) managers rely on stock market information, which yields little certain information about future activity, (3) the stock market influences investment through the cost of external capital and (4) managers cater to investors' perceptions to protect themselves. In general, if the stock market is not solely driven by fundamentals, then some aspects may be explained by investor sentiment. To enable this notion that investor sentiment yields real economic consequences. Given that the less rational beliefs are correlated across sentiment investors, else the effect cancels out. They found evidence rejecting the notion that the correlation between stock market and investment is driven by the cost of external capital. They also presented evidence that stock market pressure managers may be reactions to imperfect measures of firm fundamentals but not a dominant force. They conclude that the stock market is neither a sideshow nor central to aggregate real economic activity. Lastly, they deemed the passive view of the stock market and investment as the most prominent explanation.

(Baker & Wurgler, 2007) stated that it is no longer a question of investor sentiment, sooner a question of how to measure and quantify its extent. Departing from the classical financial model in which unemotional investors drive stock prices to equate rational present value of anticipated prospective cash flows, (Baker & Wurgler, 2007) modelled a top-down, macroeconomic approach of measuring investor sentiment. They found that stock prices in which it is difficult to arbitrage, or value, are most touched by investor sentiment.

(Jenter, 2005) provided evidence of top managers' opposing perspectives of firm value, showing that valuation diverging from the mean oppose managers perception of firm value. Low valuation firms are perceived by managers as undervalued and inversely for high valuation firms. Supporting the notion that perceived mispricing is an influential determinant for managers' decision making. Contributing to research on the effects of stock market valuation on firm decisions, (Polk & Sapienza, 2009) studied the link between mispricing and investment decisions as a catering question. Valuation diverges from fundamentals influence the propensity to advance short-run stock prices, which implies that managers of overvalued firms cater to

investor sentiment by increased investment. The propensity to cater is determined by shareholder horizon: short shareholder horizon increases the propensity to cater towards short-run advances in stock prices. They interoperate their results as short-horizon managers, temporarily distorting firm investment favouring investor sentiment and, hence misallocating resources.

Method

This section covers the approach used to analyse the problem statement and hypothesis. Attempting to address the possible presence of a catering channel of investment and, how it may affect oil and gas firms' investment decisions. In short, the applied approach utilizes a dynamic panel data estimator in order to estimate time-variant catering propensity.

Model

To test whether 'investment catering' to investor sentiment is a pragmatic issue, this thesis follow the approach by (Polk & Sapienza, 2009), which follows (Stein, 1996) alternative models of capital budgeting. Departing from the "perfect" world with perfect correlation between the expected return and the asset's fundamental economic risk (Stein, 1996) introduced two models where investors make systematic errors in estimating the expected return. Consequently, assets can become significantly over- and undervalued. The two suggested models are the *NEER-approach* and the *FAR-approach*, which differs in horizon and constraints.

The model[6] is an intertemporal model where firms utilize capital to produce output, where the capital is continuous and homogenous with the price. Thus, the true value of the firm is its fundamental value, given by V(K). The market value of the firm is measured as the fundamental value multiplied with a mispricing variable, α: $V^{MKT}(K) = (1 + \alpha_t)V(K)$. Mispricing is disappearing at rate p, $\alpha_t = \alpha e^{pt}$. Assuming that shareholders', denoted j, liquidity demand follows a Poisson process with mean arrival rate $q_j \in [0, \infty]$. The relative horizon is short if the value of q is large and, inversely for long-term investors. The expected utility for shareholder j at time zero is given by

$$(5)\ Y_j^t \equiv \int_{u=0}^{\infty} (1 + \alpha e^{-pt})\, q_j e^{q_j t} V(K) dt - (K - K_0)c.$$

Shareholder' expected return is the weighted average of the share price before and after reversion. Hence, the return depends on the reversion rate of mispricing- the duration of the liquidity shock. Following the NEER approach, managers seek to optimize short-term stock price, the first order condition of the maximization problem is:

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[6] This model is identical to the model presented in (Polk & Sapienza, 2009), its presented in this thesis to portray the narrative of investment catering. See (Polk & Sapienza, 2004, 2009) for comprehensive presentation.

$$(6) \quad V'(K) = \frac{c}{\frac{\alpha q}{q + p}}$$

The optimal investment level, in a "perfect" world- absent of mispricing, is the point where the marginal product of fundamentals equates the cost. In an imperfect market with mispricing, managers over- or underinvest at the extent of mispricing- positive mispricing implies that the manager will invest more than the optimum in the benchmark scenario, regardless to the net present value of the investment. Mispricing of investment, symmetric to that of the firm, works as compensation for inefficient investments. As the magnitude of mispricing depends on the reversion rate and investor sentiment, the managers become more inclined to invest as the reversion rate increases and the sentiment is short-term. And, inversely for undervalued firms.

In sum, this model concerns how existence of non-fundamental disruptions in stock prices influence corporate investment. Thus, presuming market inefficiency, a market characterized by imperfect arbitrage that enables over-and undervaluation. Modelling the assumption of rational managers and less-than-rational investors- managers are assumed to distinguish fundamentals from mispricing, and exercise choice as stimulus or reaction to mispricing. The assumption of rational investors is substantiated on certain premises;
1) managers possess superior information respecting their individual firm and, given some degree of discretion, the ability to produce informative advantages by administrating earnings.
2) Managers are less constrained than comparable portfolio managers. 3) Intuitive guidelines of identifying mispricing. (Baker et al., 2004).

