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Master Thesis

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The impact of intellectual capital on firms' competitive advantage: An empirical study of listed integrated oil companies

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Abstract

The aim of the thesis is to examine the relationship between intellectual capital and competitive advantages/disadvantages within firms. A sustained competitive advantage is defined as sustained superior performance compared to their peer companies.

The dataset is panel data, using financial data from eight integrated global oil companies from the time period 2004-2015. Our sample companies are in a capital-intensive industry, producing identical products. This stands in contrast to most previous studies of intellectual capital, which were performed on competence-based industries creating unique/differentiated products. Crude oil is a typical commodity at the other end of the product spectrum, where all units of production are identical, regardless of who produces them.

Due to the high capital intensity of the industry, the population of integrated global oil companies is relatively small. By choosing the world's largest privately owned integrated oil companies, our sample size is a fair representation of the population at a whole.

Building on the framework of Pulic (1998), we used value added intellectual coefficient (VAIC™) as a proxy for intellectual capital. VAIC allows us to measure the contribution of every resource – human, structural, physical and financial – to create value for the company by using the financial statements of a company.

We identified a statistically significant correlation (1% level) between VAIC and company performance. This relationship holds for economic, financial and market measures. This finding is in accordance with previous studies of the subject.

In addition, we performed vigorous statistical analysis on the panel data, confirming the positive relationship of VAIC and our proxies for performance. Dividing VAIC into value added intellectual capital coefficient (VAIN) and value added capital employed (VACA) confirmed our prior beliefs that our industry is

heavily dependent on tangible assets. However, VAIN was significant in explaining some of the variance for our economic and financial measures.

Adding research and development as an independent variable to explain some of the intellectual capital increased our model's ability to explain the variance. R&D is often used as a proxy for innovation capital. It became apparent that R&D expenditure has an initial negative effect on company performance, before positively affecting company performance in later years. This implies that investment in R&D has an impact on long-term sustainability.

1 Introduction

1.1 Theoretical background

Most companies (and all listed on a public stock exchange) are obliged to record and prepare financial statements that provide a fair representation of their financial position at a point in time and financial performance during a particular period. The goal of the financial statements is to provide investors and other stakeholders with information upon which they can base financial decisions. Compared to the management accounting, whose reporting purpose is internal and where no rules apply, the primary purpose of financial accounting is to provide information to external users (shareholders, debt holders, customers, suppliers, etc.). Two essential parts of the annual financial statements are the income sheet and balance sheet. The income statement shows revenues and expenses for a company during a specific period, e.g. quarterly or annually. It thereby makes it possible to assess the financial performance of a company, and whether it has an accounting gain or loss. The financial statements of a company contain other useful information, but this thesis will draw mainly on the income statement and balance sheet.

While the income statement measures activity during a certain period, the balance sheet is a snapshot of the financial assets and liabilities on a specific date. The income statement and balance sheet are closely connected. An accounting profit increases the equity (and thereby assets), and an accounting loss has the opposite effect.

Business expenditures can be divided into either revenue expenditures or capital expenditures. Revenue expenditures are recorded directly in the income statement as expenses because their occurrence is thought to produce benefits in one single period only. In contrast, capital expenditures produce benefits in multiple periods and must therefore be recorded in the balance sheet. The method used to recognize capital expenditures is called capitalization.

For an item to be recognized in the balance sheet strict rules must be met. In accordance with International Financial Reporting Standards (IFRS), a widely used accounting standard, an item/asset must fulfil two criteria to be capitalized[1]:

1. it must be probable that the future economic benefits associated with the item will flow to the entity; and
2. it must be possible to measure it reliably

In an accounting context, we differentiate between tangible and intangible resources. Tangible resources are physical assets, such as machinery, inventory, stocks, bonds and cash. On the other hand, intangible assets are non-physical, such as patents, trademarks, franchise rights, copyrights and goodwill. A characteristic of intangible assets is that their value must often be determined on the basis of subjective judgement, making it difficult to fulfil the capitalization requirements in IFRS (see above). The same problem arises in the standards issued by the Financial Accounting Standards Board (FASB), which is a non-profit market regulator, whose primary purpose is to establish and improve the generally accepted accounting principles (GAAP) for US entities. In Statement of Financial Accounting Concepts (SFAC) No. 5, the organization lists four criteria for asset recognition[2], and those are:

1. *Definition*: The item meets the definition of an element of financial statements.
2. *Measurability*: It has a relevant attribute measurable with sufficient reliability.
3. *Relevance*: The information about it is capable of making difference in user decisions.
4. *Reliability*: The information is representationally faithful, reliable, verifiable and neutral.

Despite some assets/resources not being classified in the balance sheet, because they do not meet the accounting standards rules for capitalization, there is an

[1] http://www.iasplus.com/en/standards/ias/ias16
[2] http://www.fasb.org/jsp/FASB/Document_C/DocumentPage?cid=1218220132773&acceptedDisclaimer=true

exception. *Goodwill*, a special type of intangible asset, arises when a company pays a premium when buying another company. The excess value (over book values) could be a payment for what the investor perceive as skilful employees, good customer relations or an innovative working culture. However, goodwill appears only when one company buys another, and is therefore not identified at all times. Furthermore, the term *goodwill* is also a much broader concept that includes intangible resources that do not meet the definition of an intangible asset (Andriessen 2004).

As explained above, a company consists of tangible and intangible resources, and most often a combination of the two. According to Čater and Čater (2009) there seems to be an agreement in the literature (Hitt et al. 2001; Wu et al. 2006; Ruzzier et al. 2007) that intangible resources are more relevant to creating a competitive advantage (definition follows in the next section) than tangible resources. The argument they provide is that tangible resources usually fail to meet the criteria in Jay Barneys (1991) VRIN model, which has a resource-based view, to be a critical factor of competitive advantage. In his model he argues that a firm´s resources must be valuable, rare and difficult to imitate and substitute. The reasoning behind this is that tangibles could be bought and accessed easily in factor markets for all participants. According to the model, knowledge is considered to be the most important firm resource since it usually fulfils all the criteria. Despite the knowledge of the people in a company being considered a key contributor to superior performance which may also give future economic benefits, personnel expenditure is expensed directly in the income statement. Of course, employees can never be owned by the company. Thus, when employees leave the company, they take with them much of this knowledge. But some of the costs (e.g. training) related to employees are of future value to the firm and could, in an alternative accounting system, be capitalized and regarded as an investment.

The intellectual-based view of the firm, which is the focus of this thesis, represents one specific aspect of the more general resource-based view, in that it more narrowly considers three resources (human capital, structural/ organizational capital and relational/customer capital) that have been theoretically linked to a firm´s competitive advantage (Reed, Lubatkin and Srinivasan 2006).

1.2 Literature review

1.2.1 Competitive Advantage

Competitive advantage has been widely discussed in the strategy management literature, but there is still no consensus on a single definition, and competitive advantage and company performance are often used as synonymous (Ercegović and Talaja 2013).

Ansoff (1965) was the first to use the term competitive advantage, which he defined as follows: "*(to) isolate characteristics of unique opportunities within the field defined by the product-market scope and the growth vector. This is competitive advantage. It seeks to identify particular properties of individual product markets which will give the firm a strong competitive position".*

Said in a rather simplistic way, competitive advantage is the ability to perform at a higher level than competitors in the same industry (Christensen and Fahey 1984; Kay 1995; Porter 1980). On the other hand, the term competitive disadvantage can be used when firms consistently perform below the level of competitors in the same industry.

Two competing perspectives for explaining value creation and competitive advantages have dominated the strategy literature over the past two decades ; the position-based framework (also called environmental models) and the resource-based view (Spanos and Lioukas (2001).

1.2.2 The position-based framework

The position-based framework (Porter 1980, 1985) explains competitive advantages by how a company adapts and makes use of key characteristics in an industry (e.g. market power and threats of substitutes). According to Porter, industry structure affects the sustainability of firm performance, whereas positioning reflects a company´s ability to establish competitive advantage compared to its rivals.

One of the models the professor uses to identify the attractiveness of a certain industry is what has become known as Porter's Five Forces. The industry characteristics or forces are: supplier power, buyer power, competitive rivalry,

threat of substitution and threat of new entry. In practical terms, for example, the larger the threat from renewable energy sources, the less attractive the oil industry.

In 1980 Porter published his famous book *Competitive Strategy* . The focus of the book was on industry analysis, with a lot of emphasis put on what has become known as Porter´s Five Factors Model. Five years later, in 1985, he released another book called *Competitive Advantage*. The second book had a broader perspective not limited only to industry factors, but was still far away from a concept that evolved rapidly a few years later.

1.2.3 The resource-based framework

Two different, but complementary frameworks could be identified in the resource-based view (RBV) of the firm to explain the sustainability of competitive advantage (Moustaghfir and Schiuma 2010). But first, what is a sustained competitive advantage in this perspective?

According to Barney (1991), a firm is said to have a sustained competitive advantage "*when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy (p. 102)*". Barney (1991) does not talk about a specific period of time that defines the existence of a sustainability of competitive advantage, but the inability of current and potential competitors to duplicate that strategy that makes a competitive advantage sustained.

According to Barney (1991), a company's resources must have four features, the so-called VRIN attributes, to have a sustained competitive advantage:

1. **V**aluable
2. **R**are
3. **I**n-Imitable
4. **N**on-substitutable

Firm resources can only be a source of competitive advantage (or sustained competitive advantage) when they are **valuable**. Furthermore, Barney states that

valuable resources possessed by a large number of competitors cannot be sources of either a competitive advantage or sustained competitive advantage. There is not a straightforward answer to how **rare** a resource must be to have a competitive advantage. But Barney (1991) cites Hirshleifer and Hirshleifer (1980) who write that "*as long as the number of firms that possess a particular valuable resource (or a bundle of valuable resources) is less than the number of firms needed to generate perfect competition dynamics in an industry, that resource has the potential of generating a competitive advantage (p. 107)*".

In addition to being valuable and rare, the resources must also be impossible to obtain for those companies who not possess them. Barney lists three reasons for firm resources to **imperfectly imitable**:

1. Unique historical position/conditions
2. Causal ambiguity (When the link between a firm´s resources and its sustained competitive advantage are poorly understood, it is difficult to duplicate through imitation.)
3. Social complexity

The fourth and last criteria Barney mentions is **substitutability**, which can take at least two forms. If it is not possible to imitate another firm's resources exactly, it is possible to substitute a similar resource that gives the same output. For instance, Barney mentions that a company can develop their own management team (with different people, different operating practices, etc.). But if it is the case that they are strategically equivalent, none of the management teams are a source of sustained competitive advantages.

Barney subsequently extended his initial VRIN framework from 1991. Unlike VRIN, his updated framework, VRIO, emphasizes that it is through the firm's internal organization that resources are transformed into competitive advantage, and that it is not enough simply to possess certain firm resources (Barney 1995, 1997). The later version takes for granted the non-substitutability requirement of VRIN under the imperfectly imitable condition and adds instead *organizational* processes, as the means for exploiting the potential of VRI resources (Barney and Clark 2007; Barney and Hesterly 2012).

The second framework within in the RBV perspective was proposed by Peteraf (1993), who identified four conditions that a firm's resources must meet to provide a sustainable competitive advantage:

1. Resource heterogeneity
2. Ex-post limits to competition
3. Imperfect resource mobility
4. Ex-ante limits to competition

Resource heterogeneity builds on Ricardian theory (Ricardo 1817) or monopoly rents. It implies that companies of varying capabilities are able to compete in the marketplace, and at least break even.

By *ex-post limits to competition* Peteraf mean that subsequent to a company´s gaining a superior position and earning rents, there must be forces which limit competition for those rents.

Imperfect resource mobility is the third condition that needs to be fulfilled, to ensure that the rents are bound to the firm and shared by it.

The fourth and equally important factor, is that there must be *ex-ante limits to competition.* By this Petereaf means that, prior to any firm´s establishing a superior resource position, there must be limited competition for that position.

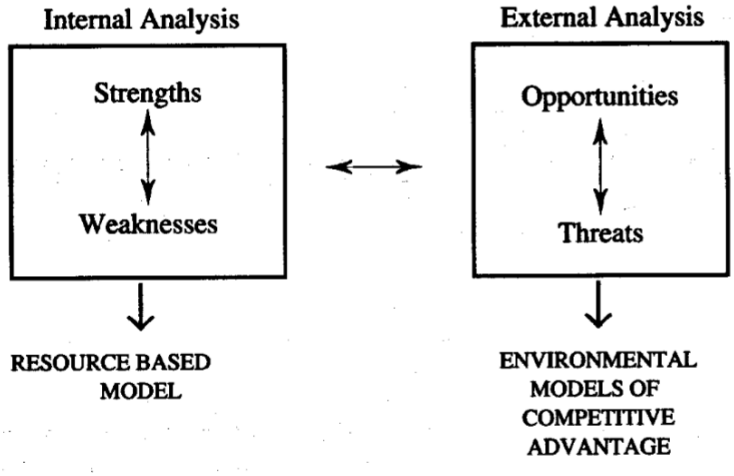


Figure 1: A comparison between the position-based view and the resource-based view as seen by Jay Barney (1991), page 100. "The relationship between traditional 'strengths-weakness-opportunities-threats' analysis, the resource-based model, and models of industry attractiveness", he writes in his description.

1.2.4 Which model is best?

Researchers such as Schmalensee (1985) and Wernerfelt and Montgomery (1986) were among the first who tested the impact of industry versus firm effects on firm performance. According to Barney and Clark (2007) their results were inconsistent with resource-based expectations. This was later contradicted in an article from Rumelt (1991), and has also been documented by several other researchers afterwards. "*All these replications continue to document that firm effects are a more important determinant of firm performance than industry effects, although the relative size of these effects can vary by industry*", claims Barney and Clark (2007).

As in most social science research, there is not a single and easy answer to a research problem. It is often more complex, which is also the case for those theorists trying to explain companies' competitive advantages. Spanos and Lioukas (2001) contrasts Porters framework with the resource-based view, or said in other words: identifies the relative impact of industry vs. firm specific factors in explaining firm performance. Their findings show that together with strategic activities, both industry and firm asset effects contribute to firm success. Therefore the two perspectives/models can be seen as complementary to each other.

Despite the fact that RBV has been widely used during the past 25 years to explain long-term differences in firm performance that cannot be attributed to industry or economic conditions (Habbershon and Williams 1999), it is also not without its limitations. Kraaijenbrink, Spender and Groen (2010) have reviewed and assessed the critiques of RBV over the years. Their review shows that the critiques fall broadly into eight categories. One of their critiques is that RBV is not sufficiently applicable.

Another problem with RBV is that it does not explain how competitive advantage is achieved (Priem and Butler 2001) and misses the cause-effect link. As a response to this, dynamic capabilities (DC) theory has emerged. This is a relatively new field, where the literature is mainly conceptual (Cardeal and Antonio 2012). Capabilities can be considered as the firm's routines and

processes, and Cardeal and Antonio (2012) therefore argue that the "O" in VRIO refers to DC. According to Collis and Montgomery (2008) the sources of competitive advantage/value drivers lie more in the context of DC than resources, because the value of resources in the context of dynamic markets tends to depreciate quickly.

Despite the failure to recognize "invisible assets" in the balance sheet, there is a large amount of evidence that investors attach considerable importance and value to the non-financial factors not included in the quantitative data reported in firms' financial reports (Mavrinac and Boyle (1996) cited in Bontis et al. (2007)). One concrete response to the criticism of financial reports' lack of focus on the knowledge in firms is the balance scorecard, developed by Kaplan and Norton (1992; 1996a). One of the goals of the model is to highlight that financial success is a result of success in non-financial areas. An important part of the balance scorecard is the strategy map. It is a graphical representation of the critical factors for value creation, modelled in a cause-effect relationship. The balanced scorecard measures performance in four perspectives (in a strategy map, listed from top to the bottom): the financial perspective, the customer and market perspective, the internal business process perspective and, lastly, the learning and growth perspective.

According to Viedma´s (2001), cited in Andriessen (2004), it is important to understand the competitive gap that exists between a company and its world-class competitor(s): "*Knowing the causes that produce the competitive gap between the company and the international market leaders in the same business activity is the key issue in order to increase company competitiveness (p. 327).*"

1.2.5 Intellectual capital

In the context of the knowledge-based view of the firm, assets related to knowledge that are perceived as key drivers for a sustainable competitive advantage are often referred to as intellectual capital (IC) or intangible/invisible assets, writes Sydler, Haefliger and Pruksa (2014).

Although intellectual capital and knowledge assets are difficult to discern and quantify, their results will nonetheless be reflected in the company´s greater productivity, efficiency, and overall profitability (Berzkalne and Zelgalve 2014).

Intellectual capital (IC) is not a new phenomenon and has been well researched over the years by several different academic disciplines (e.g. accounting and strategy). The concept of IC was introduced by economist John Keneth Galbraith as early as 1969 (Rothschild and Feiwel 1976), who wrote the following to his fellow economist: "*I wonder if you realize how much those of us in the world around have owed to the intellectual capital you have provided over these past decades.*" According to Bontis (1998), his statement can be understood to reflect his belief that intellectual capital meant more than "intellect as just pure intellect", but instead incorporated a degree of "intellectual action".

IC research has developed in two main parts and time periods (Inkinen 2015). The first period, in the late 1990s, which can be seen as the start of the research field, with authors like Stewart (1997) and Edvinsson and Malone (1997), established important foundations of intellectual capital and gave a great deal of publicity to IC research. The second phase, which began in the early 2000s, had more focus on the measurement models and new levels of analysis (Inkinen 2015).

After a "boom" in empirical research in the field, the number of published papers has dropped substantially in the past few years, according to Inkinen (2015), who urges the IC research community to continuous development by utilizing original ideas, different research angles and various methods.

There is no single definition of intellectual capital that everyone agrees upon. Karl-Erik Sveiby from Sweden, was the first to write a dedicated book on how to manage the knowledge assets in companies, in 1986. He has later produced several important publications in the IC field, and in his book "The Organizational Wealth" from 1997, he writes that intangible assets are "***invisible assets that include employee competence, internal structure and external structure***".

Two other early researchers in the field, Edvinsson and Malone (1997), define intellectual capital as follows: ***"It is the sum of human capital and structural capital. It involves applied experience, organizational technology, customer relationships and professional skills that provide an organization with a competitive advantage".***

Several authors are sceptical of the classification and the break-up of intellectual capital, since the dimensions seems to be interrelated. This is something which is illustrated by the definition of Bontis et. al. (1999): "***IC is a concept that classifies all intangible resources as well as their interconnections***". A literature review by Inkininen (2015) claims that the common theme of the reviewed literature is that the employees, the organizational supporting structures or the established relations possessed have only little value separately, but establish a strong firm performance driver when combined. A more recent definition by Ramanauskaitė (2012), cited in Ramanauskaitė and Rudžionienė (2013), illustrates not only the interconnections between all intangible resources but also the important interconnection with other tangible resources in value creation: **"*intellectual capital constitutes resource created, purchased, or maintained by an enterprise, which possess no material form; these resources, together with material and financial assets of the enterprise, help to create added value".*** Furthermore, as noted by Ramanauskaitė (2012), the definition also highlights that intellectual capital may be acquired, created or merely maintained within an enterprise without considering ownership rights (e.g. human capital cannot be owned by a company but can definitely be of future value for a company).

In total, nine IC dimensions (human capital, structural capital, organization capital, customer capital, relational capital, social capital, innovation capital, information capital and technological capital) have been used in the literature (Inkinen 2015). However, the most commonly used definitions by researchers is the one that classifies IC into human capital, relational capital and structural capital.

The EU-based MERITIUM project (Mouritsen et al.) from 2001 divides IC into three major parts and defines the elements as follows:

*"**Human capital** is defined as the knowledge that employees take with them when they leave the firm. It includes the knowledge, skills, experiences and abilities of people. Some of this knowledge is unique to the individual, some may be generic." (p. 20)*

*"**Structural capital** is defined as the pool of knowledge that stays with the firm at the end of the working day. It comprises the organisational routines, procedures, systems, cultures, databases, etc. Some of them may be legally protected and become Intellectual Property Rights, legally owned by the firm under separate title." (p. 20)*

*"**Relational capital** is defined as all resources linked to the external relationships of the firm such as customers, suppliers or R&D partners. It comprises that part of Human and Structural Capital dealing with the company's relations with stakeholders (investors, creditors, customers, suppliers, etc.), plus the perceptions that they hold about the company." (p. 21)*

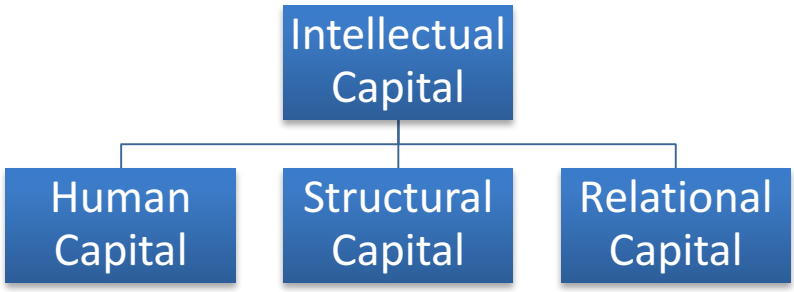


Figure 2: Components of Intellectual Capital. Source: Mourtisen et al. (2001)

Since the human capital consists of tacit knowledge embedded in the company's employees, which can easily leave the company, a key issue is to convert this knowledge into tangible assets (e.g. patents), thus converting human capital into structural capital (Sydler, Haefliger and Pruksa 2014).