The base equation is a linear model of firm investment, inspired by the specifications of (Polk & Sapienza, 2009), who regress firm investment on discretionary accruals, proxy for Tobin's Q and firm cash flow, while controlling for firm- and year fixed effects.
The use of Q in investment regressions is debated, as it exhibits shortcomings regarding validity and explanatory power, (Erickson & Whited Toni, 2008). As an alternative approach, (S. Fazzari et al., 1988) used the Euler equation to portray individual firms' optimal capital structure to a model of investment. In short, the Euler equations remains valid for firm's not characterized by financial constraints (Hubbard, Kashyap, & Whited, 1995; Whited, 1992). Another departure, attempting to capture market imperfections employ alternative measures of investment fundamentals substituting Q, as the VAR forecast equations estimated by (Gilchrist & Himmelberg, 1995). To control for the shortcomings of Q and control for effects other than the catering channel, additional control variables will be included in the model, following the

intuition of (Polk & Sapienza, 2009). Controlling for issuance of preferred and common stock as to remove the equity issuance channel (Baker et al., 2003).

$$(7) \quad \frac{I_{i,t}}{K_{i,t-1}} = \alpha + \beta_0 \frac{I_{i,t-1}}{K_{i,t-2}} + \beta_1 DACCR_{i,t} + \beta_2 Q_{i,t-1} + \beta_3 \frac{CF_{i,t}}{K_{i,t-1}} + f_i + \gamma_t + v_{i,t}$$

The dependent variable is the ratio of investment, where I is investment, measured as capital expenditure and, K is capital measured as property, plant and equipment at fiscal start. The proxy for mispricing is $DACCR$ and, the proxy for investment opportunities, Q is measured at fiscal start, to ensure that the model captures information not contained in Q, see (S. Fazzari et al., 1988). Cash flow, CF is measured as net income before extreme events and depreciation, scaled over capital, K at fiscal start. The model controls for firm- and year fixed effect. Following the notion of (Johnsen & Green, 2016; Mohn & Misund, 2008, 2009), that long-term characteristics of investments in the oil industry, and the scope of the data, induces serial correlation in the idiosyncratic error term hence, which is removed by transforming the equation to a first order autoregressive model. Assuming that the error term follows an AR (1) process: $v_{i,t} = \rho v_{i,t-1} + \varphi_{i,t}$, where $\varphi_{i,t}$ is white noise, the transformed first order autoregressive model is:

$$(8) \quad \frac{I_{i,t}}{K_{i,t-1}} = (1-\rho)\alpha + \beta_0 \frac{I_{i,t-1}}{K_{i,t-2}} + \rho\beta_0 \frac{I_{i,t-2}}{K_{i,t-3}} + \beta_1 DACCR_{i,t} - \rho\beta_1 DACCR_{i,t-1} + \beta_2 Q_{i,t-1} -$$
$$\rho\beta_2 Q_{i,t-2} + \beta_3 \frac{CF_{i,t}}{K_{i,t-1}} - \rho\beta_3 \frac{CF_{i,t-1}}{K_{i,t-2}} + (1-\rho)f_i + \gamma_t - \rho\gamma_{t-1} + \varphi_{i,t}$$

Simplifying for econometric purposes:

$$(9) \quad \frac{I_{i,t}}{K_{i,t-1}} = \alpha + \beta_0 \frac{I_{i,t-1}}{K_{i,t-2}} + \beta_1 \frac{I_{i,t-2}}{K_{i,t-3}} + \beta_2 DACCR_{i,t} - \beta_3 DACCR_{i,t-1} + \beta_4 Q_{i,t-1} - \beta_5 Q_{i,t-2} +$$
$$\beta_6 \frac{CF_{i,t}}{K_{i,t-1}} - \beta_7 \frac{CF_{i,t-1}}{K_{i,t-2}} + (1-\rho)f_i + \gamma_t - \rho\gamma_{t-1} + \varphi_{i,t}$$

Year fixed effects is captured through year-dummies, corresponding to the respective year. To capture the catering effect on investments, a control variable for equity issuance is added.

Variables	Mean	Median	Standard Deviation	Minimum	Maximum	Observations
$\frac{I_{i,t}}{K_{i,t-1}}$	0,270	0,109	0,738	0,000	9,94	6974
$DACCR_{i,t}$	-0,029	-0,020	0,122	-1,400	1,36	3882
$Q_{i,t-1}$	1,787	1,556	0,990	0,000	9,91	6756
$\frac{CF_{i,t}}{K_{i,t-1}}$	0,348	0,154	0,791	0,002	8,96	6863
$A_{i,t}$	8893	724	32986	0	411275	7977
$S_{i,t}$	7546	387	33899	0	475794	7792
$L_{i,t}$	879	57	3218	0	48242	7726
$\frac{EQUISS_{i,t}}{K_{i,t-1}}$	0,142	0,080	0,578	-7,645	13,46	5861
$(BE/ME)_{i,t}$	3,661	0,735	56,506	0,000	2705	7233

Table 1: Descriptive Statistics

Investment, *I* is capital expenditure in current fiscal year. Capital, *K* is property, plant and equipment reported in previous fiscal year. The dependent variable is the ratio of investment to capital. Cash flow, *CF* is measured as net income before extraordinary items and depreciation, scaled by capital, *K. EQUISS* is measured as the five-year logarithmic change in market value of equity, subtracted five-year total return. Accruals is measured as change in non-cash current assets minus change in current liabilities minus depreciation, all scaled by capital. The non-discretionary element of accruals is measured as five year moving average of accruals divided by the five-year moving average of sales, scaled by current fiscal year sales. Sales, *S* is firm revenue. Discretionary accruals are the difference between accruals and non-discretionary accruals. Tobin's Q is measured as market value of assets divided on book value of assets. Firms' market value of assets equal book value of assets and the market value of common stock subtracted the book value of common stock and deferred tax liabilities. Abnormal investment is measured as the difference between equally weighted market-book ratio for firms in 1th and 5th quintile of capital expenditure, measured by year *t* and subindustry.

Estimator

The choice of estimator lies within the field of dynamic panel data estimators, as they were assumed more fitting of the scenario in which this study estimates.

Dynamic Panel Data Estimators

Social science is the study of the relationships amidst individuals in the society, in which economics is a subfield, defined *as "The science which studies human behaviour as a relation between scare means having alternative uses"* by (Robbins, [1932] 2007). As its fair to assume the nature of behaviour in such setting exhibits dynamic characteristics. Dynamic panel data possess advantage over cross-section data in that it can capture the time-varying dynamics, hence utilize more information to create more nuanced pictures of society. As to aggregate timeseries models which is exposed to aggregation bias- the ecological fallacy of assuming that

which holds for a group holds for an individual (Greenland & Robins, 1994). Dynamic panel data offers adjustment in dynamics so to differentiate observations.

Dynamic panel data is usually utilized in cases of unobserved heterogeneity- assumed present in the population in this study- synonymic to endogeneity. These traits can come from omitted variables, measurement errors and simultaneity. As strict exogeneity is a fundamental assumption to classic linear estimators, these will be biased- or inefficient with dynamic panel data.

Fixed effect models are suited for panel data suffering from heterogeneity, however not suited for autocorrelated error processes. Moreover, one-way fixed effect models suffers from negative bias- underestimating the persistence of the dependent variable, consequently to the Nickell's Bias (Nickell, 1981), establishing a correlation between regressor and dependent variable that earlier did not exists. Making the dependent variable endogenous. The modelled equation in this thesis presumably contain both time invariant- and fixed effects. Moreover, (Barro, 1990) illustrates that the downward bias is not induced by an autocorrelated error process, however such process would make the bias more unsparing. As equation (9) presumably contains an autocorrelated error process, makes fixed effects models disadvantageous, given the assumptions of the modelled equation. Nevertheless, (Anderson & Hsiao, 1981) developed an approach, The Anderson-Hsiao estimator, taking the first differences which removes the individual effect and the constant term, enabling instrumental variable estimators which is effective for endogenous covariates. The prime assumption is that the dependent variable is predetermined- uncorrelated with future noise.

Generalized Moments Method is an instrumental variable estimator and an alternative approach in obtaining asymptotically efficient estimators. The standard GMM approach by (Hansen, 1982) is expanded by several adaptions. The First-Differenced GMM approach by (Arellano & Bond, 1991; Holtz-Eakin, Newey, & Rosen, 1988) is designed to handle autoregressive processes, using moment conditions from the estimated first differences of the error term, subsisting two versions; one- and two step approaches. Where the usage depends on the properties of the data set, the one-step approach provides efficient estimates under the assumption of homogeneity, while the two-step approach provides robust estimators under heterogeneity, given the T. Windmeijer correction (Windmeijer, 2005) which decreases bias and improves the asymptotic standard errors . System GMM augments difference GMM by estimating simultaneously in differences and levels. The disadvantage of FDGMM is that it

increases the gaps in unbalanced panel data, as available instruments decreases with number of lags. Moreover, SYSGMM utilize and differentiate between difference- and level equation, thus enabling more moments, hence improving efficiency. In sum, scenarios exhibiting dynamic processes, fixed- and individual effects, are appropriate for either system- or difference GMM. For instance, the extensive scope of investment projects in the oil and gas industry may induce endogeneity and serial correlation. As the population is diverse, it is fear to assume individual- and period fixed effects, as country specific time-invariant effects. See, (Roodman, 2006, 2008) for an in depth representation.

Investment-capital ratio is the dependent variable and presumed linearly depend on its own past values and, a stochastic error term- treated as endogenous, correlated both past and present with the idiosyncratic error and own values. As consequence of a quota sample encompassing diverse representatives and, the limiting nature of the model, the variable is presumed to suffer heteroscedasticity, captured by the individual specific error component.

In order to make the variables comparable, both dependent- and independent variable is scaled- or measured in some sort by firm capital. In order to preserve efficient estimates of coefficients (too many instruments), capital is presumed to be relatively inelastic in the short run, as it is presumed a function of accumulated capital expenditure- not correlated with current or past (short-run) errors. Conversely, if capital was presumed to be correlated with current and past errors, the vast majority of variables would be utilized as instrument, reducing efficiency of estimates, inflating coefficients (Roodman, 2008). In the following arguments, the above notion is taken for granted.

The dependent variable, Investment, is assumed heterogenous in individual error component, as the analysis departs the efficient market theorem. This is to say that the investment level may be influenced by biased managers. This interpretation is assumed valid as the time horizon in question is relatively small, and managers are presumed to stay in position over the period in question. Similar, following inefficient market theories, the market value of a firm is assumed to be influenced by less than rational external beliefs, and internal reactions. Moreover, the model presuppose that the stock price is established on global basis, where investors are indifferent to the underlying activity, caring only for expected future return. Implying endogenous stock price. The construction of normal accruals is assumed to remove any correlation with the error. However, the discretionary component is assumed endogenous as its

interpreted as a short-term distortion, a reaction to current elements included in the idiosyncratic error term. Period-specific errors are captured by period-dummies.