Gjønnes and Tangenes (2012) provides an interesting addition to the concept of intellectual capital, which helps illustrate an important point. But first, two important definitions of the two types of resources they argue a company consists of:

***"Transaction-based resources** include all the resources that a company can and has acquired in factor markets, and are reflected in the financial statements as fixed and current assets in the balance sheet, and as costs in the income statement."* (Gjønnes and Tangenes 2012, p. 426, own translation)

***"Competence-based resources** include all resources that a company has developed through various learning processes, and that cannot be identified and separated. This includes the competence of the employees (knowledge and skills) and an organization's structure and relations".* (Gjønnes and Tangenes 2012, p. 426, own translation)

An important point in Gjønnes and Tangenes' book (2012) is how competence-based resources (which are intangibles in an accounting context, and often not fully recognized in traditional bookkeeping) are utilized in ways that contribute to whether transaction-based resources (labour, machines, buildings, etc.) generate values or not.

The bottom half of the figure 3 illustrates how a resource-based (accounting) balance sheet could look like, and the links between transaction-based resources and competence-based resources (the upper half of the figure). Effectivity capital, which is a property of competence-based resources, exists only when a business is more effective than its benchmark (read: peers) in a short and/or long time horizon.

A traditional balance sheet in the official financial statements lacks an index of competence-based resources that constitute an organization's intellectual capital. In figure 3 financial capital is drawn with a solid ellipse to emphasize that transaction-based resources are identifiable and clearly separated from the rest of the transaction-based resources. On the other hand, competence-based resources constitute a diversified resource package that cannot be separated, hence the dotted ellipse.

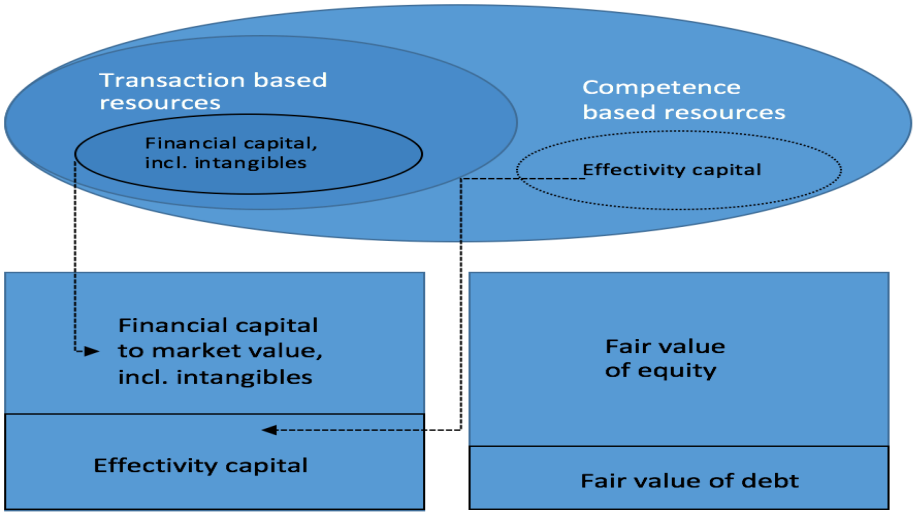


Figure 3: An extended balance sheet (bottom half), and the connection with company resources. Source: Gjønnes and Tangenes (2012) and lecture slides from Tor Tangenes (2013).

Gjønnes and Tangenes (2012) warn us that the common definition of intellectual capital, where all three components are included, is not exactly the same as the *competence-based resources* that they operate with in their book. Unlike the definition of intellectual capital, as described in MERITUM (2002) above, effectivity is a state variable free for intangible assets (transaction-based) and activities.

From figure 3, an easy conclusion could be that only competence-based resources contribute to a higher return on assets than peers, while transaction-based resources only contribute a normal return on assets. Indeed, their point is that effectivity capital is the driver for effectivity, i.e. value creation (destruction) due to a high (low) degree of resource coordination.

We will now take you through a numerical example to illustrate the concept of effectivity capital, slightly modified from Tangenes' lecture slides. We will show three different situations; one company without effectivity capital at all (performance benchmark), one company which is underutilizing and one which is ineffective today but has effectivity capital, since it is expected to be more effective in the future. In this example, we show the consequences both on the income statement and balance sheet.

Assumptions:

- Imagine a company with revenues of 150, a debt of 110 and a market value of transaction-based resources of 200 that are not affected by situation.
- Degree of effectivity affects costs, it means payments to different resource groups and the fair value of the firm and its equity.
- Assume a required rate of return of 15%.

Situation 1: Accomplishments in line with expectations, and with the same expectation in foreseeable future

Payment for contributions from transaction based resources (capitalized and non-capitalized) 120	Revenue of the period 150
Payment for contributions from competence based resources 30 (Normal rate of return: 30/200=0,15)	

Transaction based resources assessed at market value 200	Fair value of equity 90
	Fair value of debt 110

Figure 4: Example/Illustration of effectivity capital: Example one

As described in situation 1 above, and shown in the income statement (to the left) and the balance sheet (to the right), no effectivity capital exists. 30 is only the payment for normal benefits from competence-based resources.

Situation 2: Is ineffective today with expectations about the same in foreseeable future

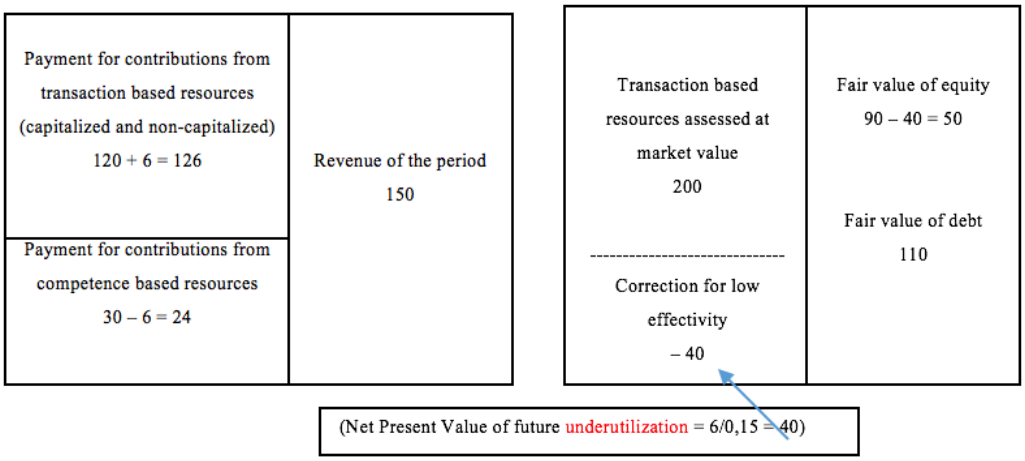


Figure 5: Example/Illustration of effectivity capital: Example two

Since the company is ineffective both today and is expected be the same in the future, it needs to reduce the payment/give a "discount" to competence-based resources based upon expectations of underutilization in the future.

Situation 3: Is ineffective today, but is expected to be effective in the future

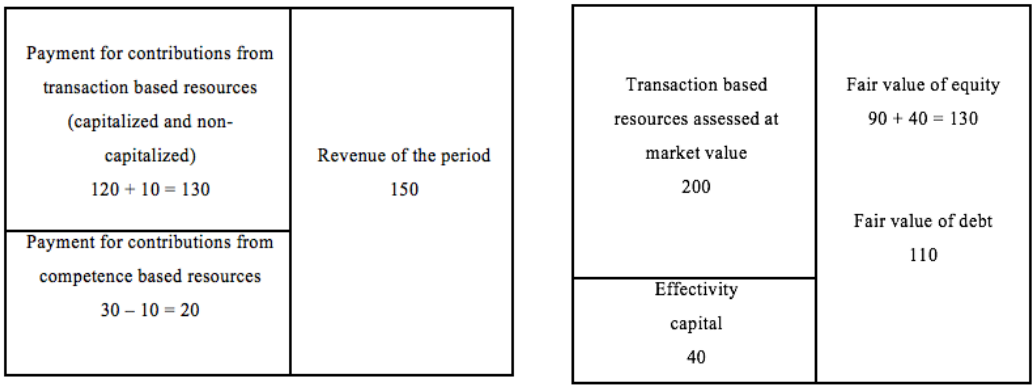


Figure 6: Example/Illustration of effectivity capital: Example three

Since the company is oriented towards future effectivity, the "payment" to competence-based resources is "discounted" by 10 for the period's underutilization. However, there is effectivity capital in the balance sheet, since it is expected to be effective in the future (to the right).

1.3 Research question and implications of the study

As explained previously, the balance sheet in companies' financial statements does not include all resources. The objective of this thesis is to examine the link between intellectual capital and company performance. This leads us to the following research question:

How does intellectual capital affect firms' competitive advantages and disadvantages, and are there some key characteristics unique to firms whose performance consistently exceeds that of their peers?

By exploring, and hopefully answering this question, we want to illuminate to what degree intellectual capital affects performance variables, and what the explanation for this might be. Thus, we hope to bring relevant information to studies involving accounting, valuation and strategic management, as well as develop suggestions for future research on the link between competitive advantages and intellectual capital. Our research builds on current and previous research in the field. This study will be unique, as it is focused on one global industry in particular, and is derived from data over a long time period.

We will not however engage in the discussion about whether intellectual capital should or should not be included in the financial statements. This discussion is complex, and would require a thesis on its own to be thoroughly examined. This implies that the thesis avoids, to a large degree, discussions of the potential shortcomings of traditional accounting theory.

1.4 Industry of study

As explained in section 1.2.1, competitive advantage is the ability to perform at a higher level than competitors in the same industry. It can therefore be argued that it is wise to not blend companies from different industries in one general analysis. Of course, we could also have chosen to perform the same analysis on several industries, while at the same time keeping them separated. This could have strengthened our results and generalizability of this study. However, due to time constraints, this has not been appropriate for us.

Additionally, a further argument strengthening our decision to study just one specific industry is the large differences in R&D expenditure in different industries (Ballester, Garcia-Ayuso and Livnat 2003), which is often a proxy for structural capital. The large variation in R&D expenditure between different industries, is also a reason why e.g. Sydler, Haefliger and Pruksa (2014) chose to study only pharmaceutical and biotechnology companies in their research into intellectual capital and performance.

We have chosen to study large, integrated oil companies, partly due to our thesis supervisor, Tor Olav Nordtømme, who writes in his lecture slides for students at BI Norwegian Business School (own translation):

"If the oil price increases, there is reason to believe that Statoil will increase its revenues, but that would also be the case for other oil and gas companies like Exxon Mobil, BP and Total. This is market-driven value creation". He continues: *"If we compare companies that benefit (or not) from the same market conditions, we will neutralize the effects of the part of the value creation (or destruction) that is due to market conditions".*

There are several reasons why we have chosen to look at the largest publicly traded, integrated oil companies in the world with regards to our research hypothesis:

- The oil sector is quite unique compared to a lot of other industries, as oil prices are easy accessible and transparent worldwide. Oil prices are also highly correlated with the economic and financial/stock performance of the companies within the industry. Based on this alone, we might assume that all companies with the same resources would perform equally well, but this is certainly not the case. One reason why this argument does not stand up in reality may be that peers utilize intellectual capital differently.
- Our sample companies are in a capital-intensive industry, producing identical products. This is unlike most previous studies of intellectual capital, which were performed on competence-based industries (IT, biotech, etc.), creating unique/differentiated products. Crude oil is a typical

commodity at the other end of the product spectrum[3], where all units of production are identical, regardless of who produces them. There are quality differences in the crude oil and thereby some price differentiation, but only a small part of the competitive advantage to the companies in the oil industry is derived from the products themselves. However, since competitive advantage in this thesis is defined as long-term overperformance compared to peers, the position-based framework is not a good tool to explain competitive advantage.

A drawback with choosing to study integrated oil companies is that our final dataset is quite small (consisting of eight peer companies), due to the difficulty of standardizing the necessary variables from firms operating all over the globe. In the notes, some companies disclose personnel expenses post pension, some pre pensions. Some do not disclose personnel expenses at all. R&D is not usually a separate line in the profit and loss statements. The standardization issues are numerous, and resulted in manual extraction of key variables from annual reports.

Other studies examine knowledge-intensive industries, which often report more relevant figures for the study of intellectual capital compared to our industry, which is highly capital intensive. In addition, the capital requirements to be a global integrated oil company are extremely high, limiting the total population. Thus, the elimination process in the sample sizing leaves us with fewer companies than similar studies, since their starting population is much larger.

In addition, no two companies are the same. The high capital requirements for a company to operate globally is a natural limitation to the amount of companies available. Size matters, and we therefore had to put a minimum threshold on company size in order to be able to compare the companies.

A second drawback of studying the oil industry is that the estimation of proved reserves (the amount of oil and gas the firm is reasonably expected to recover),

[3] https://www.extension.iastate.edu/agdm/wholefarm/html/c5-203.html

which are assets, is a complex process. Inkpen (2010) comments on this issue in "The Global Oil and Gas Industry" report, where he refers to a statement from Daniel Yergin, chairman of Cambridge Energy Research Associates, published in the Wall Street Journal in 2007:

"Though the word "audit" is customarily used for these evaluations, oil and gas reserves cannot be "audited" in the conventional sense of a warehouse inventory or a company's cash balances. Rather, "proved reserves" are an approximation about formations thousands and even tens of thousands of feet below ground. Their size, shape, content, and production potential are estimated in a complex combination of direct evidence and expert interpretation from a variety of scientific disciplines and methodologies. Added to the science is economics; if it costs more to produce oil from a reservoir than one can sell it for profitably, then one cannot "book it" as a reserve. Reserves are "proved" if there is a 90% chance that ultimate recovery will exceed that level. As perverse as it may sound, under the "production sharing agreements" that are common in many oil-producing countries, when the price goes up, proved reserves go down."[4]

1.5 Structure of the thesis

In this chapter we have given an introduction to the topic under examination, looked at some of the most important literature, formulated our research hypothesis and briefly mentioned why we have chosen to empirically study the oil sector with regards to our research hypothesis.

The thesis proceeds as follows: In chapter two we give an overview of how the value of companies can be measured/valued, with a particular focus on intellectual capital valuation models, and we comment on the advantages and drawbacks of these models. In this chapter, we have briefly explained why we are interested in studying one particular sector, namely the integrated oil industry. We will therefore in chapter three further describe the oil industry and why we have chosen this particular sector. In the same chapter we will also give a description of

[4] http://www.wsj.com/articles/SB114610122696037164

the research method applied. Chapter four presents and discusses the results from our research project. The thesis concludes in chapter five with some concluding remarks and suggestions for further studies.

2 How to value a company

In order to understand what creates competitive advantages and thereby lets some companies outperform others in the same industry, it is beneficial to gain an understanding of how investors and other stakeholders value companies. Therefore, we have devoted this chapter to an overview of general valuation principles and methods, as well as the methods that have evolved particularly to value and measure intellectual capital.

"Every asset, financial as well as real, has a value. The key to successfully investing in and managing these assets lies in understanding not only what the value is, but the sources of the value. Every asset can be valued, but some assets are easier to value than others, and the details of valuation will vary from case to case", writes Damodaran (2012) on page 1 in his book.

2.1 General approaches to valuation

According to Damodoran (2012) there are in broad terms three different valuation methods. The first, discounted cash flow (DCF) valuation, relates the value of an asset to the present value (PV) of an expected future cash flow on that asset. The second approach, relative valuation estimates the value of an asset by comparing the prices of similar assets relative to a common variable such as earnings, book value or sales. The third broad type of valuation approach is option pricing. Notice that other authors provide other groupings of methods.

2.1.1 Discounted Cash Flow Valuation

The basics behind this method is the present value rule, where the value of any asset is the present value of expected future cash flows deriving from it. There are several judgements that needs to be made when applying this comprehensive model, as can be seen from the mathematical formula in figure 7. The analyst needs to have an idea about the life expectancy of an asset as well as forecast future earnings (and thereby growth rate) generated from that particular asset. The user of a DCF model also needs to have an idea of the risk affecting the estimated cash flows, which is reflected in the discounting factor. To estimate these three

parameters is often a difficult exercise, e.g. for firms that have unutilized resources or are in the process of restructuring their businesses.

$$\text{Value} = \sum_{t=1}^{t=n} \frac{CF_t}{(1+r)^t}$$

where n = Life of the asset
CF_t = Cash flow in period t
r = Discount rate reflecting the riskiness of the estimated cash flows

Figure 7: Mathematical definition of DCF Valuation. Source: Damodaran (2012)

In theory, this model can be used to value any type of asset – physical, financial or intangible. Estimating future cash flows from intangibles, and especially what we in this thesis define as intellectual capital, is a challenging task. DCF is therefore a model that best captures the value of assets in place that generate relatively predictable cash flows (Sudarsanam, Sorwar and Marr 2006).

An example of DCF valuation:
Asset X has a life expectancy of 10 years, with an annual cash flow of USD 50. The discount rate is 5%. Using the DCF formula, this gives the asset a value of USD 386.

2.1.2 Relative Valuation

Relative valuation is a popular way of valuing companies, both for professionals and private individuals. One of the reasons for the popularity of this model is its simplicity.

Unlike DCF valuation, which is a method based more on personal judgement, relative valuation relies more on the pricing already performed on similar assets by the market. In many cases it is difficult to find exactly similar assets, and this must be corrected for when using this method. Some common multiples, irrespective of the industry or asset being valued, are: Price/Earnings Ratio (P/E), Price/Book Value of Equity (P/B) and Enterprise Multiple (EV/EBITDA). There are also specific industry multiples, e.g.: price per square metre (housing market) or combined ratio (insurance).

An example of a relative valuation:

In practice, one would compare asset or company X (with an unknown price) with a comparable asset/company, Y (with a known price), to determine the price of asset/company X. Let's say you want to determine the price of the shares of the alcoholic beverages company Beta. A possibility is then to gather the Price/Earnings Ratio (P/E) for the three peers; Zeta, Gamma and Delta They have an average P/E ratio of 15.5. If you think Beta is performing at the three peers' average, then you could use this ratio to determine what you believe is the correct price of Beta by leaving the price per share as unknown, and inserting earning per share and the P/E ratio.

2.1.3 Option pricing

The fundamental premise behind the use of option pricing models is that discounted cash flow valuation models tend to understate the value of assets that provide payoffs that are contingent on the occurrence of an event (Damodaran 2012). One of the most commonly used models is the Black-Scholes model, which is based on the assumption that the asset price process is continuous. By valuing equity as an option, one considers equity as a residual claim, meaning that all cash flow remaining after all relevant stakeholders (lenders, preferred stocks, etc.) has been claimed. The payoff to equity investors on liquidation can therefore be calculated as equity minus face value of debt, equals X. The call option, with a strike price of P, on an asset with value X, has a positive payoff if $X > K$.

2.2 Intellectual capital valuation methods

Berzkalne and Zelgalve (2014) argue that traditional corporate valuation (discounted cash flow valuation, liquidation and accounting valuation and relative valuation) to a large extent reflects historical performance and does not take into account the value of off-balance sheet items, like intellectual capital.

According to Ramanauskaitė and Rudžionienė (2013) there are more than 60 valuation/measuring methods for intellectual capital. Some researchers ask whether it is a sign of weakness with existing methods that more and more methods are being developed in addition to the already large number of models?

According to Ramanauskaitė and Rudžionienė (2013) "*most of the currently existing methods are too complicated and limited qualitative, or theoretical proposals with a limited proof of practical applicability, which complicates the development of a single and universal method of valuation of the intellectual capital of an enterprise (p. 80)*."

There are several groups of measuring and valuing intangibles in the literature. One of the groups is from Sveiby (2001). He introduced a two-dimensional matrix (see table 1), dividing existing IC valuation models according to their valuation level (organizational or component level) and their means of method (monetary and non-monetary). On the monetary side of the matrix, Sveiby lists three sets of methods: Direct Intellectual Capital Methods (DIC), Market Capitalization Methods (MCM) and Return on Assets Methods (ROA). On the non-monetary side of the matrix, we find scorecard methods. A selection of the measuring models and the specific category it belongs to are listed in Table 1.