Data

The screening process was conducted in Thomson Reuters Eikon, Screener. The data is derived from Thomson Reuters Eikon. Thomson Reuters is, among other things, a financial data vendor which offers extensive data access. The access to this service was provided by the library at the University of Stavanger.

Population

The population in question is the oil and gas industry, in this thesis defined following the Global Industry Classification Standard, GICS. The population is defined by the energy sector- and industry group, overreaching the energy, equipment and service industry and the oil, gas and consumable fuels industry. In total encompassing seven sub-industries, in which coal and consumable fuels is excluded, (MSCI, 2018). The first screen generated a sample of 1 872. To ensure comparability, only firms with fiscal year end the 31.12 where included, reducing the sample to 1325. Third, to firms with negative capital and-/or assets were excluded, leaving a sample of 464 firms.

Subindustry	Mean	Maximum	Minimum	Standard Deviation	25th	50th	75th	Frequency
Integrated Oil &Gas	110357	407097	200	118831	21265	59699	227347	32
Oil & Gas Storage	10617	128880	19	21559	735	2811	8092	69
Oil & Gas Exploration	4821	94865	0	11792	64	546	3762	176
Oil & Gas Drilling	4567	22410	97	5713	767	2352	6251	21
Oil & Gas Refining	4361	50158	15	7726	268	924	5802	72
Oil & Gas Equipment	3960	71987	6	10107	174	952	2850	94

Table 2 Summary statistics of firms, subindustry and total assets reported. All numbers are in 10 million USD$.

All data is measured in USD$, and fundamental data is reported after the US GAAP Standard, so to ensure comparability. As the data was extracted individually, a non-insignificant element of the data process is related to cleaning and sorting the data. The extraction was executed in two-steps: downloaded to Microsoft Excel and thereafter, STATA. The cleaning and sorting process were done manually in STATA in multiple steps. First, importing to STATA and reformatting the data. Second, sorting and grouping variables based on their respective cases. Third, preliminary data analysis concerning the characteristics of the data. Fourth, combining all data in a merged dataset, containing all relevant variables. Lastly, all variables requiring calculations were computed in STATA. The end result is a strongly balanced panel data set, reported in table 3. Out of the aggregate population of active- and inactive public- and private oil and gas related companies were approximately 25 percent

included in the panel data. Hence, the sample under consideration can be classified as a quota sample, where the quotas was based on attributes restricting- or complicate the analysis.

Period	Freq.	Percent	Cum.
2000	466	5.56	5.56
2001	466	5.56	11.11
2002	466	5.56	16.67
2003	466	5.56	22.22
2004	466	5.56	27.78
2005	466	5.56	33.33
2006	466	5.56	38.89
2007	466	5.56	44.44
2008	466	5.56	50.00
2009	466	5.56	55.56
2010	466	5.56	61.11
2011	466	5.56	66.67
2012	466	5.56	72.22
2013	466	5.56	77.78
2014	466	5.56	83.33
2015	466	5.56	88.89
2016	466	5.56	94.44
2017	466	5.56	100.00
Total	8,388	100.00	

Table 3: Panel data Structure

The calculation of the variables reduced the effective population, as certain variables contain running averages, while other are composed of a subset of variables, which not always was present. This is shown in Table 4, the maximum of observation utilized in the analysis is 5513, approximately 65 % of the panel data. Additionally, lagging the variable reduced the entire set by one period.

Results

As all variables to some degree rely on firms' capital, its assumed exogenous so to reduce the instrument count. The presumption is that capital is the result of an accumulated process thus relatively linear in the short run, represented in the data. Given the notion of extensive duration of investment projects in the oil and gas industry, the dependent variable is treated as an endogenous variable- dependent of own current and past investment levels and an idiosyncratic error term. Furthermore, firm investment is presumed to contain unobserved fixed effects omitted in the model, such as industry- and country fixed effects. In the same manner, discretionary accruals are treated as a predetermined regressor, as investment decisions are initiated at firm level. Seeing as investor sentiment and managers' respective reaction is hard to model, a non-insignificant aspect of discretionary accruals is inferentially contained in current and lagged values of the idiosyncratic risk. In particular, discretionary accruals is considered to quantify a reaction- not proactive decision.

With reference to (Polk & Sapienza, 2009), the proxy for investment opportunities, Tobin's Q is treated as a predetermined regressor. Specifically, Tobin's Q assumes long-run market equilibrium where the stock price equates the prospective replacement cost of firms' assets. Due to complexity of correctly modelling the replacement cost and, that the modelled scenario presumes market imperfections, Tobin's Q is presumed predetermined. Likewise, firms' cash flow is assumed correlated with past idiosyncratic errors- outcome of past shocks. Equity issue is modelled strictly exogenous due to the nature of its construction[7]. Time-specific errors is captured through period-dummies. To avoid instrument proliferation, some specifications utilize principal component analysis[8]. In brief, this chapter covers the study of investment and market imperfections- the time varying catering effects on investment- through two step system GMM with Windmeijer correction, instrumented by principal component analysis.

Table 4, column (1) present the results of the base regression (9) unaccounted for discretionary accruals. Under the present circumstances included in the model, controlling for investment opportunity, the coefficient of lagged level of investment-ratio is significant at a five percent level. Implying that initiated investment projects command continuing commitment, consistent with the notion of long-run investment commitments. Coherent with past research on cash flow

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[7] Equity issuance is measured as the five-year log-change in market value subtracted five-year log stock return.
[8] PCA is an approach to reduce the number of moment conditions in GMM, exploiting PCA scores as instruments for the panel data.

sensitivity[9], current cash flow is a significant explanatory element of firm investment. Even so, the cash flow coefficient may be ambiguous as it may suffer from multicollinearity, following the drastic decrease in magnitude when controlling for mispricing. Subsequent estimates of cash flow coefficient are more aligned with results from similar studies[10].

Variables	(1)	(2)	(3)	(4)	(5)
$\frac{I_{i,t-1}}{K_{i,t-2}}$	0.229**	0.364***	0.397***	0.436***	0.355**
	(0.0155)	(6.10e-06)	(3.41e-06)	(0.00638)	(0.0458)
$Q_{i,t-1}$	-0.246	-0.0610	-0.0586	-0.0632	-0.0399
	(0.325)	(0.213)	(0.306)	(0.146)	(0.202)
$Q_{i,t-2}$	0.0457	0.0687	0.0593	0.0878	0.112
	(0.711)	(0.164)	(0.299)	(0.173)	(0.150)
$\frac{CF_{i,t-1}}{K_{i,t-2}}$	0.293***	0.163**	0.156**	0.117***	0.112***
	(0.000)	(0.0466)	(0.0365)	(8.43e-06)	(1.96e-06)
$\frac{CF_{i,t}}{K_{i,t-1}}$	-0.157	-0.122	-0.115	-0.1623	-0.0760
	(0.216)	(0.163)	(0.170)	(0.231)	(0.220)
$DACCR_{i,t}$		-0.114	-0.112	-0.177	-0.129
		(0.785)	(0.781)	(0.337)	(0.383)
$DACCR_{i,t-2}$		0.366**	0.258**	0.332**	0.207*
		(0.0394)	(0.0161)	(0.0445)	(0.0878)
$\frac{EQUISS_{i,t}}{K_{i,t-1}}$			0.0503*	0.0666***	0.0785**
			(0.0696)	(0.00553)	(0.0204)
$\frac{EQUISS_{i,t-1}}{K_{i,t-2}}$			-0.0799**	-0.0766**	-0.0672**
			(0.0216)	(0.0338)	(0.0273)
Observations	5513	1970	1911	1,911	1,911
Number of firms	434	246	241	241	241
R-squared				0.480	0.361
Instruments	426	213	210		
Hansen J	431.34	225,86	212,08		
	(0.167)	-0,164	0,13		
AR(1)	0.153	0,148	0,151		
AR(2)	0.498	0,764	0,829		
Wald	118.91***	244,33***	234,26		
	(0.000)	(0.000)	0		
Portion of variance explained		0,897	0,898		
Kaiser-Meyer-Olkin measure		0,955	0,954		

Table 4: The estimation is conducted in STATA, column (1) (3) follows a two-step system GMM Approach while (4) and (5) respectively represent Clustered OLS and Fixed effects estimators. All regression contains year-dummies. * p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parenthesis

Including the mispricing regressor, discretionary accruals (2), reduces the magnitude of the cash flow coefficient and, increases the magnitude of lagged investment levels. Insinuating that firms with degraded earnings quality invest more, than the frame work in (1) would suggest. Moreover, the shift in cash flow magnitude may suggest that, in presence of overvaluation that firms focus more on short-term distortions by boosting stock price through exaggerated

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[9] See (Gilchrist & Himmelberg, 1995; Hovakimian & Hovakimian, 2009; Lamont, 1997)

investments. However, only the lagged component of discretionary accruals is significant. This could be interpreted as perceived intermediate duration of mispricing and, moderate reaction time. A plausible interpretation is that managers do not operate under complete discretion[11]. To account for the equity channels impact on investment (Baker et al., 2003), Column (3) include a control for funds from issuance of stock , $\frac{EQUISS_{i,t}}{K_{i,t-1}}$. Both current and lagged values are significant, but with contrasting signs. Current equity issue influences investment positive, coherent with (Baker et al., 2003). Inversely, the negative lagged coefficient suggests limits of equity issuance, current issuance induce subsequent issuance constraints. A possible explanation is that managers are averse to dilution of current stock, as reported in (Graham & Harvey, 2001).

Columns (5) and (6) reports the benchmark models, clustered OLS- and the fixed effect estimators. Their limited efficiency follows Nickell's Bias and an autocorrelated error process. For POLS to be efficient, the model needs to be subordinate to a set of strict assumptions, in which is often not achievable with panel data, without adjustments. Failing to account for the assumptions render POLS inefficient and, consequently inducing persistently upwards biased coefficients. Alternatively, if the model exhibits time invariant effects, estimators can be estimated using a fixed effect estimator, inverse to POLS the estimated coefficient within FE will be persistently downward biased. However, due to the nature of the biases, the two model can provide a frame work presenting an efficient interval for coefficients. On average, the coefficients presented in column (3) contains values within the interval represented by column (5) and (6).

Column (4) report the result of equation (9) under a component restriction in combination with principle component analysis. In sum, the restriction increased the effectiveness of the estimates.

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[11] (Finkelstein & Hambrick, 1990; Stulz, 1990; Williamson, 1963) study the effect of managerial discretion on firm decisions, the agency cost of managerial discretion. Stulz propose that managerial discretion induces two costs related to over- and underinvestment.