Organizational level		**Market Capitalization Method** • Market-To-Book Value • Tobin's Q **Return on Asset Method** • Economic Value Added • Calculated Intangible Value • Value Added Intellectual Coefficient • Intangible Driven Earnings • Residual Income Model
Components level	**Scorecard Method** • Balance Scorecard • Value Chain Scoreboard • Skandia Navigator • ID-index • Intellectual Capital • Benchmarking System	**Direct Intellectual Capital Method** • Citation-Weighted Patent • Real Option Model
Non-monetary		Monetary

Table 1: Intellectual capital valuation models. Source:(Sydler, Haefliger and Pruksa 2014). The model is an adjusted version of Sveiby (Sveiby 2001).

According to Andriessen (2004), there is an important and clear distinction between valuation and measurement : "*Valuation always includes values, the use of certain values or yardsticks. If these yardsticks are missing, the method is not valuing intangibles but is measuring intangibles (p. 116).*"

As Sveiby (2001) writes, the methods including a monetary value, such as MCM and ROA, are useful for valuation purposes and benchmarking against competitors in the same industry. A drawback is that it is often hard to translate everything into money, he argues. These methods are also extremely sensitive to assumptions like interest and discounting rates.

Compared with pure financial measures, DIC and SC methods offer the chance to obtain a deeper overview of the health of an organization. But these methods' results are difficult to compare with other competitors. Furthermore, the methods need individual adjustment to fit every organization.

A review of the literature shows that the most common methods used to evaluate intellectual capital are scorecard methods (Ramanauskaitė and Rudžionienė 2013). This type of method does not make use of monetary units at all in the process of valuation, is qualitative and is often presented as a text. According to Ramanauskaitė and Rudžionienė (2013), there are too few studies focusing on the financial aspect of intellectual capital valuation methods, which they recommend be considered in future research.

Based on the lack of studies with a financial aspect, as noted above, and the fact that we approach our research topic from mainly from an accounting point of view, the focus of this thesis will be MCM and ROA methods (IC models with a monetary aspect). We will now look more deeply into some of the important valuation models, particulary the Economic Value Added, Residual Income Model, Tobin's Q, Market-to-book and Value-Added Intellectual Coefficient (VAIC), and comment on their advantages and drawbacks.

2.2.1 Economic Value Added

EVA is a trademarked method owned by Stern Stewart and Co, and is a financial valuation method. In its basic form, EVA is calculated by subtracting the costs of a project, including financial expenses (capital x cost of capital) from revenue. What is left is the economic value added. Augmented to fit company valuation, EVA is the difference between the firm's total value and the total capital from investors. In addition, Stewart III introduced 164 possible adjustments to the reported accounting results to eliminate variations in measuring true economic performance. As such, EVA is not a management tool, nor is it a method to measure intangible resources. Stewart III claims that EVA is a superior measure of performance, and that it can explain close to 50% of changes in market value.

Nevertheless, many intellectual capital researchers name EVA as an intellectual capital measurement method. One of the arguments used for this is that effective management will increase EVA, and thus, EVA can be used as an indicator of success in managing knowledge assets (Bontis et al. 1999)**.** This is also known as the implicit argument. However, the implicit argument falls a bit short when

considering that EVA explicitly states that the management of resources is not important, one needs only to consider implementing profitable projects. These projects may not add to the long-term sustainability of knowledge assets, if the short-term cash-flow is more significant. In addition, EVA is influenced not only by intellectual capital but many other factors, which makes the interpretation of changes in EVA difficult.

Strassmann (1998) introduces the patented Knowledge Capital, which uses EVA as an indicator of the value of knowledge capital. Knowledge Capital is calculated by dividing EVA by the interest rate the firm pays on its long-term debt. The argument is that "the value added is the interest rate earned from an accumulation of knowledge residing in the firm" (Strassmann 1998).

Knowledge Capital's ability to measure intellectual capital is limited. Firstly, EVA is not a product solely of intangible assets. Tangible assets provide opportunity for economic surplus, evident from positive EVA measurements from firms with low knowledge intensity. Secondly, intellectual capital is comprised not only of knowledge capital, but also of structural capital and relational capital.

Baruch Lev (as cited in Andriessen (2004) and Webber (2000)) criticizes the use of historical data, and the fact that EVA is not forward looking in its calculations. He suggests using an income approach; calculating the present value of future EVA. However, this approach has to deal with problems such as income funnelling, income allocation, useful life estimation and capitalization. The main problem with EVA is that it will never guide managers/stakeholders to a better understanding of an entity's intangible resources and how they contribute to EVA. EVA is described by some as the "black box" approach that blocks efforts to validate and manage the company's resources.

2.2.2 Residual Income Model

In 1961 Edwards & Bell challenged the traditional view of profitability. Investors require a rate of return on resources which should compensate them for the risk they take on by investing. Therefore, ordinary profit on the income statement is not necessarily profit in Edwards & Bell's eyes. Many researchers, including,

famously, Ohlson in 1995, have since worked on this underlying idea. Ohlson (1995) introduces the residual income model, which works in many respects the same way as EVA. Residual income is calculated as the discounted return on invested capital, using a rate applicable to the chosen industry or peer companies. Any income greater than the required rate of return is deemed residual income. This method is good at comparing companies, and detecting efficient use of resources. However, as a method of identifying intellectual capital, it faces the same problem as EVA. Even under the premise that the efficiency stems from intellectual capital management, the exact contribution of intellectual capital remains unknown.

A simple example:
Firm A has a profit of USD 100, and invested capital of USD 1,000. The industry yields an average of 5% return. This implies that firm A has a residual income of 100 – (1 000x0.05) = 50. The excess profit of USD 50 is the "superprofit", the profit that exceeds the expected market return.

2.2.3 Market-to-book ratio

As mentioned earlier, many claim that the difference between market value and book value represents intellectual capital. The rationale behind this is that "everything left in the market value after accounting for the fixed assets must be intangible assets" (Stewart 1997)**.** Thus, the market-to-book is an easy and reasonable indicator of intellectual capital in a firm.

Unsurprisingly, many authors criticize this method's ability to measure intellectual capital. Andriessen (2004) states that it is like "comparing apples and oranges (p. 95)". Book value is the reported stockholders' equity, while market value is the perceived future value of the firm's cash flow.

Pike, Rylander and Roos (2001) claim that all resources of a company interact with each other, and one can therefore not separate book value from intellectual capital. (Mauritsen, Larsen and Bukh 2001) argues in the same way that EVA and Residual Income is criticized; the unknown difference between the measured factors can be influenced by many factors, not only intellectual capital. In

addition, by changing accounting standards, one changes the market-to-book ratio. This changes the perceived value of intellectual capital, with no apparent change in corporate management.

A simple example:
Company A has a book value of 100, and a market capitalization of 150. This gives a P/B value of 1.5 – indicating that approximately 33% of the firm's value is not reflected in the balance sheet.

2.2.4 Tobin's Q

Tobin's Q was introduced in 1981 by the Nobel Prize winning James Tobin. Tobin's Q represent the ratio between market value and its replacement cost. This ratio is perceived by many authors to be an improvement of the market-to-book ratio's ability to measure intellectual capital. The advantage that Tobin's Q has over market-to-book ratio is that Tobin's Q negates the companies' depreciation policy over assets, and instead uses replacement cost. However, this does not negate the problem of identifying the unidentified.

A simple example:
Company A has USD 50 m in assets, and a market capitalization of USD 60 m. This implies that the Tobin's Q is 0.83 and that it costs more to replace company A's assets than the firm is worth. Any value above 1 would in theory mean that the company is overvalued.

2.2.5 Value-Added Intellectual Coefficient

One commonly used method, which belongs to the ROA category, is the Value-Added Intellectual Capital Coefficient (VAIC™). This framework was developed and trademarked by Professor of Economics Ante Pulic. It was first presented at a conference in Canada in 1998. The VAIC model is intended to measure the extent to which a company produces added value based on intellectual (capital) efficiency or intellectual resources (Ståhle, Ståhle and Aho 2011). The professor emphasizes that there are two key resources that create added value in companies; namely capital employed and intellectual capital (Pulic et al. 2003). Capital employed consists of physical and financial capital, while intellectual capital is

the sum of human capital and structural capital, which is illustrated in figure 8. Pulic's VAIC model consists of the three components; human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency (CEE).

It is important to notice that the terms "human" and "structural" in Pulic's model differ from the meaning commonly used by others in the IC research community. According to Iazzolino and Laise (2013), this has led to "confusion" about Pulic's VAIC model.

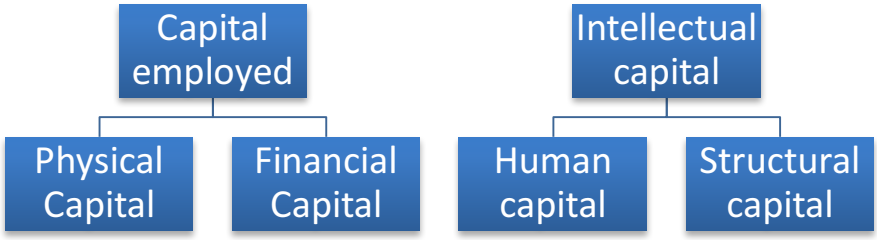


Figure 8: Professor Ante Pulic´s conceptualization of a company´s total resources, which is an important part of the VAIC model. Source: Andriessen (2004, 365).

VAIC is a financial valuation method (Andriessen 2004), also called monetary denominated valuation (Sveiby 2001). Since it draws on publicly available data, it can be used for both listed and unlisted companies, as long the financial statements are publicly available. VAIC is designed to provide information about the efficiency of tangible and intangible assets within a company. The model shows how much new value is created by each monetary unit invested in (all) resources. One of the main assumptions of the VAIC model is that labour expenses are treated as an asset instead of a cost.

The VAIC indicator has been used and tested several times by different companies and industries to detect if it correlates with company performance. The results have been inconsistent (Andriessen 2004). While Pulic (2000a), without any control variables, managed to explain 19% of the variance in market value by VAIC, Firer and Williams (2003) found a small negative correlation between VAIC and productivity and market value.

Andriessen (2004) gives Pulic credit for trying to develop the field of intellectual capital, but he has trouble accepting some of the basic assumptions in the model, which may also be the reason for the mixed results. Here are some of Andriessen's (2004, 367-371) objections to the model:

- VAIC methods do not properly separate expenses from assets. For example, he believes that treating all labour expenses as a future benefit is wrong, since a part of this expenditure provides immediate benefits only.
- The aim of VAIC methods is to calculate the efficiency of capital employed, human capital and structural capital. Unfortunately, VAIC does not calculate efficiency.
- The methods ignore the fact that value added is not produced only by human capital, structural capital, and capital employed individually, but is a result of the synergies between them.
- Use of the model is also problematic for those companies with substantial liabilities, since it can result in very positive VAIC scores, which may not be correct.

Hang Chan (2009) lists the following advantages of VAIC:

- It produces quantifiable, objective and quantitative measurements without requiring any subjective grading. This enables computation and statistical analysis of a large sample size over a long period of time.
- It provides useful and informative indicators that are of interest to all stakeholders, not only shareholders, which enables users to asses and compare key components of IC in order to evaluate company performance.
- The measurements can be used for comparisons along with traditional financial indicators commonly found in businesses.
- The computations are simple, and so is the output. This enables management and business users to utilize and understand the output.
- The measurement output is standardized, and as such, can be used for comparison between industries, companies and countries (benchmarking)
- It uses publicly available data.
- It treats human capital as the most important source of intellectual capital, consistent with intellectual capital literature

In the literature review we wrote about Gjønnes and Tangenes' take on the concept of IC. One of the main points, as we understand it, is that all companies have some sort of competence-based resources/intellectual capital, but it is their use (read: efficiency) that makes some companies more competitive than others. From the models presented in this paper, we believe that despite Andriessen's critique of the VAIC model, it provides the best available model to actually underpin the concept of effectivity capital, which is a property of the competence-based resources. By dividing intellectual capital efficiency into efficiency of tangible and intangible assets (VAIN and VACA, explained in depth in chapter 3.4.1), we will be able to more accurately pinpoint the effect intellectual capital has on efficiency.

A simple example of calculating a company's VAIC:
The first step is to calculate the value added (VA) of the firm.
In company A the cost of goods sold is USD 200, depreciation USD 100 and sales USD 500. In addition company A has USD 600 in total assets, intangible assets of USD 100 and employee costs of USD 150.
Value added = Sales – costs of goods sold – depreciation = 500 – 200 – 100 = 200

The second step is to calculate CE (capital employed), HC (human capital) and SC (structural capital).
CE is calculated as total assets – intangible assets = 600 – 100 = 500.
Pulic treats employee costs as an indicator of HC, making HC = Employee cost = 150.
Structural capital is calculated as VA – HC, meaning that SC is not an independent variable, but dependent on the created VA and in inverse proportion to HC.
SC = 200 – 150 = 50.

The third step is to calculate the three components as a ratio to VA.
VACA = CE/VA = 0.4
VAHU = VA/HC = 1.33
STVA = SC/VA = 0.25

The fourth step is to calculate the value added intellectual coefficient (VAIN), which shows the contribution of intellectual capital in value creation.
VAIN = VAHU + STVA = 1.33 + 0.25 =1.58

The fifth and final step is to assess each resource that helps to create value added, the VAIC proposed by Pulic.
VAIC = VAIN + VACA = 1.58 + 0.4 = 1.98

3 Sample and research methodology

The aim of this thesis is to test a specific industry sector with firms competing with more or less identical products, with the ultimate objective of identifying competitive advantages created by intellectual capital. We hypothesize that the competitive advantage will positively contribute to economic and financial performance, and, indirectly, to market performance.

Part of the methodology we use to identify competitive advantages is to divide our sample into two groups – "winner group" and "loser group". By dividing the firms in this way, we will be able to pinpoint differences between top and bottom performers. This will enable us not only to comment on the general contribution of intellectual capital to efficiency, but also to pinpoint key differences between the two groups. However, since all statistical analysis draws its power from the sample size used, such a division could impact the credibility of our findings. Therefore, the main analysis of this paper focuses on the sample size as a whole, while the separation of winning and losing firms is considered a supplementary exercise.

By thoroughly examining each oil firm's annual reports and comparing firms using different statistical techniques, we can potentially reveal the underlying forces that create comparative advantages. More specifically, we examine the firms by utilizing the framework established by Pulic (1998), the VAIC™ theory. As such, we will use VAIC as a measurement for the firm's intellectual capital. Before looking more closely at the research methodology used, we will start this chapter with an overview of the global oil sector, in addition to the short explanation given in chapter one. Since the industry is quite complex, we will try not to go into too much detail, but will focus on information relevant to the research topic of this thesis.

Unless otherwise stated in footnotes or references, all compiled data used in our analysis has been obtained from Bloomberg, as well as manual extraction from annual and quarterly reports.

3.1 An overview of the global oil sector

The oil and gas industry is one of the largest, most complex and important global industries (Inkpen 2010). Despite falling from 46% in 1973 to 31% in 2013, oil still accounts for the largest share of the total primary energy supply, followed by coal (29%) and natural gas (21%), according to statistics from The International Energy Agency (IEA)[5].

A widely used way to describe the value chain of the oil and gas industry is to break it down into three major parts (in chronological order); upstream, midstream and downstream. See figure 9 below. Upstream covers those activities related to exploration, development and production, and is often referred to as E&P. The midstream activity comprises oil and gas storage, transportation and trading, while the downstream activity comprises oil and gas refinement and marketing. There are companies operating within only one part of this value chain, but a common theme for the industry is vertical integration. The term integrated oil companies (IOCs) relates to those companies that have activities in many industry segments from exploration to refining, marketing and retail (Inkpen 2010). In short, integrated oil companies operate within the whole value chain listed in figure 9.

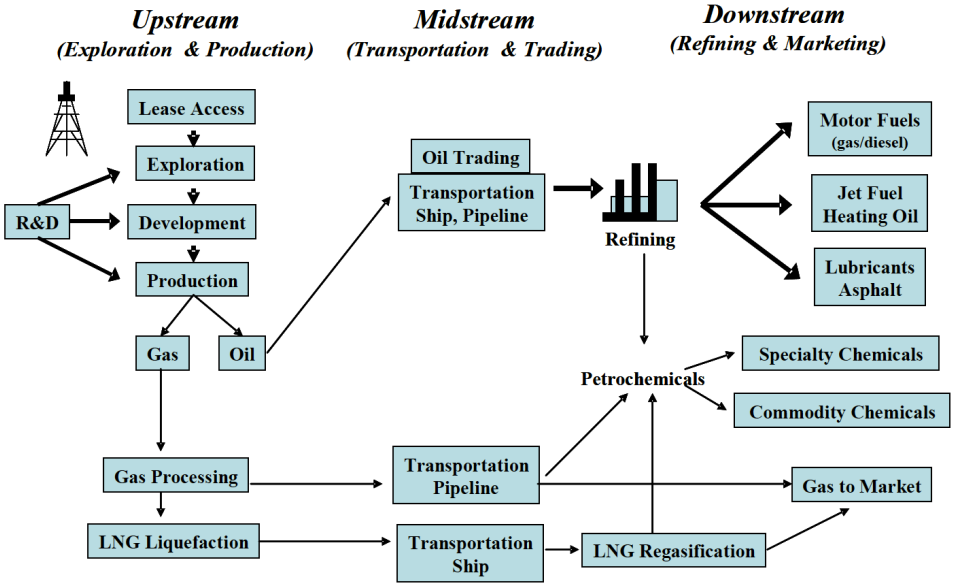


Figure 9: Global oil and gas value chain. Source: Andre Inkpen (2010)

[5] http://energyatlas.iea.org/?subject=-1920537974

For clarification purposes, we will explain two common measurements in the oil industry:

Reserve replacement ratio (RRR):

The reserve replacement ratio is an important measure in the oil industry. It measures the amount of proved reserves added to a company´s reserves during the year relative to the production of oil (and gas) in the same period. This means that if a company has a replacement ratio of 50%, then its assets (oil reserves) will be lowered. To stay in the business in the long run, a company needs to replace its assets.

Barrel of oil equivalent (boe):

Barrel of oil equivalent is used by oil and gas companies that combine both oil and gas reserves and production into one common measure. This makes it easier to get an understanding of total reserves and production, regardless of oil and gas. One barrel of oil equivalent is an approximation of energy released by burning one barrel of crude oil. Often abbreviated in terms of million, mboe.

3.2 Sample selection

Oil is one of the most sought after products in the world. However, there is little difference for the end-user if company A extracted the crude oil, or if company B did the same job. The product remains more or less the same, and companies operating within this industry compete mainly in terms of cost efficiency measures.

The underlying hypothesis for the **VRIO** framework is that the firms' resources need to be **V**aluable, **R**are, **I**n-imitable and **O**rganized to capture value. Arguably, major integrated oil companies' tangible assets, namely ownership stakes in different oil fields, possess all these attributes, except for the **O**, which relates to the firm exploiting the resources. However, if tangible assets are the main driver for competitive advantage, one is hard pressed to explain why some firms consistently outperform others.

There are several different projections of the likelihood of finding oil after

preliminary geographic surveys. According to Milkov (2015), the exploration technical success rate has increased from about 20% in the 1950s to about 35% in 2012. There are also sources which operate with a success rate closer to 50%[6]. Assuming normal distribution in the data, both concerning the likelihood of finding oil and production costs, underperforming firms should over time "luck out", and obtain profitable licences. Over time, this would mean that the profitability of the firms is evened out.

One possible explanation for firms' competitive advantage is their possession and use of intellectual capital. This intellectual capital can increase the odds of finding oil after geological surveys, decrease extraction cost, decrease logistic costs, etc. Intellectual capital can then be used to create VRIO tangible assets, enhance the likelihood of finding such assets, or be a VRIO asset in itself. As such, we argue, intellectual capital represents the **O** in VRIO, namely the firm's ability to organize itself to capture value from the resources.

To be able to evaluate the performance of companies over time, many factors must be considered when choosing the sample data. Small integrated oil companies' share prices can be greatly affected by major oil finds. However, based on the aforementioned assumptions, these finds, could also to some degree be attributed to luck. It is therefore preferable that the companies are of a certain minimum size to cancel out some of that effect.