Table (6) reports the estimated sensitivity of future stock returns to discretionary accruals, controlling for investment opportunity cash flow and funds from equity issues. Column (1) reports estimated sensitivity of total return in current year, column (2) reports the estimates for total return $t+1$, column (2) and (3) respectively report estimates for total return for quarter $t+1$ and $t+2$. The investment capital ratio in current year is significant, interpreted as market reaction to perceived firm investment. In this specification, the proxy for investment opportunities, Tobin's Q is positive and significant. Contrary to literature on mispricing and future stock return, the proxy for mispricing is positive and significant in both specification (1) and (2). This unexpected returns may be related to the sample in question and, number of observations and time period of analysis. (Polk & Sapienza, 2009) utilized a sample covering the period between 1963-2000, containing more than 31 659 observations of discretionary accruals. Conversely, the sample in question covers the period between 2000-2017 and only the firms within the petroleum industry. Furthermore, the choice of estimator reduced the sample four years, making the effective range 2004-2017. Additionally, their regression on investment and future stock return differs from the estimation conducted in this thesis. However, granted the population and horizon, it is plausible that earnings quality is not as clearly identified. Opposed to other industries, the oil and gas industry is heavily commodity dependent, as illustrated in (z). Thus, it is plausible that the aggregate short-run perception of the industry is more sensitive to fluctuations in the oil price.

Variables	(1)	(2)	(3)	(4)	(5)
$(ME/BE)_{H,t}-(ME/BE)$					0.155**
					(0.0364)
$R_{i,t-1}$		0.232	0.232	0.198	-0.114
		(0.139)	(0.287)	(0.183)	(0.395)
$R_{i,t}$	0.0320				
	(0.650)				
$\dfrac{I_{i,t}}{K_{i,t-1}}$	0.105**	0.150	0.275	0.288*	-0.106
	(0.0277)	(0.672)	(0.516)	(0.0660)	(0.589)
$\dfrac{I_{i,t-1}}{K_{i,t-2}}$	0.0488	-0.0164	-0.136	-0.292	-0.117
	(0.794)	(0.942)	(0.516)	(0.172)	(0.224)
$Q_{i,t-1}$	0.074***	-0.327	0.00917	-0.0878	0.0817
	(0.000810)	(0.213)	(0.968)	(0.629)	(0.556)
$Q_{i,t-2}$	-0.104***	0.196	-0.00617	0.149	-0.257**
	(0.00184)	(0.129)	(0.977)	(0.320)	(0.0247)
$\dfrac{CF_{i,t}}{K_{i,t-1}}$	-0.175	-0.0553	-0.245	-0.103*	0.366***
	(0.223)	(0.825)	(0.636)	(0.0959)	(0.00503)
$\dfrac{CF_{i,t-1}}{K_{i,t-2}}$	0.0427	-0.0423	0.225	0.243	-0.0865
	(0.740)	(0.840)	(0.596)	(0.177)	(0.494)
$DACCR_{i,t}$	0.172***	0.263***	0.314	0.208	0.324
	(3.59e-06)	(0.00385)	(0.212)	(0.403)	(0.460)
$DACCR_{i,t-2}$	0.0955	0.118***	0.201***	0.210	0.0705
	(0.570)	(0.00851)	(0.000842)	(0.112)	(0.822)
$\dfrac{EQUISS_{i,t}}{K_{i,t-1}}$	-0.054***	0.0172	0.147	-0.00987	-0.0905
	(4.87e-08)	(0.859)	(0.363)	(0.932)	(0.547)
$\dfrac{EQUISS_{i,t-1}}{K_{i,t-2}}$	0.383***	-0.00573	-0.145	0.0533	0.0761
	(3.33e-08)	(0.949)	(0.400)	(0.585)	(0.597)
Observations	1,910	1,762	416	1,346	283
Number of firms	241	236	161	230	113
Instruments	65	57	55	57	91
Hansen J	56	47	45	47	82
	0.219	0.333	0.471	0.112	0.541
AR(1)	0.000	0.000	0.000	0.000	0.00944
AR(2)	0.112	0.227	0.224	0.538	0.960
Wald	1319	43.72	76.42	37.02	41845
	0.000	0.000	0.000	0.000	0.000
Portion of variance explained	0.946	0.945	0.954	0.946	0.682
Kaiser-Meyer-Olkin measure	0.987	0.987	0.950	0.985	0.944

Table 5: The estimation is conducted in STATA, following the same specifications as the above table. All regression contains year-dummies. * p < 0.10, ** p < 0.05, *** p < 0.01. P-values in parenthesis.

Column (5) includes a proxy for investment premium. The concept is to capture the effect of abnormal investment on the stock price. Abnormal investment is conceptualized as the difference between the price-book ratio of the highest and lowest investment quintiles. Investment quintiles is measured individually for each firm by period t and the sub-industries. Followingly, for each period t, there is reported six different investment premiums, representing the industry. The difference in price-book is measured as the difference between equally weighted *P/B*-portfolios. The top and bottom quintile portfolios is measured as the weighted average of all *P/B*-ratios recorded in their respective quintile. The estimates are reported in table

(5), with regard to period and sub-industry. The estimated coefficient for investment premium is positive and statistically significant at a 5 percent level. Under said specification, the coefficient for cashflow t, exhibits significant change, relative to the levels in specification (1) too (4). As the investment premium is only measured for the top quintile, the number of viable observations drastically diminishes. One reason might be misspecified specification, which (Roodman, 2006) argues is one disadvantage with system and difference GMM, *"They are complicated and can easily generate invalid estimates"* .

Period	Integrated Oil & Gas	Oil & Gas Drilling	Oil & Gas Equiptment and Service	Oil & Gas Exploration	Oil & Gas Refining	Oil & Gas Storage
2000	.091177	.3678638	.2570834	.5358331	.1469925	.1696527
2001	.1176098	.3185488	.2256521	.5189822	.1362381	.1712017
2002	.1169093	.1872868	.2266318	.4722766	.151289	.2004029
2003	.1237462	.1522227	.2450103	.4445352	.1327927	.1540367
2004	.1185784	.1841016	.2070685	.4471661	.1756696	.1798923
2005	.1171888	.3978899	.2425572	.4375338	.1399868	.2807794
2006	.1166639	.203331	.2925071	.3979391	.1253202	.2304185
2007	.1406863	.1858421	.2327553	.4184203	.1789423	.1974493
2008	.1590273	.2193426	.2278213	.4195092	.176327	.1775895
2009	.125721	.1672508	.172391	.28999	.1397658	.1521412
2010	.1357302	.1629643	.188121	.2973233	.1130537	.2025341
2011	.1376316	.1842433	.2115124	.3638853	.1267686	.1161463
2012	.1315375	.1958502	.1941786	.5090637	.164216	.1421003
2013	.1222276	.1199949	.1801578	.305275	.1051178	.243292
2014	.1222525	.2147545	.1835805	.3327307	.1051177	.2637835
2015	.1059309	.147223	.162006	.3726885	.0864924	.240499
2016	.0974432	.0616353	.0932795	.1850166	.0842114	.1544769
2017	.0816499	.0934296	.1245137	.2622146	.097836	.1689027

Table 6: Investment premium by industry and period

Interpretation and Discussion

The analysis builds on a model of investment, regressing investment on a proxy for mispricing, Tobin's Q and cash flow. Throughout Panel (x), which gradually expands the frame work specification, the coefficient for cash flow remain positive and statistically significant. Similar to (Gilchrist & Himmelberg, 1995), these results can be interpreted as a suggestion of market imperfections, hence disregarding the notion of irrelevance to capital structure (Modigliani & Miller, 1958). Regarding the propagation mechanism[12], figure (4) reports EBIT and Capital expenditure, in which capital expenditure is a lagged effect to earnings, consistent with the notion of as a financial accelerator. In sum, the results regarding cash flow and investment fits the recent development in the petroleum industry, following the oil crisis of 2014.

Discretionary accruals are the measure of mispricing, measured as the accounting difference between reported earnings and the fundamental cash flow, earning quality. The lagged coefficient is positive and statistically significant throughout the specifications in panel (4). These results is consistent with (Polk & Sapienza, 2009), implying that soft-earning-firms are more inclined towards investment than comparable firms. However, only the lagged coefficient is significant, in which may suggest presence of limited managerial discretion and time-extensive nature of initiating investment projects. One implication regarding the efficiency of coefficient estimates of DACCR is the possible multicollinearity with Q, as Tobin's Q assumes market efficiency hence, elements of mispricing can be captured in Q making the coefficient of DACCR systematically underestimated. Following the notion of (Polk & Sapienza), adding a variable controlling for equity issue. All previous coefficient remains significant, with minor changes in magnitude. Interestingly, the current and lagged coefficient of equity issuance have contradictory effects on investment. This may suggest a 'indirect constraint' on investment, limiting the discretion of equity issuance. Moreover, (Graham & Harvey, 2001) reports that the two major factors influencing managerial decisions of equity issuance are earning per share dilution and magnitude of mispricing. The results suggest that investment levels subsequent to equity issuance decreases, this may follow of financial constraints or reluctance of additional issues, regarding earning per share dilution.

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[12] (Gilchrist & Himmelberg, 1995), cash flow working as a financial accelerator, increasing magnitude of disruptions.

Panel (6) reports that investment, Tobin's Q, discretionary accruals and equity issue have estimated predicative power of subsequent returns. These results are somewhat confusing, as they contradict (Chan et al., 2001; Sloan, 1996) who finds that presence of abnormal accruals reduces future stock returns. One reason for these results may be difference in mean reversion time of analysed population. The studies referred to all study an aggregate population covering multiple industries, while the population in question is limited to the oil and gas industry. Hence, mispricing may be more persistent in the oil and gas industry, than of others. Moreover, the duration captured in the studies differs, where this analysis has the shortest timespan. Granted no misspecification in the estimates, the result is interpreted as higher perseverance of mispricing in the oil and gas industry than the aggregate average.
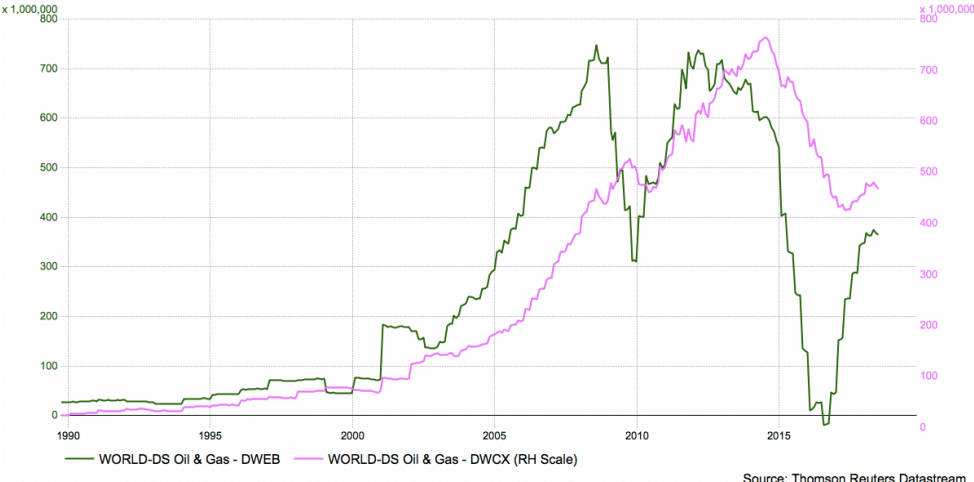