Additionally, in a discussion paper from The International Finance Corporation (Schiffer and Weder 2001), an affiliate of the World Bank, which draws on a global survey in 80 countries of about 10,000 executives, the authors find that smaller firms experience more obstacles in doing business than larger firms. To be more concrete, the report concludes that smaller firms face significantly more problems than larger firms with regard to financing, taxes and regulations, inflation, corruption and street crime. Whether or not the report's claims are correct in the context of our chosen sector, there seem to be important differences

[6] http://www.history.co.uk/shows/britains-oil-hunters/articles/finding-oil-and-gas

between larger and smaller firms when it comes to market and governmental obstacles. Another factor that strengthens our decision to examine only larger firms in this study is that smaller firms, according to a study from Moen (1999), tend to have different competitive advantages compared with larger firms. Blending small and large firms together, could therefore create noise in our empirical investigation of integrated oil companies.

By also including the extraction, production and refining of oil, we gain more service areas where intellectual capital can help explain competitive advantages. Many such large integrated oil companies have national ownership and gain profitable oil licences in their native countries, i.e. companies like Saudi Aramco, Sinopec and Petrobas. The largest oil and gas firms, based on reserves, are national oil companies (NOCs), which are partially or wholly state-owned. NOCs control about 90% of the world's oil and gas (Inkpen 2010). In order to cancel out these effects to some extent, we have chosen to exclude such major players from our sample.

A search of Bloomberg for "integrated oil companies", produced 115 companies with a total market capitalization (2015) of USD 87,372,771,167,334. Of these, 22 are nationally owned companies, such as Ecopetrol, Petrochina, etc., leaving us with 93 companies with a market capitalization of USD 3,239,391,071,334. Dividing the remaining group in half, with market capitalization as a divider, leaves us with 46 companies with a market capitalization of USD 3,177,611,327,488. This has been done to enable a comparison of companies based on size.

Excluding companies whose main focus is not offshore oil production leaves us with 35 companies, with a total capitalization of USD 2,601,913,500,672. Final sorting is done using subjective assessment, with the goal of picking the most comparable companies. By assessing the fame of the company (determined by the number of analytical reports produced), the companies' own listing of peer companies (found on the companies' webpages) amongst other criteria, we whittled down the sample size to eight companies. Our eight companies have an aggregated market capitalization of USD 882,722,319,360, which is 33.9% of

total the population (after our sampling reduction).

Our final sample consists of eight publicly traded, integrated oil companies: BP, Chevron, ENI, Exxon, OMV, Repsol, Royal Dutch Shell and Total.

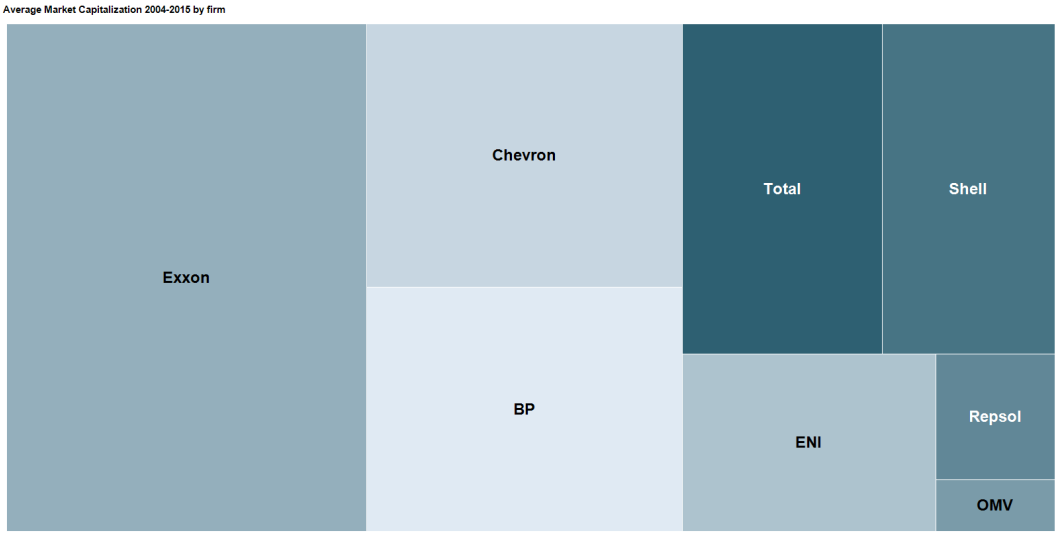


Figure 10: Average Market Capitalization of the sampled companies in the period between 2004 and 2015.

Ranging from one of the world's largest companies, Exxon, to ENI, our sample includes major integrated oil companies. See figure 10 for a visualization of the average market capitalization per company in the relevant time period (2004-2015).

Being a global integrated oil company requires major assets, so the sample size is limited by its very nature. In addition, no two companies are 100% comparable (in any aspect), which further limits the sample potential. Nonetheless, our sample size represents, arguably, the top eight major comparable players.

Our sample includes data from the period between 2004 and 2015. By choosing to examine a relatively lengthy time period, we are better able to see the long-term contribution that intellectual capital may have on competitive advantage.

3.3 Company overview

Below follows a short description of each of the eight companies in the sample.

2015 Numbers in mUSD where applicable	Average	BP	Chevron	ENI	Exxon	OMV	Repsol	Shell	Total
Revenue	141 870	222 894	122 566	75 192	236 810	25 005	44 110	264 960	143 421
EBITDA	8 %	3 %	7 %	12 %	9 %	14 %	0 %	7 %	11 %
Production	2 222	3 136	2 622	1 760	4 098	303	559	2 954	2 347
Number of employees	60 896	79 800	61 494	30 970	73 500	24 817	27 566	93 000	96 019
P/B	1,08	1,41	1,13	0,98	1,84	0,78	0,59	0,58	1,35
Annualized return*	163	120	248	115	199	170	98	175	178
Reserve replacement ratio	134 %	72 %	107 %	107 %	67 %	110 %	508 %	-5 %	107 %
Free cash flow	-2 901	-7 337	-5 733	-4 649	3 518	1 115	-1 183	671	-9 607
Total assets	209 947	261 832	266 103	146 209	336 758	35 493	68 539	340 157	224 484
Exploration/total assets	1,4 %	0,9 %	1,3 %	1,2 %	0,8 %	2,2 %	2,4 %	1,7 %	0,9 %
Tobins Q	0,56	0,63	0,43	0,62	0,49	0,64	0,55	0,52	0,59
Residual income	-10 524	-18 334	-15 703	-9 728	-7 687	-3 038	-5 178	-16 310	-8 214
VAIC	2,21	0,34	2,36	2,72	4,80	3,32	0,01	1,60	2,50

*2004 benchmark

Table 2: Chosen key parameters for our eight sample companies in the time period 2004-2015.

Only three companies from our sample size generate more than USD 200,000 m in revenue: BP, Exxon and Shell. However, revenue size is not a determinant of efficiency, as seen by the EBITDA ratio of BP, which is only 3%, compared to the average of 8%. Exxon has the highest production output (4,098 mboe), while the smallest producer of our sample is OMV (303 mboe). Total has the highest number of employees, more than three times as many as OMV. The sample average P/B ratio is 1.08, which is heavily influenced by Exxon's ratio of 1.84. Annualized return is calculated with a baseline of 100 in 2004, and shows the return on the share (corrected for dividends, share issues and buybacks) since the benchmark year. Only Exxon, OMV and Shell had a positive free cash flow in 2015, reflective of the prevailing market conditions facing the oil sector in 2015. Comparing the book value of total assets shows that Shell is approximately ten times bigger than OMV. Tobin's Q indicates that none of the companies was overvalued in 2015. Using weighted average cost of capital (WACC) as a required rate of return on assets, all of the companies posted negative value creation in 2015. Also worth noting is the high VAIC ratio of Exxon, 480 times the VAIC component of Repsol.

BP

BP, formerly known as British Petroleum, is an integrated oil and gas company with 79,800 employees and operations in more than 70 countries.

As of 31 December 2015, BP produces around 3.3 million boe per day and has proved reserves of 17.18 billion boe[7]. In 2015 the group generated total revenues of USD 222.89 billion and made a loss of USD 6.5 billion[8], the biggest loss in the company´s history. BP had a market capitalization of USD 95.872 million at end the of 2015.

In 2010 an explosion aboard BP's oil rig Deepwater Horizon caused millions of barrels of crude oil to spill into the Gulf of Mexico. In 2015, five years after the oil platform exploded, the total pre-tax charges associated with the spill totalled USD 53.8 billion for BP, according to The Economist[9]. The event and the economic consequences in the Gulf of Mexico must be taken into account when interpreting the final results, as BP could be an outlier in the sample. Despite this possibility, we choose to include the company, since events like Deepwater Horizon are a part of the general "risk of doing business".

BP has its primary listing on the London Stock Exchange, but is also listed on the Frankfurt Stock Exchange and New York Stock Exchange. The company was initially a state-owned company, but the British government sold their shares in five stages during 1977 and 1987[10].

By the end of 2015, BP had a broad ownership structure. Bloomberg classifications shows that investment advisors (investment entity that manages investors' assets in return for a fee) hold 77.49%, where the largest single shareholder in this group, Legal & General Group PLC, owned approximately 3%. The second largest group of shareholders is what is classified as governments, with 6.97% of the company. This group of investors also includes sovereign wealth funds like the Norwegian Government Pension Fund. The third largest ownership type is banks totalling 6.42% of the share capital.

Chevron

Chevron is an integrated oil and energy company with nearly 60,000 employees

[7] http://www.bp.com/en/global/corporate/about-bp/bp-at-a-glance.html
[8] http://www.bp.com/content/dam/bp/pdf/investors/bp-annual-report-and-form-20f-2015.pdf
[9] http://www.economist.com/news/business-and-finance/21656847-costly-mistake
[10] www.parliament.uk/briefing-papers/rp14-61.pdf

and worldwide operations. In 2015, the company had revenues of USD 122.56 billion and a net profit of USD 4.6 billion. In 2015 the company's upstream business had a net production of of 2.6 million boe per day and proved reserves of 11.2 billion boe[11]. The company had a market capitalization of USD 169,308 million at the end of 2015.

Chevron's shares are listed on the New York Stock Exchange and the company has a broad ownership structure. By the end of 2015, investment advisors owned a total of 88.06% of the company, with Vanguard Group INC as the largest shareholder with approximately 6%. The second largest group of shareholders were pension funds and insurance companies, with approximately 3% each.

Eni

Eni, whose name was originally Ente Nazionale Idrocarburi, is an Italian energy company. It has operations in 66 countries across Europe, Africa, Asia, Oceania and America. In 2015 production averaged 1.76 million boe per day, while proved reserves stood at about 7 billion boe at the end of the year[12]. The company generated revenues of USD 75,192 million and made a net loss of USD 9,791 million in the financial year ended December 2015, according to Bloomberg. At the end of 2015 the company had a market capitalization of USD 54,721 million.

At the end of 2015 the Italian Government controlled 30.3% of the company's shares, according to Bloomberg. This means that the Italian Government has de facto control of Eni SpA[13]. More specifically, the Italian Government directly owns approximately 3.93% through the state Treasury (Ministero Dell´Economia E Delle) and 26.37% indirectly via the Casse Depositi E Prestiti SpA. The third largest single shareholder is People´s Bank of China, which owns 2.10% of ENI's shares.

ENI is traded on both the Milan Stock Exchange and New York Stock Exchange (NYSE).

[11] https://www.chevron.com/-/media/chevron/annual-report/2015/2015-Annual-Report.pdf
[12] https://www.eni.com/docs/en_IT/enicom/publications-archive/publications/reports/reports-2015/Integrated-Annual-Report-2015.pdf
[13] https://www.eni.com/en_IT/company/governance/shareholders.page

Exxon Mobil

Exxon Mobil is by far the largest publicly traded international oil and gas company, with a market capitalization of USD 324,501 million at the end of 2015. It has approximately 73,500 employees and is present on six continents. The company as we know it today was formed by the merger of Exxon and Mobil in 1999. In 2015 the company generated revenues of USD 236,810 million and had a net income of USD 16,150 million[14].

At year-end 2015, ExxonMobil's proved reserves totalled 24.8 billion barrels of oil-equivalents[15].

Exxon Mobil is listed on the New York Stock Exchange (NYSE) and the largest group of shareholders is investment advisors[16] with a total of 85.64% of the company's shares. Within this group, Vanguard Group Inc. is the largest entity, with approximately 6.4% of the shares.

OMV

OMV, formerly Österreichische Mineralölverwaltung, has activities in both the upstream and downstream part of the oil and gas sector. It has a workforce of approximately 24,100 employees and is headquartered in Vienna, Austria. The group generated revenues of EUR 22.5 billion (USD 25 billion) and made a net loss of USD 1.2 billion in the financial year 2015. In 2015 daily production averaged 303 kboe/d, and by the end of the year the company had proved reserves of 1,028 million boe[17]. At the end of 2015 the company had a market capitalization of USD 9,331 million.

As of December 2015, the largest shareholders were ÖBIB (Österreichische Bundes- und Industriebeteiligungen GmbH, Austrian state holding company), with 31.5% and IPIC (International Petroleum Investment Company, Abu Dhabi), with 24.9%. The shares are listed on the stock exchanges in Vienna and USA.

[14] http://cdn.exxonmobil.com/~/media/global/files/summary-annual-report/2015_Summary_Annual_Report.pdf
[15] http://news.exxonmobil.com/press-release/exxonmobil-announces-2015-reserves-additions
[16] Bloomberg classification: Investment entity that manages investor´s assets in return for a fee.
[17] https://www.omv.com/SecurityServlet/secure?cid=1255769898132&lang=en&swa_id=446987947759.73846&swa_site=

Repsol

Repsol is an integrated oil and gas company with activities in five continents and more than 40 countries. The company, headquartered in Madrid, generated revenues of EUR 39,737 million (USD 44,108 million) and made a net loss of USD 1,275 billion in 2015. Repsol had a market capitalization of USD 15 399 at the end of 2015.

Repsol's average production in 2015 totalled 559,000 boe per day. This includes the acquisition of the Talisman's assets, which contributed 203,000 boe per day to its average annual production. Proved reserves increased by 54% during 2015, to reach 2,373 billion boe[18].

It has official listings on the Spanish stock exchanges: Madrid, Barcelona, Bilbao and Valencia. Additionally, is the company's shares are also listed on the Buenos Aires Stock Exchange[19]. The three largest individual shareholders are Caixabank (10.24%), Sacyr (8.48%) and Temasek (4.95%) as of 5 March 2016[20].

Royal Dutch Shell

Royal Dutch Shell, commonly known simply as Shell, is a multinational oil and gas company, headquartered in The Hague in the Netherlands, with 93,000 employees and activities in more than 70 countries. In 2015 Shell generated revenues of USD 265 billion and had a net income of USD 1.9 billion. It produced 3.0 million boe per day in 2015[21]. The company had a market capitalization of USD 91,479 million at the end of 2015.

In April 2015 Shell announced that it had reached agreement to buy the British oil and gas company BG Group. The USD 53 billion acquisition, which was completed in February 2016, puts the Shell second behind Exxon Mobil on the list

[18] http://www.annualreport.repsol.com/en/informacion-financiera/resultados/
[19] https://www.repsol.com/es_en/corporacion/accionistas-inversores/servicio-ir/preguntas-frecuentes/faq_acciones.aspx
[20] https://www.repsol.com/es_en/corporacion/accionistas-inversores/la-accion-de-repsol/distribucion-acionarial/
[21] http://www.shell.com/about-us/who-we-are.html

of the largest energy companies by market capitalization, according to USA Today[22].

Shell has its primary listing on the London Stock Exchange and secondary listings on Euronext Amsterdam and the New York Stock Exchange. 79.08% of the shares were owned by what Bloomberg classifies as 'Investment Advisors' at the end of 2015, with no single owner holding more than 10%.

Total

Total is a French multinational oil and gas company with 100,000 employees in more than 130 countries. In 2015 the company generated sales revenues USD 143,421 million and made a net profit of USD 5,087 million. In 2015, Total's average daily production of liquids and natural gas totalled 2,347 kboe/d, while its proved reserves of oil and gas stood at 11,580 million boe at the end of the year.

The company is listed on the Paris, Brussels, London and New York stock exchanges, and it had a market capitalization of USD109,408 million at the end of 2015. 82.17% of Total's shares were owned by what Bloomberg classifies as 'Investment Advisors' at the end of 2015, with no single investor owning more than 10% of the shares[23].

[22] http://www.usatoday.com/story/money/2016/02/15/royal-dutch-shell-bg-group/80403694/
[23] http://www.total.com/sites/default/files/atoms/files/total-ddr2015-en_acces.pdf

3.4 Research methodology

Building on the framework from Bontis et al. (2005), "*an empirical investigation of the relationship between intellectual capital (IC) and firms' market value and financial performance*", figure 11 presents the theoretical framework for developing the research hypothesis of this thesis.

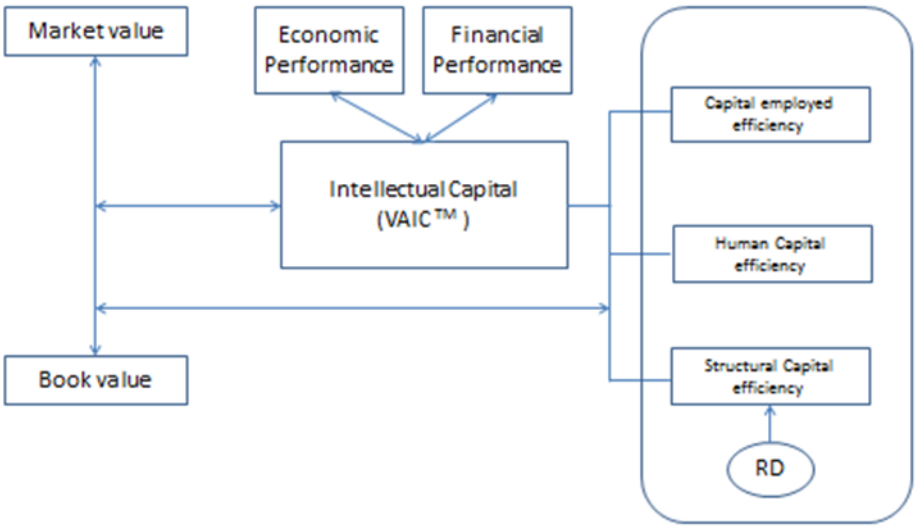


Figure 11: Theoretical research framework. Source Bontis et al (2005)

If VAIC is a contributor to competitive advantages in a firm, VAIC will positively be effecting economic performance. In an efficient market, economic and financial measures of a company are the main drivers for a company's stock value.

Using the VAIC framework, we will measure IC's effect on economic, financial and market performance, in order to distinguish between effects.

Many of the studies on intellectual capital have been performed on intellectually intensive industries, such as the IT sector. Our chosen industry is capital intensive, and as such needs a more refined measure of VAIC to quantify the effects.

Dividing VAIC into (Zéghal and Maaloul 2010):
- value added intellectual capital coefficient (VAIN), and

- value added capital coefficient (VACA)

will enable us to see the impact that intellectual capital will have on the efficiency of capital employed. More detailed descriptions of the variables will follow.

The aim of this thesis is to measure intellectual capital's effect on competitive advantages within firms, making them able to outperform peer companies.
By dividing firm performance into three separate dimensions, we will be able to more precisely pinpoint the effect of intellectual capital. Literature (Zéghal and Maaloul 2010) suggests dividing firm performance into:

- *Economic:* Defined as the operating profitability which represents an economic surplus or an economic margin acquired by the difference in revenue and costs.
- *Financial:* Defined by profitability, an expression of invested capital's ability to earn a certain level of profit.
- *Stock market:* Defined by the value of the firm's stock – and therefore its value.

We will therefore outline four hypotheses in general, which will be amended to test each dimension of firm performance – making a total of 12 hypotheses to be tested.

Nakamura (2001) suggests that by increasing IC in companies, the success of these investments should permit companies on average to reduce their production costs and/or increase any kind of operating margins. We will therefore test the following hypotheses:

H1-a Companies with greater intellectual capital, measured by VAIC, have greater economic performance

H1-b Companies with greater intellectual capital, measured by VAIN and VACA, have greater economic performance

H1-c Companies with greater intellectual capital, measured by VAIN, VACA and R&D, have greater economic performance

H1-d IC affects future economic performance

Many authors argue that IC has a positive effect on the company's financial performance, which is defined by the ability of invested capital to earn a certain degree of profit. If IC does have the hypothesized effect on sustained competitive advantage, it will be a determinant of superior financial performance. Therefore, we test the following hypotheses:

H2-a Companies with greater intellectual capital, measured by VAIC, have greater financial performance

H2-b Companies with greater intellectual capital, measured by VAIN and VACA, have greater financial performance

H2-c Companies with greater intellectual capital, measured by VAIN, VACA and R&D, have greater financial performance

H2-d IC affects future financial performance

Assuming that IC positively contributes to sustained competitive advantage, an efficient stock market will reward IC-intensive companies. We therefore test our hypothesis on the stock market, to see the effects of IC on valuation.

H3-a Companies with greater intellectual capital, measured by VAIC, have greater stock market performance

H3-b Companies with greater intellectual capital, measured by VAIN and VACA, have greater stock market performance

H3-c Companies with greater intellectual capital, measured by VAIN, VACA and R&D, have greater stock market performance

H3-d IC affects future stock market performance

Before commencing the statistical tests on our data material, we hypothesize a lagged effect of R&D on our performance indicators. In Hx-d we therefore test one, two and three-year lagged effects on the Hx-a/b/c hypotheses. By lagged effects we mean testing the effect that the independent variable at time t-1 has on the dependent variable at time t.

Our sample includes companies from many different countries in the world, and

as such, the companies are subject to different tax regulations. In order to mitigate this effect, we will, as far as possible, use pre-tax financial figures.

3.4.1 Variables

The step-by-step procedure in the VAIC method is as follows:

- **Calculate value added (VA)**

$$Value\ Added = OUTPUT - INPUT \quad (1)$$

Value added can also be expressed as:

$$R = S - B - DP - W - I - DD - T \quad (2)$$

where R is changes in retained earnings, S is revenue, B is cost of goods sold, DP is depreciation, W is wages, I interest, DD is dividends and T is taxes. One can rearrange equation (2) as follows:

$$S - B = DP + W + I + DD + T + R \quad (3)$$

$$S - B - DP = W + I + DD + T + R \quad (4)$$

Equation (3) is the gross value approach and equation (4) is the net value approach. We define VA as the net value created by firms during the year, and because

dividends plus change in retained earnings equals net income under the clean surplus assumption, equation (4) can be expressed as follows:

$$VA = S - B - DP = W + I + T + NI \quad (5)$$

Note that we use pre-tax income for net income, due to the different tax effects on our companies.

- **Calculate CE (capital employed), HU (human capital) and SC (structural capital)**

Following the framework of Pulic (1998), one can calculate CE, HU and SC using the following equations:

$$CE = physical\ capital + financial\ assets$$
$$= Total\ assets - intangible\ assets \quad (6)$$

$$HU = total\ expenditure\ on\ employees \quad (7)$$

$$SC = VA - HU \quad (8)$$

Dividing the firm's resources into these three categories is consistent with the resource-based view of the firm. RBV postulates that the firm's resources are the main driver behind competitiveness and firm performance. This includes both tangible and intangible assets. Here, CE is a proxy for the firm's tangible assets, HU is a proxy for major intangible assets, and SC is a proxy of the synergy within the company.

- **Calculate VAIC**

By definition, the three components of VAIC are calculated as follows:

$$VACA = \frac{VA}{CE} \quad (8)$$

$$VAHU = \frac{VA}{HU} \quad (9)$$

$$STVA = \frac{SC}{VA} \quad (10)$$

IC cannot create value on its own. Therefore, it is important to take financial and physical capital into account when trying to measure the totality of VA created by a company's resources. The value added capital employed coefficient (VACA) shows how much value has been created by one unit invested in capital employed. The value added human capital coefficient (VAHU) indicates how much VA has been created by one unit invested in employees. In the VAIC method, wages are not considered costs, but an investment.

Structural capital (STVA) is a dependent indicator of human capital and value added; the higher the share of human capital on VA, the lower contribution from structural capital.

Our tests relate mainly to the effects of IC on tangible and intangible assets, so we introduce the value added intellectual capital coefficient (VAIN), which is a proxy for major intangible assets, calculated as follows:

$$VAIN = VAHU + STVA \quad (11)$$

VAIC measures how much new value has been created per invested monetary unit in each resource, and can be calculated as follows:

$$VAIC = VAIN + VACA \quad (12)$$

Our three dimensions of firm profitability are each divided into two indicators,

acting as dependent variables in our regression analysis. The dependent variables are calculated as follows for the **economic variables**:

$$EBITDA = Operating\ income + Depreciations \quad (13)$$

In addition, we used revenue as a dependent variable. Economic performance is defined by operating profitability, which represents an economic surplus equivalent to the difference between income and production costs.

Financial:

$$ROE = \frac{Pre{-}tax\ income}{Adjusted\ equity} \quad (14)$$

$$ROA = \frac{Pre{-}tax\ income}{Total\ assets} \quad (15)$$

We adjusted equity to account for the different tax rates, i.e. we calculated an average tax rate for each year (based on all the firms in our sample), and calculated a new after tax income. This allowed us to adjust retained earnings for each year, evening out some of the external differences between our sample companies. Financial performance is defined by profitability, the ability of invested capital to earn a certain level of profit.

Stock market performance:

We used price-to-book ratio (P/B), calculated as follows:

$$Price - to - book\ ratio = \frac{Market\ capitalization}{Book\ value} \quad (16)$$

In addition, we used annual return (AR) as an indicator of stock market performance. AR was adjusted for dividends, etc., and obtained from Bloomberg.

3.4.2 Regression models

The following regression models use Y as a common denominator for our different dependent variables. Model 1 examines the relationship between the dependent variable and the all-inclusive term VAIC. In model 2 we divide the term VAIC into two subcategories, to distinguish between IC-affecting physical assets, and other IC. Finally, in model 3, we include R&D, which many authors link with structural and/or innovative capital.

$$Y = \beta_0 + \beta_1 VAIC_{it} + \mu_{it} \quad (1)$$

$$Y = \beta_0 + \beta_1 VAIN_{it} + \beta_2 VACA_{it} + \mu_{it} \quad (2)$$

$$Y = \beta_0 + \beta_1 VAIN_{it} + \beta_2 VACA_{it} + R\&D_{it} + \mu_{it} \quad (3)$$

In addition to these three models, we test the independent variables for values of t-1, t-2 and t-3, totalling out to 3 x 2 x 3 x 4 = 72 regressions.

In order to adjust for potential outliers, all variables are winsorized at the 95% level. Revenue and annual return is standardized, in order to more easily interpret the results.

As mentioned, our dataset consists of eight companies, with financial data for 2004-2015, totalling 96 firm-year observations. Our aim is to observe the above-mentioned variables over multiple time periods for the same firms, thus making our dataset panel data. As such, we utilize the *xtreg* function in Stata (statistical software). For the non-lag period t, we bootstrap our regression models with 100 in order to compensate for our somewhat low sample size. This will strengthen the residuals' Gaussian distribution, and lower the risk of positive negatives in our regression analysis. Bootstrapped standard deviations reduce the risk of finding significant results due to errors in the residuals. If the residuals do not possess a Gaussian distribution, the p-values might be too low. This will enhance the risk of obtaining significant results where there are none, so called "positive negatives".

In order to test the residuals for Gaussian distribution, we use the shapiro-wilk test, which is applicable for sample sizes $4<n<2000$. In shapiro-wilk (abbreviated swilk), low p-values indicate that the residual does not have a Gaussian distribution. In addition, we will use the built-in command *vce (robust)*, which uses the robust estimator of variance. This is robust for some types of misspecification, as long as the observations are independent, mitigating the chances of heteroscedasticity. Robust does not eliminate heteroscedasticity, but allows Stata to correct some of the heteroscedasticity in the residuals, reducing the risk of too low p-values. This will also reduce the problems with autocorrelation, where the spatial autocorrelation refers to the correlation of itself through the time period.

We test all other variables for normality, but due to limitations of relevance, we

will only discuss some chosen parameters in detail, where informative. We will use a standard Pearson correlation analysis on the explanatory variables to detect multicollinearity issues. However, our main purpose is not to pinpoint the precise effect of each variable, but to identify the overall fit. This means that mild potential multicollinearity issues can be disregarded to some extent.

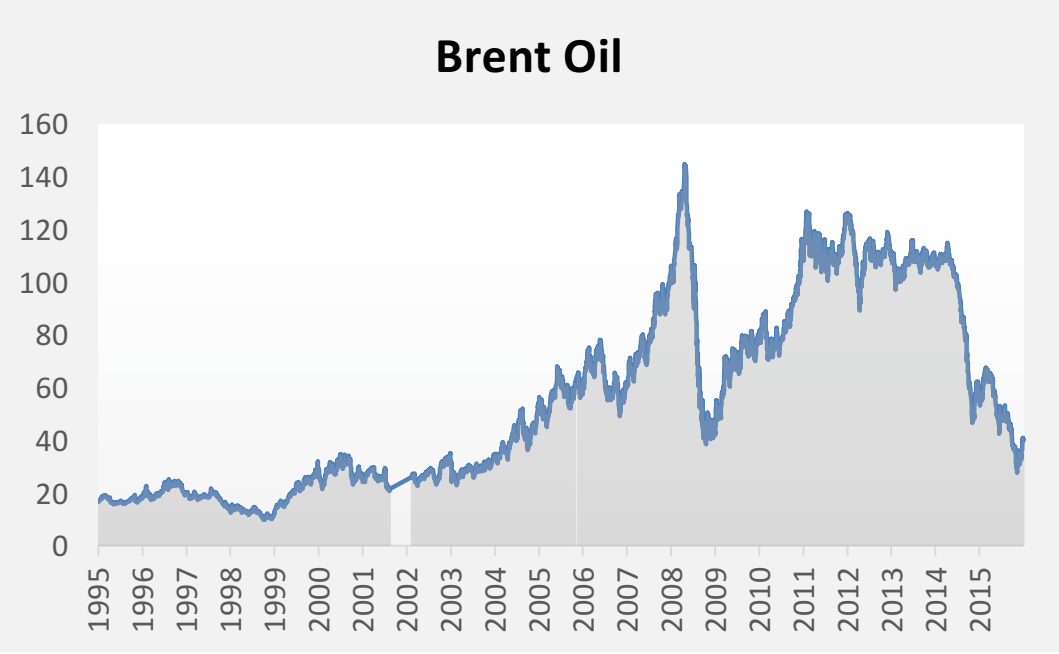
We test our panel data using the *xtreg* function in Stata, testing for random effects. Random effects, unlike fixed effects, assume the variation across companies to be random and uncorrelated with the independent variable included in the model. Further, it assumes that the company's error term is not correlated with the dependent variable (the heteroscedasticity problem we addressed previously) which allows for time-invariant variables to be explanatory.

4 Findings and discussion of results

In chapter 3 we presented the methodology used to examine our research question. In this chapter we present the results of our analysis. Before looking at the results from the statistical methodology presented in chapter 3, we will in section 4.1 present some fundamental analyses of the sample companies.

4.1 Sample performance

The oil price (Brent Crude) is a key profit/revenue indicator for integrated oil companies. Our chosen time-period contains many key changes in this price, ranging from USD 30 per barrel in 2004, peaking in mid-2008 at USD 145, declining to USD 40 in less than 5 months, gaining some traction up to the USD 100-120 range, before declining to around USD 30 in 2015.

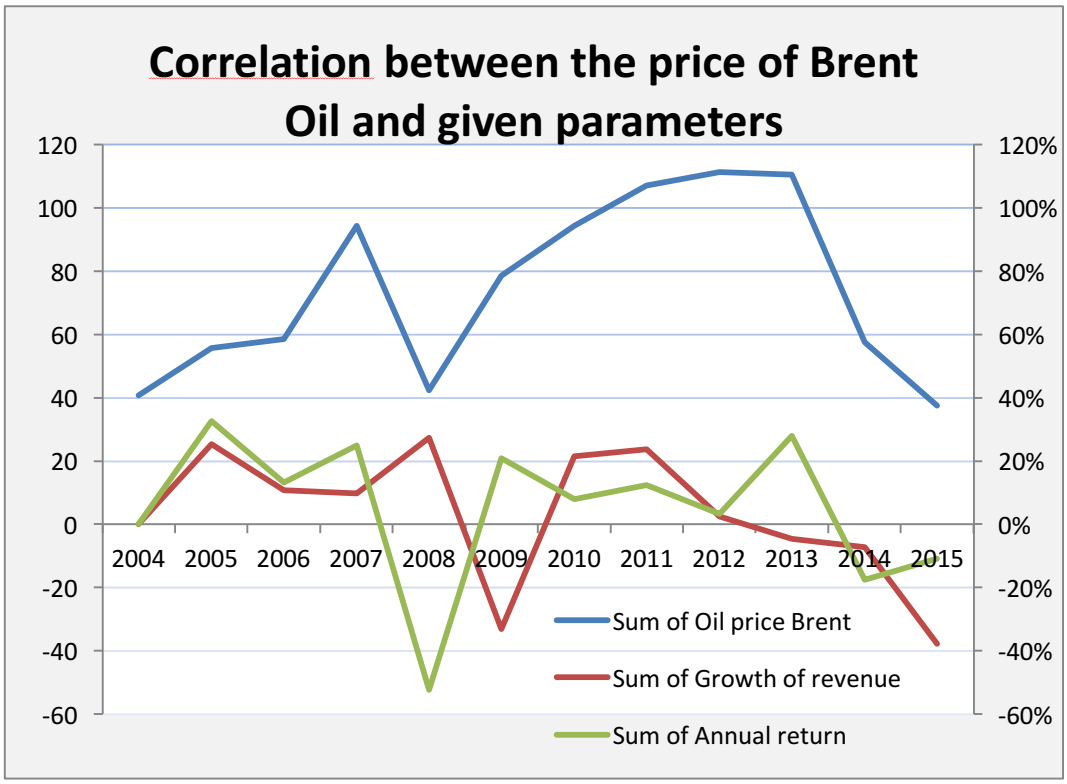


Graph 1: Price development for Brent Crude Oil between 1995 and 2015. The y-axis refers to the dollar price for one barrel of crude oil.

Brent Oil (price development shown in the graph above) is also known as London Brent or North Sea Oil. It originates from the fields which were named by Shell and ExxonMobil after the Brent Goose. It is used to price two-thirds of the world's internationally traded crude oil supplies, according to Wikipedia[24].

[24] https://en.wikipedia.org/wiki/Brent_Crude

As a natural benchmark for the sample firms, the oil price will further help to identify firms outperforming their peers.

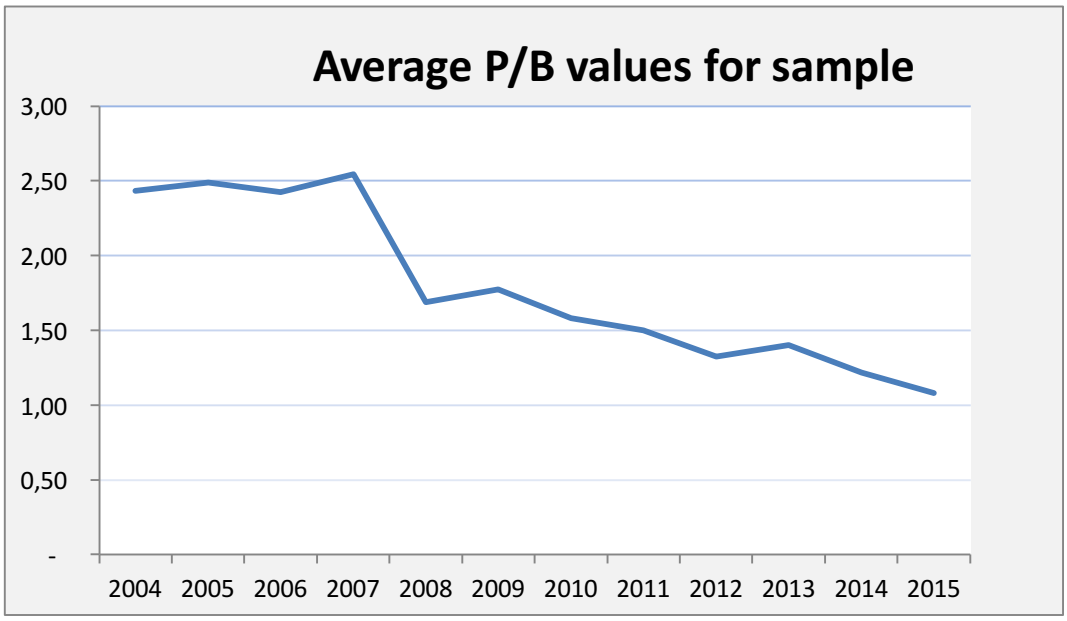


Graph 2: Revenue growth (red line) and return (green line) for our eight integrated oil companies are highly correlated with the price for Brent Oil (blue line).

As is evident from graph 2 above**,** the stock market values the sample companies, on average, using the oil price as an indicator of future revenue. The lagged response in revenue growth is due to the release dates of the companies' annual financial reports.

Many of the relevant studies of intellectual capital have been performed in an attempt to explain the growing difference between market and book value Our sample has experienced a sharp decline in P/B, which indicates investors' loss of faith in the future performance of our sample companies, valuing them close to book value. As is evident in graph 2, the correlation between the oil price and the performance of the oil companies is high. However, by 2010 most of the loss in the Brent oil price had been regained, whilst our P/B graph shows a slow decline from about 1.50 to 1.0 in the time period 2010-2015 and no "bounce back". This might indicate that investors considered the pre-financial crisis valuation to be overly positive. However, any conclusions on the oil industry alone needs to be

viewed with caution, as our sample size is only a part of the population, and certainly not representative for other industries as well. The decline in book value might just as well stem from our eight companies along. That said, Exxon, often ranked as the world's most valuable company, has a peak of 4.12 in 2007, and 1.84 in 2015, indicating that "blue chip" stocks in the oil sector took a heavy hit in the time period.



Graph 3: Average P/B values for sample

P/B	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Average	2,43	2,49	2,42	2,54	1,69	1,77	1,58	1,50	1,33	1,40	1,22	1,08	
BP	3,33	3,35	3,15	3,00	2,00	2,22	1,87	1,71	1,59	1,57	1,46	1,41	
Chevron	2,45	2,19	2,48	2,71	1,82	1,76	1,81	1,80	1,59	1,65	1,40	1,13	
ENI	2,62	2,61	2,73	2,63	1,66	1,70	1,46	1,30	1,15	1,11	0,90	0,98	
Exxon	3,11	3,05	3,93	4,12	3,40	2,83	2,42	2,53	2,26	2,43	2,18	1,84	
OMV	1,20	1,97	1,42	1,66	0,66	1,00	1,11	0,77	0,81	1,04	0,65	0,78	
Repsol	1,85	1,97	1,90	1,65	1,12	1,57	1,36	1,49	0,91	0,93	0,80	0,59	
Shell	1,41	1,29	1,18	1,26	0,75	0,81	0,82	0,80	0,76	0,78	0,79	0,58	
Total	3,48	3,50	2,60	3,34	2,11	2,30	1,79	1,63	1,55	1,71	1,56	1,35	

Table 3: Price to Book ratio.

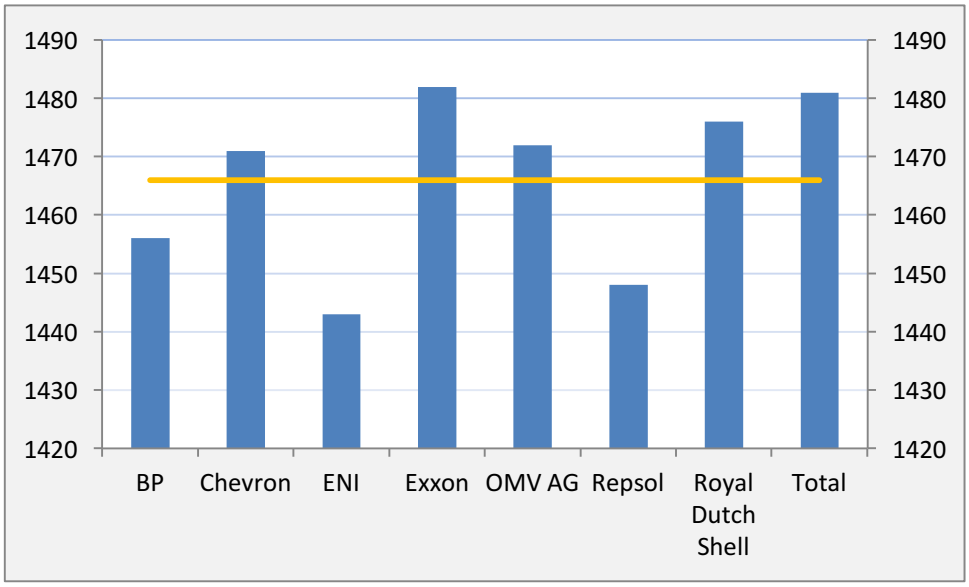
A preliminary conclusion from our findings indicates that material assets in the chosen industry remain important. However, intellectual capital may still be partly responsible for creating sustained competitive advantages (Kaplan and Norton 1996b). This further underpins the necessity of measuring intellectual capital's effect on capital employed.

Table 4 shows a correlation analysis on the day-to-day oil price, total return and market capitalization, with a star indicating significant correlation with 99% confidence. This statistical test is further evidence that oil is a strong benchmark to use in our analysis of firm performance.