Figure 4 EBIT and oil price development

Lastly, the proxy for investment premium, $(\frac{BE}{ME})_{H,t} - (\frac{BE}{ME})_{L,t}$ suggest presence of catering initiative, as investors add value to firms with abnormally high investment levels. The time-varying effect is also reported in Table (6) and illustrated in figure (5). The intuition is that overpriced firms- firms with positive discretionary accruals and abnormally high investment level- overinvest by initiating projects associated with negative net present value. The market evaluation of the firm and the loss related to negative NPV projects are presumed to reduce the loss, inversely for undervalued firms. The negative correlation between future stock returns and equity issue may explain managers reluctance of issuing equity, as it both lowers valuation and dilutes earnings per share.
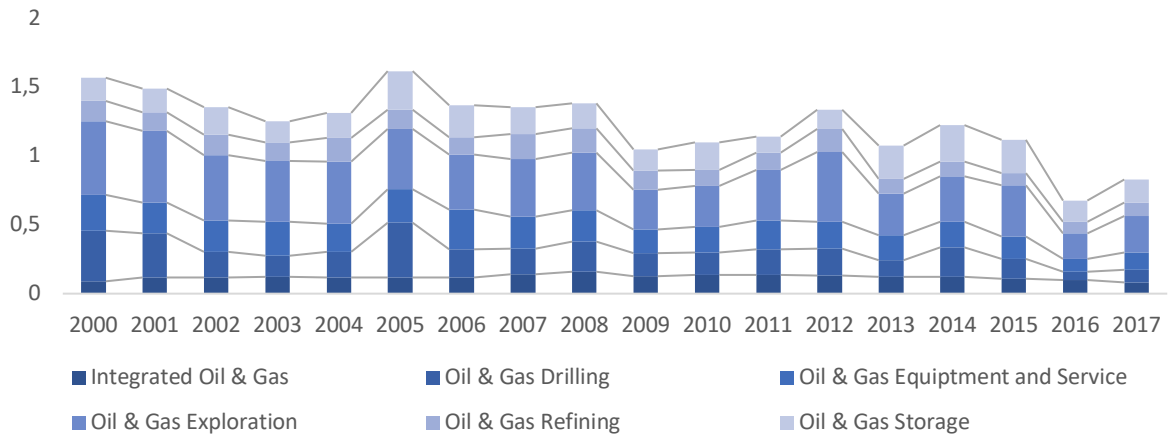
Figure 5: Estimated Investment Premium since 2000

In sum, some results are ambiguous as they contradict establish consensus. However, the aggregate perception of the results is in line with expected results; overpriced oil and gas companies invest more than those who are not overpriced. The results suggest that the oil and gas industry exhibit a more extensive mean reversion rate for overpriced firms, positive subsequent stock return. The estimated investment premium differs significantly across industries, implying varying propensity to cater.

Conclusion

This thesis has investigated the potential presence of an investment catering channel in the petroleum industry and, it's potential effect on firms' investment decisions. Theoretically, investment decisions are based on the notion of future expected earnings. Given the population studied, the payback time of investments are commonly intensive, suggesting long-term focus. Departing the theoretical foundation of efficient markets enables disruptions due to less than rational investors or managers and arbitrage opportunities. Moreover, the focus has been investor sentiment and managers' catering to exogenous sentiment. How managers cater to exogenous investor demand when investors assign a premium to certain firm characteristics.

Inefficient markets enable firms to become over- and undervalued, which is assumed to affect firm decisions. When a firm is undervalued, the market undervalues current capital and assumedly acquisition of new capital, indirectly reducing the net present value of a project. Hence, undervalued firms are assumed to underinvest, forgo investments with positive prospective as the market disagrees and indirectly append an abstract cost to current and future investments, in the short-run. And, inversely for overvalued firms. The scenario implies short-run distortions at the cost of long run prospective. The magnitude of this effect is assumed dependent on the level of mispricing and the mean reversion rate, where high degree of mispricing in combination of extensive mean reversion rate suggests abnormal investment levels where negative NPV projects may be initiated.

Some findings in this study is consistent with established consensus. Cash flow possess predictive power over firm investments. Overvalued firms invest more than those who are not overvalued. Equity issuance have a positive effect on investment, however previous fiscal period equity issue affects investment negatively. Implying diminishing propensity of equity issue, as it dilutes earnings per share and firm valuation. Contrary to similar studies and studies of accruals, the results of this study suggest a positive correlation between mispricing and subsequent stock returns, which is interpreted as more extensive mean reversion rate than industry average. The results suggest presence of a time-varying catering initiative, which may explain elements of overinvestment in the oil and gas industry.

Possible sources of error may be related to measurement, sampling and the time-scope of the study. The data is extracted from a service in which I had no prior knowledge about. The

obtainable population encompass more than 1500 firms with data ranging from 1970 till 2018, while the effective sample in this study is limited to 466 firm with data ranging from 2000 till 2017. Effectively representing the possibility that the panel data set is to narrow and, thus estimating biased coefficients.

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