	Market~n	Totalr~n	OilPrice
Marketcapi~n	1.0000		
Totalreturn	0.1875*	1.0000	
OilPrice	-0.0184*	0.0774*	1.0000

Table 4: Correlation analysis between market capitalization, total return and day-to-day oil prices.

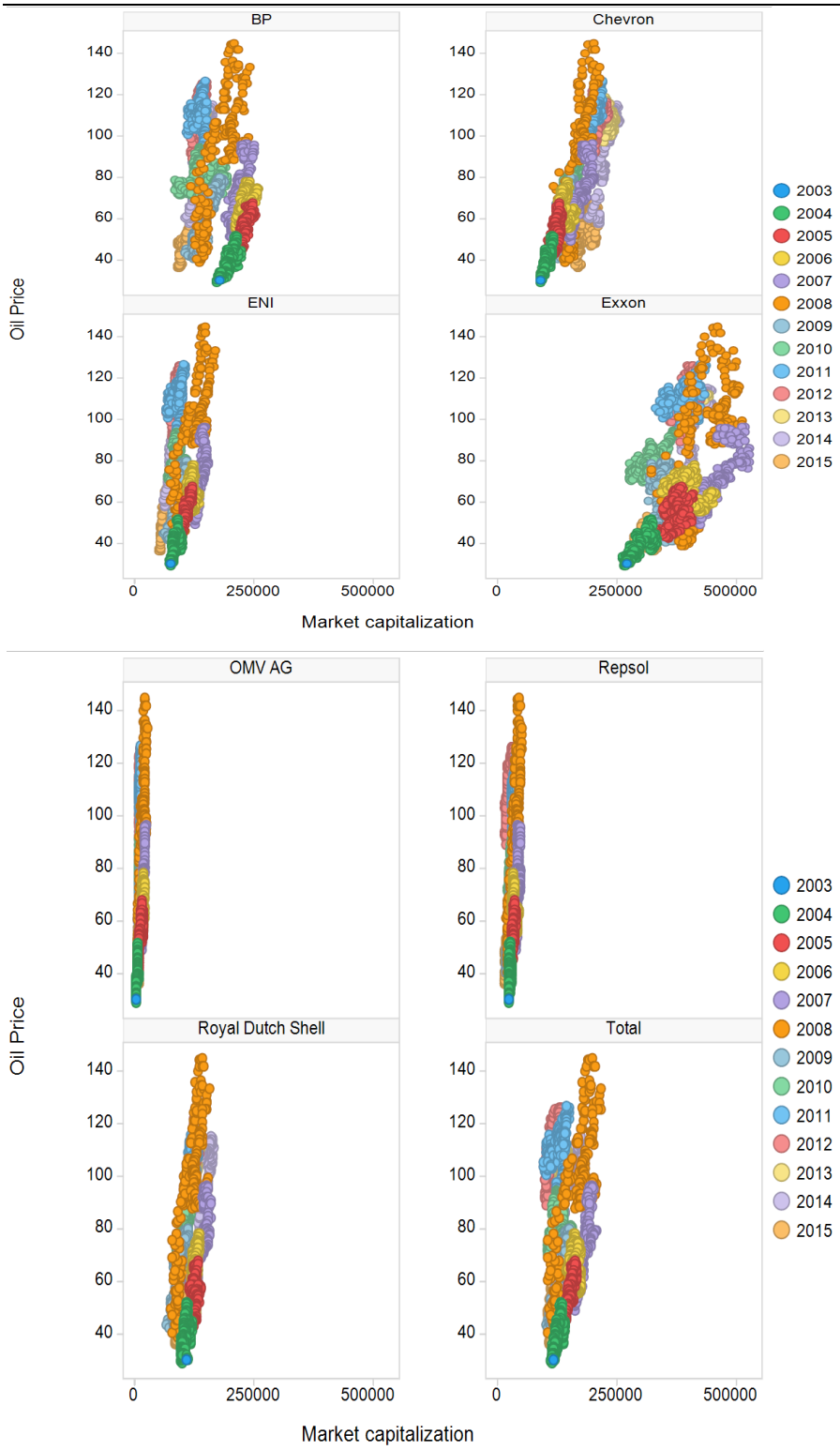
We conclude, both based on visual and statistical methods, that the oil price is strongly correlated with the performance of large integrated oil companies. This correlation allows us to use the oil price as a benchmark for more companies than our sample includes, and identify above-market performance. That the correlation is proved comes as no surprise, since the companies' main product is priced in accordance with the Brent oil price.



Graph 4: Companies performing better (measured by change in market cap) than day-to-day change in oil price. Average performance marked with yellow line.

Graph 4 above depicts the number of days the day-to-day change in market capitalization outperformed the day-to-day change in oil price. This is measured by calculating the percentage change in market capitalization, and comparing it to the percentage change in oil price. Building on the strong correlation previously identified between oil price and firm performance, we measure "outperformance" by the number of days the change in market capitalization exceeds the change in

oil price. Chevron, Exxon, OMV, Royal Dutch Shell and Total perform above average (yellow line). This implies that the average number of days in which the market valuation of our sample changed more than the oil price was 1,466 days. This is used as an indicator of above-average performance in our firms, in an effort to identify firms with strong performance



Graph 5: Day-to-day correlation of market capitalization and oil price for each firm in the sample of eight companies.

The above graphs depict the day-to-day correlation of market capitalization and oil price for each firm. The x-axis depicts market capitalization, and y-axis the oil price of the corresponding day. The further to the right a point is, the more "value per oil price dollar" the company has. Again, Exxon, Chevron, Total, Royal Dutch

Shell and ENI have a wider reaction span to the oil price, compared with the others. A notable exception is BP which, in the years prior to the Deepwater Horizon spill (2010), had a wider reaction area.

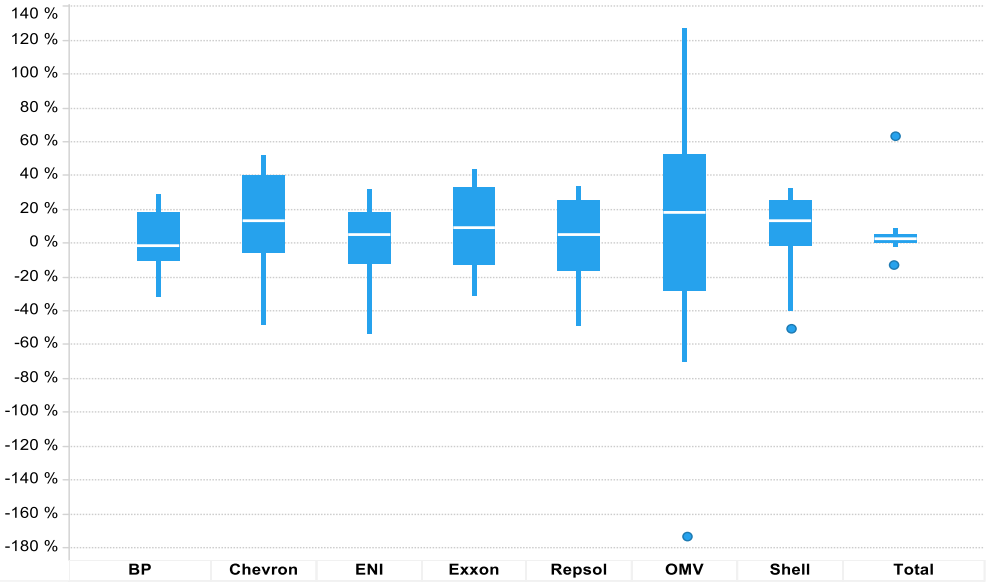
Table 5 below is a listing of annual returns from 2004 (the benchmark year), with year-to-year change, grand total and the average in the colorized bottom rows. Chevron and Exxon are clearly the investors' favourites, with average annual return around 10%. BP was amongst the top tier before the Deepwater Horizon spill, with a notably high resilience in the 2008 financial crisis, falling only 12%. However, in the years after 2010, returns are low/negative.

Total has low variation, yielding stable but low returns, with a notable exception in 2015, where the annual return is 63%. Shell is consistently in the high digits of return, both positive and negative, averaging at 6.2%, only 0.3% below Total. The average for our sample size is 5.2%, below OMV's return. However, OMV is highly volatile, as we shall see more clearly later on.

Annual return	Average	BP	Chevron	ENI	Exxon	OMV	Repsol	Shell	Total
2004	0	0	0	0	0	0	0	0	0
2005	33 %	26 %	12 %	17 %	12 %	127 %	34 %	29 %	4 %
2006	13 %	-6 %	38 %	32 %	44 %	-26 %	11 %	10 %	3 %
2007	25 %	16 %	46 %	22 %	41 %	64 %	-8 %	16 %	3 %
2008	-52 %	-12 %	-36 %	-54 %	-31 %	-173 %	-49 %	-51 %	-13 %
2009	21 %	29 %	13 %	17 %	-17 %	65 %	32 %	22 %	7 %
2010	8 %	-32 %	39 %	-12 %	14 %	8 %	17 %	32 %	-2 %
2011	12 %	4 %	43 %	2 %	30 %	-36 %	25 %	30 %	2 %
2012	3 %	-3 %	13 %	31 %	6 %	29 %	-45 %	-6 %	2 %
2013	28 %	26 %	52 %	9 %	42 %	49 %	29 %	8 %	9 %
2014	-17 %	-16 %	-22 %	-37 %	-11 %	-70 %	-8 %	25 %	1 %
2015	-11 %	-10 %	-48 %	-13 %	-30 %	33 %	-42 %	-40 %	63 %
Grand Total	**62,8 %**	**20,2 %**	**148,5 %**	**14,6 %**	**98,7 %**	**69,6 %**	**-2,4 %**	**74,7 %**	**78,4 %**
Average total	**5,2 %**	**1,7 %**	**12,4 %**	**1,2 %**	**8,2 %**	**5,8 %**	**-0,2 %**	**6,2 %**	**6,5 %**

Table 5: Summary of annual return from 2004 (the benchmark year), with year to year change, with the grand total and the average in the colorized bottom.

Below is a boxplot (figure 12) with the same information, depicting annual return variations from 2004 and 2015 for each firm. As can be seen, OMV has a standard deviation of 77%, with a minimum of -173% return and a maximum of 127%. Therefore, we deem the share to be too inconsistent to possess a sustainable competitive advantage.



	BP	Chevron	ENI	Exxon	Repsol	OMV	Shell	Total
Median	-1,74 %	12,90 %	5,07 %	8,99 %	5,51 %	18,49 %	12,95 %	2,48 %
StdDev	19,05 %	33,39 %	26,55 %	27,15 %	30,54 %	77,10 %	26,97 %	18,67 %
Avg	1,68 %	12,37 %	1,21 %	8,22 %	-0,20 %	5,80 %	6,23 %	6,53 %
Min	-32,06 %	-48,08 %	-54,03 %	-30,84 %	-48,55 %	-173,43 %	-50,58 %	-13,07 %
Max	28,71 %	51,62 %	32,10 %	43,86 %	33,85 %	127,13 %	31,92 %	63,22 %

Figure 12: Boxplot of annual return variations from 2004 and 2015 for each firm in the sample.

Testing for financial performance, Table 6 shows return on assets (pre-tax income) for the same time-period. Chevron and Exxon are highly efficient, averaging around 20%. Shell and Total also deliver above the group average of 13.1%.

Return on assets (Pretax)	Average	BP	Chevron	ENI	Exxon	OMV	Repsol	Shell	Total
2004	16 %	13 %	22 %	18 %	22 %	7 %	10 %	17 %	21 %
2005	20 %	15 %	20 %	22 %	29 %	13 %	13 %	20 %	25 %
2006	20 %	16 %	24 %	22 %	31 %	12 %	12 %	19 %	23 %
2007	18 %	13 %	22 %	19 %	30 %	11 %	11 %	19 %	22 %
2008	20 %	15 %	27 %	17 %	37 %	11 %	10 %	18 %	22 %
2009	10 %	11 %	11 %	10 %	15 %	5 %	5 %	7 %	12 %
2010	11 %	-2 %	17 %	12 %	18 %	7 %	10 %	11 %	15 %
2011	15 %	13 %	23 %	13 %	22 %	8 %	4 %	16 %	17 %
2012	13 %	6 %	20 %	12 %	24 %	9 %	4 %	14 %	14 %
2013	10 %	10 %	14 %	10 %	17 %	7 %	2 %	9 %	11 %
2014	7 %	2 %	12 %	6 %	15 %	3 %	2 %	8 %	6 %
2015	-1 %	-4 %	2 %	-3 %	7 %	-6 %	-3 %	1 %	3 %
Grand Total	**157,8 %**	**108,7 %**	**213,7 %**	**157,4 %**	**263,8 %**	**87,9 %**	**79,7 %**	**159,5 %**	**191,2 %**
Average	**13,1 %**	**9,1 %**	**17,8 %**	**13,1 %**	**22,0 %**	**7,3 %**	**6,6 %**	**13,3 %**	**15,9 %**

Table 6: Summary of annual return on assets from 2004 (the benchmark year), with year-to-year change, grand total and the average in the colorized bottom rows.

The same findings emerge from Table 7, depicting return on equity. ENI averages 28.3%, outperforming Shell, which averages 27.7%. Again, Exxon is highly efficient, averaging 42%, an indication of why it is the most valuable company in our sample.

Return on equity (Pretax)	Average	BP	Chevron	ENI	Exxon	OMV	Repsol	Shell	Total
2004	38 %	33 %	46 %	38 %	40 %	16 %	23 %	35 %	54 %
2005	46 %	41 %	39 %	44 %	52 %	27 %	28 %	45 %	59 %
2006	45 %	41 %	45 %	44 %	58 %	23 %	24 %	38 %	56 %
2007	43 %	34 %	41 %	42 %	55 %	22 %	23 %	40 %	52 %
2008	46 %	38 %	49 %	40 %	70 %	29 %	23 %	39 %	49 %
2009	23 %	25 %	20 %	22 %	30 %	11 %	13 %	15 %	29 %
2010	25 %	-5 %	30 %	28 %	34 %	17 %	26 %	23 %	33 %
2011	36 %	35 %	39 %	30 %	45 %	17 %	11 %	32 %	39 %
2012	30 %	15 %	34 %	25 %	47 %	19 %	10 %	29 %	31 %
2013	23 %	24 %	24 %	21 %	32 %	15 %	4 %	18 %	24 %
2014	17 %	4 %	20 %	12 %	29 %	7 %	5 %	16 %	13 %
2015	2 %	-10 %	3 %	-7 %	13 %	-14 %	-7 %	1 %	7 %
Grand Total	**373,4 %**	**276,8 %**	**391,5 %**	**340,1 %**	**504,5 %**	**189,2 %**	**184,6 %**	**333,0 %**	**447,3 %**
Average	**31,1 %**	**23,1 %**	**32,6 %**	**28,3 %**	**42,0 %**	**15,8 %**	**15,4 %**	**27,7 %**	**37,3 %**

Table 7: Return on Equity (pre-tax) for sample companies.

Extending the analysis to economic performance, in Table 8 we list EBITDA as a percentage of revenue for the same time-period. ENI emerges as the winner with a 22% average, with Total coming in second with 18%. This indicates high operational efficiency with consequently low costs. However, as the last table shows, not all companies are equally efficient in generating revenue from deployed assets.

EBITDA %	Average	BP	Chevron	ENI	Exxon	OMV	Repsol	Shell	Total
2004	17 %	14 %	15 %	28 %	15 %	13 %	20 %	12 %	20 %
2005	18 %	15 %	12 %	30 %	15 %	18 %	19 %	14 %	25 %
2006	17 %	10 %	15 %	28 %	17 %	16 %	18 %	14 %	21 %
2007	17 %	12 %	14 %	28 %	16 %	16 %	18 %	12 %	22 %
2008	15 %	11 %	14 %	24 %	14 %	16 %	14 %	11 %	18 %
2009	15 %	13 %	14 %	25 %	11 %	17 %	15 %	8 %	18 %
2010	15 %	-1 %	17 %	25 %	12 %	18 %	21 %	9 %	18 %
2011	14 %	10 %	18 %	22 %	12 %	13 %	13 %	9 %	19 %
2012	12 %	6 %	17 %	18 %	9 %	13 %	12 %	8 %	16 %
2013	11 %	10 %	15 %	12 %	10 %	12 %	5 %	9 %	15 %
2014	9 %	4 %	13 %	17 %	9 %	12 %	2 %	9 %	10 %
2015	8 %	3 %	7 %	12 %	9 %	14 %	0 %	7 %	11 %
Grand total	**170 %**	**107 %**	**171 %**	**269 %**	**149 %**	**176 %**	**157 %**	**122 %**	**212 %**
Average	**14 %**	**9 %**	**14 %**	**22 %**	**12 %**	**15 %**	**13 %**	**10 %**	**18 %**

Table 8: EBITDA as a percentage of revenue for sample companies.

The last table shows asset turnover ratio (ATO), computed as total assets / pre-tax income. Generally speaking, a higher ATO ratio indicates higher efficiency in generating revenue from deployed assets.

Sum of ATO	Average	BP	Chevron	ENI	Exxon	OMV	Repsol	Shell	Total
2004	1,09	1,03	1,55	0,80	1,35	0,68	0,88	1,38	1,06
2005	1,23	1,16	1,47	0,92	1,58	1,06	1,10	1,40	1,16
2006	1,23	1,22	1,47	0,93	1,53	1,02	1,08	1,36	1,20
2007	1,16	1,20	1,37	0,81	1,48	0,89	1,04	1,32	1,13
2008	1,45	1,58	1,58	0,98	1,86	1,26	1,30	1,62	1,43
2009	0,91	1,01	0,97	0,69	1,18	0,81	0,80	0,95	0,85
2010	0,98	1,09	1,03	0,74	1,13	0,88	0,86	1,14	0,97
2011	1,13	1,28	1,13	0,81	1,31	1,29	0,77	1,36	1,09
2012	1,12	1,25	0,96	0,89	1,26	1,36	0,86	1,33	1,04
2013	1,04	1,24	0,83	0,80	1,13	1,28	0,81	1,26	0,95
2014	1,01	1,24	0,72	0,82	1,04	1,16	0,98	1,19	0,92
2015	0,66	0,85	0,46	0,51	0,70	0,70	0,64	0,78	0,64
Grand total	**13,01**	**14,17**	**13,54**	**9,70**	**15,55**	**12,39**	**11,14**	**15,09**	**12,45**
Average	**1,08**	**1,18**	**1,13**	**0,81**	**1,30**	**1,03**	**0,93**	**1,26**	**1,04**

Table 9: Asset turnover ratio (ATO) for sample companies

The industry average is 1.08, indicating 8% surplus revenue from each invested unit in assets. ENI is the lowest performer, averaging 81%. Again, the same winners emerge; Chevron, Exxon, Shell and Total.

We will therefore divide the sample into the following two subgroups.

Overperformers:

- Chevron
- Exxon
- Shell
- Total

Underperformers:

- BP
- ENI
- OMV
- Repsol

All the companies experience a steady decline in all our performance measures, whilst the oil price has been highly volatile for all years. This might be indicative, as we briefly mentioned in the paragraph on the P/B ratio, that investors deem the

share prices to be overvalued in the pre-financial crisis years. Many companies in our sample regain their financial performance, but not their P/B ratio. The average of ATO reaches the 2007 level in 2011, while average P/B is down to 1.5 from 2.5. EBITDA remains high (with the exception of BP and the blowout incident) until 2012 and beyond. The same decline is witnessed in the ROE and ROA measures.

Even though performance measures have declined, market capitalization (compared to book value), has declined further still. There are many explanations for this, the most intuitive being

- Investors apply a more fundamental analysis of the firms – valuing them close to reported book value
- Investors are sceptical to the long-term sustainability of non-green energy
- Investors are looking for safe havens, and are unwilling to speculate strongly in stocks

In the next section we will perform tests on the dataset. Most of the tests will be performed on the sample as a whole. As mentioned before, we define competitive advantages as superior financial performance. Judging from economic, financial and stock market performance, we conclude that Chevron, Exxon, Shell and Total outperform the remaining companies. This will enable us to create two subgroups within our group, one "winning" group, and one "losing" group. By creating this division in our sample, we will be able to test for differences between groups, which can help us identify key differences. However, due to our limited sample size, we will lose some statistical strength by doing this, and as such, the results from these tests should be treated with caution.

4.2 Descriptive statistics

Table 10 lists descriptive statistics of the dependent and independent variables.

Variable	Mean	Std dev	Min	Max
VAIN	5,44	2,18	1,71	9,20
VACA	0,20	0,10	0,03	0,46
VAIC	5,64	2,26	1,79	9,49
ROE	0,28	0,16	-0,05	0,55
ROA	0,13	0,08	-0,02	0,27
AR	0,06	0,27	-0,49	0,52
P/B	1,78	0,80	0,75	3,40
R&D/B	0,0025	0,0012	0,0007	0,0045
EBITDA	0,14	0,05	0,04	0,25
Revenue	202 558	128 077	12 229	470 171

Table 10: Descriptive statistics of dependent and independent variables.

The mean P/B ratio for our sample over the years is 1.78, indicating that investors generally valued the sample companies over the book value of assets as reported in their financial statements. Consequently, close to 44% of a company's value is not reflected in the financial statements. However, it is worth noticing that the standard deviation is nearly half of the mean value, indicative of big differences both between the companies and within the companies throughout the years. Comparing VACA and VAIN shows that the companies were much more efficient at creating value from their intellectual capital than from physical and financial capital employed. The average VAIN of 5.44 indicates that for each unit invested in intellectual capital, value added increases by 5.44 units. The same interpretation applies to VACA – one unit increase in capital assets increases value added by 0.2. The findings on the capital asset gain are as expected, seeing as the industry is very capital intensive. In total, the mean aggregate of our sample selection for VAIC is 5.64 – indicating that the companies create USD 5.64 for every USD employed.

In the period 2004-2015, all performance indicators, ROE, AR, etc., are relatively high, but with a high standard deviation, indicating high variance between groups and/or various external factors, i.e. oil price volatility. Table 11 shows a paired T-test performed on our sample, differentiating between the over and underperformers. Mean refers to the average value, while SEM is an abbreviation of standard error of the mean.

	Overperformers (group 1)		Underperformers (group 2)			
	Mean	SEM	Mean	SEM	T-test	Significance
VAIN	6,731	0,296	4,147	0,205	-7,172	0,000*
VACA	0,251	0,016	0,149	0,009	-5,472	0,000*
VAIC	6,988	0,305	4,298	0,213	-7,219	0,000*
R&D/B	0,0034	0,000	0,0016	0,0001	-13,991	0,000*
ROE	0,345	0,211	0,21	0,02	-4,628	0,000*
ROA	0,169	0,01	0,092	0,008	-5,727	0,000*
AR	0,081	0,371	0,032	0,042	-0,88	0,381
P/B	1,953	0,121	1,605	0,104	-2,177	0,032*
R&D/B	0,0034	0,0001	0,0015	0	-13,9912	0,000*
EBITDA	0,136	0,006	0,147	0,009	1,0375	0,302
Revenue	274 375	14 789	130 740	15 891	-6,616	0,000*

Table 11: Paired T-test.

The mean difference between the two groups are statistically significant at 5% for all variables except AR and EBITDA. Noticeably, a key difference between our groups is the VACA, where group 1 nearly doubles the mean of group 2. In a capital-intensive industry, this is a key differentiator between companies.
For VAIC, group one generates close to USD 7 for each USD invested, compared to USD 4.3 for group 2.

There is a two-fold difference between the R&D/B means of the two groups, meaning that the research intensity in the winning companies is twice that of those in the losing group. Interestingly, although not statistically significant, EBITDA mean is actually higher for group 2, although with a higher standard error of the mean. This supports the findings from section 4.1, where we found evidence of both high and volatile economic efficiency.

We have established that the two groups, the "winning" and "losing", have statistically different means of economic, financial, market and intellectual capital proxies. This might help us explain some of the differences between companies as we apply the regressions described earlier.

4.3 Correlation analysis

Correlation analysis is one of the initial statistical techniques used to analyse the link between our independent and dependent variables. Table 12 shows the results from our Pearson pair analysis.

	VAIN	VACA	VAIC	ROE	P/B	EBITDA	R&D/B
VAIN	1,00						
VACA	0,7613*	1,00					
VAIC	0,9994*	0,7826*	1,00				
ROE	0,8703*	0,8945*	0,8814*	1,00			
P/B	0,5841*	0,6560*	0,5944*	0,7071*	1,00		
EBITDA	0,4149*	0,5447*	0,4260*	0,5216*	0,3793*	1,00	
R&D/B	0,5001*	0,5471*	0,5093*	0,4835*	0,3784*	-0,05	1,00
* Significant at 1% level							

Table 12: Pearson pair analysis.

As evident from Table 12, VAIN contributes to the VAIC component immensely. This is due to the high numbers of VAIN compared to VACA, meaning a change in VAIN will have a greater effect on the aggregated VAIC. Interestingly, VAIN is positively associated with VACA, with a 0.76 correlation coefficient. This can be indicative that intellectual capital increases physical capital efficiency.

Our variables are all statistically significant at the 1% level, except for the correlation between EBITDA and RD/B, indicating that investments in research have a negative effect on a company's bottom line in the same year in which they are made. This is, however, not statistically significant.

VAIC is strongly positively correlated with ROE, indicating that higher VAIC will have a positive effect on financial variables. The correlation is stronger than for the economic variable EBITDA and VAIC.

Comparing VAIC, VACA and VAIN reveals a stronger positive correlation between ROE, P/B, EBITDA, R&D/B and VACA, than for the other proxies of intellectual capital. This may be partly attributable to the fact that our chosen industry has a large quantity of physical assets, thus capital employed contributes to a large part of the book value of the company. Therefore, a change in the efficiency with which physical assets create value will be more essential than a change in the ability to create value from intangible assets. In addition, companies

with high annual income after tax, will have a high return on equity, ceteris paribus. Following the formula for calculating VACA, firms with high income after tax will have high VACA, ceteris paribus. This enables a mechanical relationship which follows from using the same variables in the calculation. The strong positive correlations are therefore partly due to this.

The correlation analysis lends support to hypothesis X a, b and c, whereas d has not yet been tested.

4.4 Panel data regression results

As mentioned, the preliminary descriptive and correlation analysis lends support to our hypotheses. We will now continue to test the hypotheses through our regression models mentioned in section 3.4.2.

First, however, we will use the correlation table from the previous section to identify multicollinearity issues between our dependent variables. Literature suggests (Kennedy 1985) that multicollinearity is a severe problem if the correlation between the dependent variables exceeds 0.8. Our dependent variables are:
1) VAIC
2) VACA + VAIN (0.76 correlation)
3) VACA + VAIN + R&D/B (highest 0.76 correlation)
This means that our dataset is not severely affected by multicollinearity, and we may continue with our analysis.

Note that our sample size is half the original sample when we perform the analysis on the "winning" and "losing" groups separately, meaning we should be cautious about interpreting the results.

4.4.1 Economic model

Table 13 shows the results from the regression models on the economic performance indicators. Columns show the independent variables, whereas the rows show the dependent variables. Panel A refers to the regression using the

whole dataset, Panel B refers to regressions on the "winners" in the dataset, and Panel C refers to regressions on the "losers".

Panel A: All	**Economic**							
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue
VAIC	0,166*	0,081*	0,123*	0,057*	0,119**	-0,009	0,007	-0,045
R^2	18,15 %	15,12 %	7,63 %	14,91 %	7,78 %	11,78 %	5,07 %	9,48 %
Residual Swilk	0,525	0,241	0,973	0,477	0,985	0,041	0,338	0,009
VAIN	0,003	0,22*	-0,003	0,2234*	-0,004	0,04	-0,0085***	-0,0848***
VACA	0,3307*	-30,2378**	0,3768*	-3,801**	0,4149*	-1,10	0,3956*	0,86
R^2	29,36 %	14,17 %	18,31 %	11,23 %	16,25 %	0,32 %	11,18 %	8,45 %
Residual Swilk	0,113	0,427	0,506	0,027	0,384	0,011	0,168	0,015
VAIN	0,0023	0,23*	-0,0029	0,2414*	-0,0035	0,0754**	-0,0070	-0,0131
VACA	0,343*	-3,319*	0,3757*	-4,1103*	0,389*	-1,7158*	0,3376*	0,3613
R&D/B	-5,31	131,89	-2,6662	113,92***	1,7654	139,00***	8,8058	234,65**
R^2	35,48 %	31,58 %	20,61 %	26,71 %	15,15 %	42,10 %	7,74 %	49,85 %
Residual Swilk	0,120	0,351	0,566	0,063	0,338	0,050	0,244	0,298
Significant at	*1% **5% ***10%							
Panel B: Overperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue
VAIC	0,0117*	0,113*	0,0085**	0,07695*	0,0037	-0,0306	-0,0011	-0,1033*
R^2	25,78 %	2,17 %	9,11 %	0,02 %	6,03 %	4,58 %	3,26 %	11,57 %
Residual Swilk	0,943	0,255	0,749	0,633	0,771	0,124	0,512	0,215
VAIN	-0,0027	0,2907	-0,007419*	0,2358**	-0,01149*	0,0020	-0,016*	-0,1365**
VACA	0,3412*	-3,8659	0,3818*	-3,4723***	0,38794*	-0,7989	0,3784*	0,7828
R^2	73,01 %	14,69 %	52,82 %	10,68 %	38,94 %	17,72 %	29,06 %	2,48 %
Residual Swilk	0,923	0,477	0,176	0,145	0,055	0,079	0,003	0,195
VAIN	-0,0026	0,2357*	-0,0046	0,1450	-0,0035	0,0157	-0,0033	-0,0668
VACA	0,3603*	-4,6486**	0,3612*	-4,2815**	0,3052*	-3,7887***	0,2608*	-0,3525
R&D/B	-10,143*	425,672*	-14,714*	267,65***	-11,44***	190,815	-2,967	224,69
R^2	74,99 %	23,86 %	58,41 %	18,97 %	47,21 %	19,08 %	37,42 %	22,88 %
Residual Swilk	0,073	0,144	0,952	0,410	0,398	0,459	0,810	0,592
Significant at	*1% **5% ***10%							
Panel C: Underperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue
VAIC	0,02898*	0,0042	0,022*	0,0139	0,0285*	-0,0063	0,0233	-0,0012
R^2	64,85 %	0,01 %	41,06 %	0,06 %	48,67 %	0,09 %	37,61 %	0,01 %
Residual Swilk	0,966	0,178	0,816	0,213	0,995	0,159	0,737	0,039
VAIN	0,02098**	0,1739	0,0111	0,2381***	0,0129	0,1058*	0,0073	-0,0029
VACA	0,2003	-0,2770	0,2652	-5,2899***	0,3845	-2,6366**	0,3716	0,0209
R^2	61,96 %	3,98 %	36,34 %	3,52 %	44,19 %	5,26 %	33,38 %	0,29 %
Residual Swilk	0,996	0,166	0,857	0,502	0,966	0,111	0,815	0,038
VAIN	0,6915*	-0,2383**	0,03518*	-0,1805	0,3392***	-0,2313	0,0274	-0,2877
VACA	-0,0657	3,1862	-0,1241	2,4116	0,0568	3,2541	0,0924	4,1258
R&D/B	16,3618	773,7404*	-9,6629	801,41**	-9,9962	818,712**	-2,8270	866,133**
R^2	69,15 %	44,70 %	43,00 %	46,15 %	49,95 %	48,42 %	37,65 %	55,03 %
Residual Swilk	0,273	0,035	0,607	0,052	0,931	0,015	0,493	0,026
Significant at	*1% **5% ***10%							

Table 13: Results from the regression models on the economic performance indicators.

As evident from Panel A in Table 13, when performing the tests on the eight companies, we experience some problems with non-Gaussian distribution (swilks marked with red). This can be explained by the fact that revenue is highly different between each firm, meaning that the size of the error will vary across the dataset. The coefficients from the analysis are therefore inefficient to some degree, but remain unbiased. In the "no lag" year, we bootstrap the regression, creating 100 random samples, mitigating the heteroscedasticity effect. However, this is not possible when performing tests on the lagged variables. Some caution should therefore be applied when interpreting the variables where swilk residuals are less than 0.05.

Panel A: All	**Economic**							
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue
VAIC	0,166*	0,081*	0,123*	0,057*	0,119**	-0,009	0,007	-0,045
R^2	18,15 %	15,12 %	7,63 %	14,91 %	7,78 %	11,78 %	5,07 %	9,48 %
Residual Swilk	0,525	0,241	0,973	0,477	0,985	0,041	0,338	0,009
VAIN	0,003	0,22*	-0,003	0,2234*	-0,004	0,04	-0,0085***	-0,0848***
VACA	0,3307*	-30,2378**	0,3768*	-3,801**	0,4149*	-1,10	0,3956*	0,86
R^2	29,36 %	14,17 %	18,31 %	11,23 %	16,25 %	0,32 %	11,18 %	8,45 %
Residual Swilk	0,113	0,427	0,506	0,027	0,384	0,011	0,168	0,015
VAIN	0,0023	0,23*	-0,0029	0,2414*	-0,0035	0,0754**	-0,0070	-0,0131
VACA	0,343*	-3,319*	0,3757*	-4,1103*	0,389*	-1,7158*	0,3376*	0,3613
R&D/B	-5,31	131,89	-2,6662	113,92***	1,7654	139,00***	8,8058	234,65**
R^2	35,48 %	31,58 %	20,61 %	26,71 %	15,15 %	42,10 %	7,74 %	49,85 %
Residual Swilk	0,120	0,351	0,566	0,063	0,338	0,050	0,244	0,298
Significant at	*1% **5% ***10%							

Table 14: Results from the regression models on the economic performance indicators, Panel A (all).

Panel A, regression 1:

VAIC is statistically significant as an explanatory variable for both EBITDA and revenue. R^2 is 18.15% for EBITDA, declining to a mere 5% and non-significance with a three-year lag. For each unit gained in VAIC, EBITDA will increase by 16%. For revenue, we have statistical significance in the present year and one-year lag. This indicates that an increase in intellectual capital is positively effecting revenue, enhancing top line performance. R^2 starts from 15% and is reduced a mere 0.21% in the lagged year, indicating a prolonged effect in investing in intellectual capital on revenue, lasting for two years. These findings lends support to hypothesis 1a and 1d; Companies with a high VAIC have better economic performance for the given year and later years.

Panel A, regression 2:

Dividing VAIC up into VAIN and VACA boosts R^2 for EBITDA up to 29.36%, before declining towards 11% in a 3-year lag. VAIN is not significant (except for the year-3 lag, where we have only 90% confidence in significance), and a low/negative coefficient. This indicates that, to the extent it has an effect, it is to reduce EBITDA. Intuitively, this makes sense, as the larger part of the HC proxy is salary. VACA on the other hand is significant at 95% confidence for all time periods, with increasing coefficient. This indicates a maturity process with regard to the tangible assets, which increase in efficiency and value throughout the years. However, as we approach the year-2 lag, our model only accounts for 16% of the variance in EBITDA, which is somewhat low.

Revenue on the other hand, has a statistically significant relationship with VAIN. This could indicate that intellectual capital positively affects the ability to utilize the tangible assets, i.e. extract more of the natural resources from oil fields, etc. The fact that in year t and t-1, the relationship is statistically negatively significant, further boosts the credibility of our claim, as the addition of new oil fields will require a great deal of attention and reduce revenue (as resources are deployed towards developing, not utilizing, assets), before gaining a positive coefficient in year 2 and onwards. Standardized revenues are highly varied among the firms, and as such, we experience some problems with heteroscedasticity. We will therefore put little emphasis on the coefficient value for revenue in year t-1, t-2 and t-3.

In short, VAIN has a positive effect on revenue for year t and t-1, whereas VACA has a positive effect on EBITDA for all years, and a strong negative effect on revenue in year t, with a positive trend throughout the years.
This lends partial support to H1-b and H1-d.

Panel A, regression 3:

Adding R&D/B to the regression significantly increases our model's explanatory power. R&D has a delayed effect on revenue gain, with significant relationships at the 95% and 90% level for years t-1, t-2 and t-3 with a positive momentum. This

may indicate that research expenditures' positive effects have a delayed effect on the revenue generating abilities of our sample companies. As evident from the table, the R&D coefficient on EBITDA is negative, changing to positive in year t-2 and t-3. Note that this relationship is not significant at our 10% threshold. We therefore have no statistical evidence to support the claim that research and development are centred on "top side" gains, in contrast to "bottom line" gains. However, as mentioned, R&D gains strength in explaining revenue throughout the years, both for statistical significance and coefficient value.

VAIN's contribution to EBITDA is non-significant, but positively significant on revenue. The interpretation for VAIN and VACA are equal to the interpretation from regression 2.

Comparing our results to Nakamura (2001), we find that IC plays a major role in revenue generating activities, unlike Nakamura, who found IC to play a major role in reducing production costs. However, Nakamura uses operating income/revenue, making his finding not directly inconsistent with our own. Increasing sales will make a significant contribution to their economic performance proxy variable. We include both a top and bottom line measurement, making our analysis more comprehensive. VACA is significant for all proxies for all years, except for revenue in year 3.

Following Pulic's argument about VAIC being the best proxy for IC,
our results from the regression on the economic proxies are in line with previous studies conducted on the matter. Lev and Sougiannis (1996) found IC to have a positive effect on the economic performance of American companies. Dividing VAIC into VAIN and VACA gives mixed results. VACAs coefficient is negative, which might be due to the extra expenses and attention demanded when obtaining new physical assets. R&D is positively significant for future performance, though not for the current year.

Based on our interpretation of the results, we find support for H1-a, H1-b and H1-d, and reject H1-c.

Breaking down the analysis into our two subgroups yields the following results:

Panel B: Overperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue
VAIC	0,0117*	0,113*	0,0085**	0,07695*	0,0037	-0,0306	-0,0011	-0,1033*
R^2	25,78 %	2,17 %	9,11 %	0,02 %	6,03 %	4,58 %	3,26 %	11,57 %
Residual Swilk	0,943	0,255	0,749	0,633	0,771	0,124	0,512	0,215
VAIN	-0,0027	0,2907	-0,007419*	0,2358**	-0,01149*	0,0020	-0,016*	-0,1365**
VACA	0,3412*	-3,8659	0,3818*	-3,4723***	0,38794*	-0,7989	0,3784*	0,7828
R^2	73,01 %	14,69 %	52,82 %	10,68 %	38,94 %	17,72 %	29,06 %	2,48 %
Residual Swilk	0,923	0,477	0,176	0,145	0,055	0,079	0,003	0,195
VAIN	-0,0026	0,2357*	-0,0046	0,1450	-0,0035	0,0157	-0,0033	-0,0668
VACA	0,3603*	-4,6486**	0,3612*	-4,2815**	0,3052*	-3,7887***	0,2608*	-0,3525
R&D/B	-10,143*	425,672*	-14,714*	267,65***	-11,44***	190,815	-2,967	224,69
R^2	74,99 %	23,86 %	58,41 %	18,97 %	47,21 %	19,08 %	37,42 %	22,88 %
Residual Swilk	0,073	0,144	0,952	0,410	0,398	0,459	0,810	0,592
Significant at	*1% **5% ***10%							
Panel C: Underperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue	EBITDA	Revenue
VAIC	0,02898*	0,0042	0,022*	0,0139	0,0285*	-0,0063	0,0233	-0,0012
R^2	64,85 %	0,01 %	41,06 %	0,06 %	48,67 %	0,09 %	37,61 %	0,01 %
Residual Swilk	0,966	0,178	0,816	0,213	0,995	0,159	0,737	0,039
VAIN	0,02098**	0,1739	0,0111	0,2381***	0,0129	0,1058*	0,0073	-0,0029
VACA	0,2003	-0,2770	0,2652	-5,2899***	0,3845	-2,6366**	0,3716	0,0209
R^2	61,96 %	3,98 %	36,34 %	3,52 %	44,19 %	5,26 %	33,38 %	0,29 %
Residual Swilk	0,996	0,166	0,857	0,502	0,966	0,111	0,815	0,038
VAIN	0,6915*	-0,2383**	0,03518*	-0,1805	0,3392***	-0,2313	0,0274	-0,2877
VACA	-0,0657	3,1862	-0,1241	2,4116	0,0568	3,2541	0,0924	4,1258
R&D/B	16,3618	773,7404*	-9,6629	801,41**	-9,9962	818,712**	-2,8270	866,133**
R^2	69,15 %	44,70 %	43,00 %	46,15 %	49,95 %	48,42 %	37,65 %	55,03 %
Residual Swilk	0,273	0,035	0,607	0,052	0,931	0,015	0,493	0,026
Significant at	*1% **5% ***10%							

Table 15: Results from the regression models on the economic performance indicators, Panel B (overperformers) and Panel C (underperformesr).

Panel B shows statistical significance on both EBITDA and revenue for year t and t-1, as opposed to panel C which is only significant for EBITDA. This might be indicative of cost reduction goals for the underperforming group, and revenue generating goals combined with efficiency for the winning group. Results from regression 2 indicate a statistically stronger link between VACA and our economic performance proxies for panel B. This is crucial for capital-intensive industries, and may help to explain the difference between our groups. Contrary to our analysis performed on the sample as a whole, we identify a significant relationship at time t for R&D/B. The coefficient is negative for EBITDA, due to the expenses affecting EBITDA. However, it is statistically significant for all time periods relating to revenue for the underperforming group,

as opposed to our overperforming group which focuses on year t and t-1. Seeing as the coefficient is negative for EBITDA in year t, we confirm our preliminary findings, where the winning group has a higher R&D intensity than the other companies. In addition, R&D for the underperforming group seem to relate to income-increasing activities.

Comparing the two groups seems to indicate a higher capability of utilizing the physical assets, and higher VAIC for the year t and t-1 for the winning group.

4.4.2 Financial model

Table 16 shows the results from the regression models on the financial performance indicators. Columns show the independent variables, whereas the rows show the dependent variables. Panel A refers to the regression using the whole dataset, Panel B refers to regressions on the "winners" in the dataset, and Panel C refers to regressions on the "losers".

Panel A: All	**Financial**							
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
VAIC	0,0718*	0,0321*	0,04899*	0,02591*	0,04141*	0,02234*	0,03334*	0,01857*
R^2	77,69 %	87,72 %	43,43 %	52,90 %	29,52 %	36,93 %	20,14 %	26,62 %
Residual Swilk	0,2265	0,0727	0,4080	0,3044	0,1074	0,1530	0,6007	0,9079
VAIN	0,02316*	0,01621*	0,0283*	0,0202*	0,02155*	0,01705*	0,134**	0,1324*
VACA	1,2514*	0,4573*	0,6325*	0,1876*	0,6039*	0,1725**	0,5822*	0,1655**
R^2	87,20 %	89,22 %	49,39 %	54,78 %	35,50 %	38,76 %	26,21 %	28,46 %
Residual Swilk	0,0157	0,0313	0,1536	0,2336	0,1323	0,2586	0,3491	0,6959
VAIN	0,0233*	0,01623*	0,0277*	0,0197*	0,01827**	0,01501*	0,0046	0,0085**
VACA	1,2471*	0,4488*	0,612441*	0,1709**	0,5306*	0,1270	0,4236***	0,0801
R&D/B	-1,1048	3,3607	4,4967	3,7440	17,1987	10,6802	40,3964*	21,7461*
R^2	87,29 %	89,02 %	49,46 %	54,98 %	36,44 %	40,31 %	31,47 %	34,96 %
Residual Swilk	0,0164	0,0130	0,1436	0,1245	0,0552	0,0842	0,2042	0,3501
Significant at	*1% **5% ***10%							
Panel B: Overperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
VAIC	0,0928*	0,03977*	0,0628*	0,0286*	0,0555	0,0248*	0,0372*	0,01628*
R^2	79,17 %	84,39 %	37,42 %	43,00 %	27,68 %	30,34 %	13,43 %	14,74 %
Residual Swilk	0,1469	0,0529	0,8268	0,8976	0,7897	0,4691	0,4535	0,4973
VAIN	0,01326**	0,00567*	0,0273***	0,0141	0,0054	0,0053	-0,0174**	-0,0036
VACA	1,8475*	0,8088*	1,0027	0,4266	1,4705**	0,5759	1,6336*	0,5979**
R^2	96,39 %	98,87 %	40,42 %	45,85 %	35,61 %	36,88 %	25,02 %	23,56 %
Residual Swilk	0,2249	0,3256	0,3090	0,6940	0,2270	0,4076	0,8443	0,8547
VAIN	0,0104***	0,0082*	0,0308	0,0154	0,0065	0,0058	-0,0176	-0,0037
VACA	1,8647*	0,7561*	0,7269	0,3216	1,2487***	0,4853	1,36**	0,4936***
R&D/B	12,492***	3,8811*	48,6408*	18,5147**	39,9986*	16,3351	53,3316*	20,39924*
R^2	96,80 %	99,12 %	46,23 %	50,34 %	39,82 %	40,71 %	33,43 %	30,62 %
Residual Swilk	0,6831	0,1463	0,9019	0,4691	0,0090	0,0149	0,0126	0,0253
Significant at	*1% **5% ***10%							
Panel C: Underperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
VAIC	0,0672*	0,0303*	0,0465*	0,0465	0,0244*	0,01404*	0,0089	0,0064
R^2	74,11 %	85,32 %	27,83 %	27,83 %	6,97 %	9,77 %	0,92 %	1,93 %
Residual Swilk	0,5831	0,1508	0,1462	0,1462	0,1996	0,0596	0,7536	0,5707
VAIN	0,0242*	0,2254*	0,0239**	0,01974*	0,0040	0,01144**	-0,0208	0,0044
VACA	1,09*	0,266**	0,7273*	0,1631*	0,585*	0,1071	0,608*	0,7590
R^2	85,67 %	88,74 %	38,82 %	36,79 %	14,52 %	11,19 %	6,09 %	2,77 %
Residual Swilk	0,5359	0,2860	0,0070	0,0762	0,0134	0,0526	0,6303	0,5073
VAIN	0,0392*	0,0259*	0,02264***	0,01692*	0,0058	0,0088	-0,0017	0,0052
VACA	0,6654*	0,1676*	0,689*	0,2055*	0,5608**	0,1437	0,3910	0,5969
R&D/B	11,5869	7,6685	-32,1323	-15,9521	-34,8540	-16,1629	6,4872	8,2090
R^2	89,54 %	89,84 %	40,26 %	37,86 %	16,29 %	12,28 %	7,46 %	3,08 %
Residual Swilk	0,9373	0,2914	0,0219	0,1218	0,2127	0,1648	0,7197	0,5536
Significant at	*1% **5% ***10%							

Table 16: Results from the regression models on the financial performance indicators.

The non-Gaussian distribution problems are far less prevalent in this model, making the interpretation easier, with an exception for year t for regression 2 and 3.

Panel A: All	Financial							
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
VAIC	0,0718*	0,0321*	0,04899*	0,02591*	0,04141*	0,02234*	0,03334*	0,01857*
R^2	77,69 %	87,72 %	43,43 %	52,90 %	29,52 %	36,93 %	20,14 %	26,62 %
Residual Swilk	0,2265	0,0727	0,4080	0,3044	0,1074	0,1530	0,6007	0,9079
VAIN	0,02316*	0,01621*	0,0283*	0,0202*	0,02155*	0,01705*	0,134**	0,1324*
VACA	1,2514*	0,4573*	0,6325*	0,1876*	0,6039*	0,1725**	0,5822*	0,1655**
R^2	87,20 %	89,22 %	49,39 %	54,78 %	35,50 %	38,76 %	26,21 %	28,46 %
Residual Swilk	0,0157	0,0313	0,1536	0,2336	0,1323	0,2586	0,3491	0,6959
VAIN	0,0233*	0,01623*	0,0277*	0,0197*	0,01827**	0,01501*	0,0046	0,0085**
VACA	1,2471*	0,4488*	0,612441*	0,1709**	0,5306*	0,1270	0,4236***	0,0801
R&D/B	-1,1048	3,3607	4,4967	3,7440	17,1987	10,6802	40,3964*	21,7461*
R^2	87,29 %	89,02 %	49,46 %	54,98 %	36,44 %	40,31 %	31,47 %	34,96 %
Residual Swilk	0,0164	0,0130	0,1436	0,1245	0,0552	0,0842	0,2042	0,3501
Significant at	*1% **5% ***10%							

Table 17: Results from the regression models on the financial performance indicators, Panel A (all).

Panel A, regression 1:

VAIC is statistically significant for all time periods for all financial performance proxies at the 1% level.

ROE has a R^2 of 77.69%, declining towards 20% in year t-3. In the current year, each unit gained in VAIC yields a 7.18% gain in ROE. This declines to a 3% gain in year t-3. For ROA the same applies, with stronger explanatory power – starting from 87.72% and declining to 26.62%. The coefficient indicates a gain of 3.2% in the current year, and 1.8% in year t-3.

The findings give strong support for H2-a and H2-d.

Panel A, regression 2:

Dividing VAIC into VACA and VAIN increases our explanatory power by 10% for ROE and 2% for ROA. For all time periods, VAIN and VACA are positively significant for both ROA and ROE. However, due to high variation between our sample in terms of financial proxies, we encounter some problems with non-

Gaussian distribution. This reduces the efficiency of the coefficient values, although they still are unbiased, i.e. their significance remains the same.

The findings give strong support for H2-b and H2-d.

Panel A, regression 3:

Contrary to our intuition, VACA loses explanatory power on the ROA variable in year t-2 and t-3 when we include the R&D/B variable. R&D/B is statistically significant for both ROE and ROA in year t-3, suggesting some of the explanatory power in VACA resides within R&D/B, i.e. research is mostly concentrated on exploiting physical assets more efficiently.

Although we do not gain more explanatory power in year t by adding a new variable, we are able to explain more of the variance in the latter years, especially in year t-2 and t-3, where R^2 is increased by 10% compared to regression 1. This puts further emphasis on our findings regarding the delayed positive effects of research and development.

VAIN, more so than VACA, is positively effecting ROE and ROA for the time periods in question. R&D has a prolonged effect, which causes us to discard H2-c.

Our analysis reveals a positive relationship between VAIC, VACA, VAIN and R&D and our financial performance proxies. This is in line with previous research regarding the same. Chen, Cheng and Hwang (2005) and Zéghal and Maaloul (2010) found a positive relationship between the two for Taiwanese and UK companies, respectively. Zéghal analyses different industries and finds that VACA is not significant for the high-tech industry. Our findings indicate that both VACA and VAIN play a major role in financial performance, and we therefore find support for H2-a, H2-b and H2-d, and reject H2-c.

Breaking down the analysis into our two subgroups yields the following results:

Panel B: Overperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
VAIC	0,0928*	0,03977*	0,0628*	0,0286*	0,0555	0,0248*	0,0372*	0,01628*
R^2	79,17 %	84,39 %	37,42 %	43,00 %	27,68 %	30,34 %	13,43 %	14,74 %
Residual Swilk	0,1469	0,0529	0,8268	0,8976	0,7897	0,4691	0,4535	0,4973
VAIN	0,01326**	0,00567*	0,0273***	0,0141	0,0054	0,0053	-0,0174**	-0,0036
VACA	1,8475*	0,8088*	1,0027	0,4266	1,4705**	0,5759	1,6336*	0,5979**
R^2	96,39 %	98,87 %	40,42 %	45,85 %	35,61 %	36,88 %	25,02 %	23,56 %
Residual Swilk	0,2249	0,3256	0,3090	0,6940	0,2270	0,4076	0,8443	0,8547
VAIN	0,0104***	0,0082*	0,0308	0,0154	0,0065	0,0058	-0,0176	-0,0037
VACA	1,8647*	0,7561*	0,7269	0,3216	1,2487***	0,4853	1,36**	0,4936***
R&D/B	12,492***	3,8811*	48,6408*	18,5147**	39,9986*	16,3351	53,3316*	20,39924*
R^2	96,80 %	99,12 %	46,23 %	50,34 %	39,82 %	40,71 %	33,43 %	30,62 %
Residual Swilk	0,6831	0,1463	0,9019	0,4691	0,0090	0,0149	0,0126	0,0253
Significant at	*1% **5% ***10%							
Panel C: Underperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA
VAIC	0,0672*	0,0303*	0,0465*	0,0465	0,0244*	0,01404*	0,0089	0,0064
R^2	74,11 %	85,32 %	27,83 %	27,83 %	6,97 %	9,77 %	0,92 %	1,93 %
Residual Swilk	0,5831	0,1508	0,1462	0,1462	0,1996	0,0596	0,7536	0,5707
VAIN	0,0242*	0,2254*	0,0239**	0,01974*	0,0040	0,01144**	-0,0208	0,0044
VACA	1,09*	0,266**	0,7273*	0,1631*	0,585*	0,1071	0,608*	0,7590
R^2	85,67 %	88,74 %	38,82 %	36,79 %	14,52 %	11,19 %	6,09 %	2,77 %
Residual Swilk	0,5359	0,2860	0,0070	0,0762	0,0134	0,0526	0,6303	0,5073
VAIN	0,0392*	0,0259*	0,02264***	0,01692*	0,0058	0,0088	-0,0017	0,0052
VACA	0,6654*	0,1676*	0,689*	0,2055*	0,5608**	0,1437	0,3910	0,5969
R&D/B	11,5869	7,6685	-32,1323	-15,9521	-34,8540	-16,1629	6,4872	8,2090
R^2	89,54 %	89,84 %	40,26 %	37,86 %	16,29 %	12,28 %	7,46 %	3,08 %
Residual Swilk	0,9373	0,2914	0,0219	0,1218	0,2127	0,1648	0,7197	0,5536
Significant at	*1% **5% ***10%							

Table 18: Results from the regression models on the financial performance indicators, Panel B (overperformers) and Panel C (underperformers).

For the underperformers it is evident that their VAIC does not predominantly explain ROE and ROA in year t-3, as opposed to the overperformers. Breaking it up into VAIC and VACA reveals, again, that the overperformers are more efficient in the long-term VACA, whereas the underperformers have explanatory power in year t-2. This might indicate a short-term focus on the part of the underperformers.

In addition, including R&D lowers the explanatory power of VACA for the overaperformers, but for the underperformers it remains the same. This might indicate that the research efforts of the underperformers are focused elsewhere. From the economic model we hypothesized that the undeperforming firms focused more on revenue-increasing activities. This is in contrast to the overperforming group, which had a positive relationship with both EBITDA (bottom line) and revenue (top line) for R&D short term (t and t-1).

The implications of those findings affect the ROE and ROA, which is evident from the lack of influence on the financial indicators of the underperforming firms' R&D.

4.4.3 Market model

Table 19 shows the results from the regression models on market performance indicators. Columns show the independent variables, whereas the rows show the dependent variables. Panel A refers to the regression using the whole dataset, Panel B refers to regressions on the "winners" in the dataset, and Panel C refers to regressions on the "losers".

Panel A: All	**Stock market perfomance**							
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	PB	AR	PB	AR	PB	AR	PB	AR
VAIC	0,2088*	0,0762**	0,2122*	0,0417	0,162*	0,054**	0,0879*	0,0170
R^2	35,33 %	2,98 %	31,36 %	0,74 %	28,30 %	1,20 %	23,20 %	0,11 %
Residual Swilk	0,0620	0,0723	0,0029	0,0000	0,0002	0,0000	0,0002	0,0001
VAIN	-0,071**	0,1015***	-0,0614	0,0570	-0,0721**	0,0511	-0,1234***	0,2453
VACA	6,532*	-0,5934	6,6789*	-0,3928	5,8341*	0,1349	5,144*	-0,1800
R^2	38,77 %	3,22 %	34,13 %	0,82 %	25,32 %	1,20 %	15,18 %	0,13 %
Residual Swilk	0,7990	0,6520	0,0132	0,0000	0,0006	0,0005	0,0004	0,0008
VAIN	-0,0677	0,1043	-0,0507	0,0454	-0,0656***	0,0175	-0,1147***	-0,0404
VACA	6,2904*	-0,4746	6,3417*	-0,7452	5,5365*	-0,6161	4,6145*	-1,3617
R&D/B	130,333***	-27,1635	141,0728	78,8642	126,8241	176,3454**	190,2323	301,099*
R^2	38,94 %	3,28 %	34,68 %	1,30 %	27,68 %	3,55 %	23,13 %	6,28 %
Residual Swilk	0,9942	0,8426	0,0479	0,0005	0,0001	0,0003	0,0001	0,0015
Significant at	*1% **5% ***10%							
Panel B: Overperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	PB	AR	PB	AR	PB	AR	PB	AR
VAIC	0,1676*	0,0726	0,1742*	-0,1293	0,1398*	-0,0231	0,0537	-0,0616
R^2	40,64 %	4,37 %	39,43 %	0,09 %	35,22 %	0,21 %	24,10 %	1,32 %
Residual Swilk	0,4475	0,6311	0,0701	0,3691	0,0026	0,4794	0,0002	0,7666
VAIN	-0,0243	0,1123	-0,0518	0,0037	-0,0479	-0,0140	-0,1501**	-0,0639
VACA	5,0049*	-1,0901	5,6597*	-0,5774	4,692*	-0,3412	4,8272*	0,0949
R^2	40,21 %	6,42 %	30,76 %	0,54 %	19,80 %	0,34 %	6,74 %	1,26 %
Residual Swilk	0,7103	0,3677	0,4897	0,1843	0,0049	0,4119	0,0001	0,7645
VAIN	0,1419*	0,1193	0,2047**	0,0053	0,2166**	0,0349	0,1836**	0,0008
VACA	3,4797*	-1,2349	3,4927*	-0,6017	2,9545**	-1,0305	2,5777**	-0,8611
R&D/B	-33,4084	46,2277	13,1580	9,1415	-73,9631	304,7434**	-0,3553	484,2035*
R^2	51,67 %	6,52 %	52,14 %	0,54 %	43,36 %	3,43 %	31,79 %	9,11 %
Residual Swilk	0,2523	0,3386	0,2743	0,1826	0,0078	0,2534	0,0041	0,7196
Significant at	*1% **5% ***10%							
Panel C: Underperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	PB	AR	PB	AR	PB	AR	PB	AR
VAIC	0,3094*	0,1032	0,2928*	0,0747	0,222*	0,0326	0,1341	-0,0822
R^2	27,52 %	1,59 %	22,66 %	0,69 %	14,30 %	0,13 %	6,66 %	0,77 %
Residual Swilk	0,7175	0,0003	0,0960	0,0013	0,0008	0,0007	0,0001	0,0005
VAIN	0,0200	-0,0244	-0,0196	0,1109	-0,1159	-0,0196	-0,0780	0,1798
VACA	6,617*	3,3028	7,7695***	-0,9330	8,282**	1,5122	5,0961	-7,7701
R^2	42,11 %	2,31 %	37,98 %	0,73 %	32,08 %	0,25 %	18,57 %	3,95 %
Residual Swilk	0,6715	0,0003	0,0310	0,0014	0,0011	0,0004	0,0003	0,0124
VAIN	-0,0800	-0,0342	-0,1122	0,1168	-0,142**	-0,0165	-0,1185	0,1793
VACA	6,9679*	3,9233	7,934*	-1,3994	6,916*	0,9212	4,0574	-9,3465
R&D/B	485,2381*	-112,7320	474,2179*	82,2359	497,195*	106,5693	500,3616*	308,1151**
R^2	64,79 %	2,71 %	63,27 %	0,94 %	64,48 %	0,66 %	64,54 %	7,24 %
Residual Swilk	0,0370	0,0000	0,0007	0,0024	0,0016	0,0012	0,0000	0,1129
Significant at	*1% **5% ***10%							

Table 19: Results from the regression models on market performance indicators.

In the market model we have big issues with non-Gaussian distribution, especially for lagged variables and the underperforming group in panel C. We will therefore put little emphasis on the values of the coefficient, due to the errors in the standard deviation resulting from these issues. We hypothesize that the problems are due to the high variability in the sample size performance, and relative low sample size.

Panel A: All	**Stock market perfomance**							
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	PB	AR	PB	AR	PB	AR	PB	AR
VAIC	0,2088*	0,0762**	0,2122*	0,0417	0,162*	0,054**	0,0879*	0,0170
R^2	35,33 %	2,98 %	31,36 %	0,74 %	28,30 %	1,20 %	23,20 %	0,11 %
Residual Swilk	0,0620	0,0723	0,0029	0,0000	0,0002	0,0000	0,0002	0,0001
VAIN	-0,071**	0,1015***	-0,0614	0,0570	-0,0721**	0,0511	-0,1234***	0,2453
VACA	6,532*	-0,5934	6,6789*	-0,3928	5,8341*	0,1349	5,144*	-0,1800
R^2	38,77 %	3,22 %	34,13 %	0,82 %	25,32 %	1,20 %	15,18 %	0,13 %
Residual Swilk	0,7990	0,6520	0,0132	0,0000	0,0006	0,0005	0,0004	0,0008
VAIN	-0,0677	0,1043	-0,0507	0,0454	-0,0656***	0,0175	-0,1147***	-0,0404
VACA	6,2904*	-0,4746	6,3417*	-0,7452	5,5365*	-0,6161	4,6145*	-1,3617
R&D/B	130,333***	-27,1635	141,0728	78,8642	126,8241	176,3454**	190,2323	301,099*
R^2	38,94 %	3,28 %	34,68 %	1,30 %	27,68 %	3,55 %	23,13 %	6,28 %
Residual Swilk	0,9942	0,8426	0,0479	0,0005	0,0001	0,0003	0,0001	0,0015
Significant at	*1% **5% ***10%							

Table 20: Results from the regression models on stock market performance indicators, Panel A (all).

Panel A, regression 1:

VAIC has a statistically significant positive relationship with the price/book ratio of the firms at the 1% confidence level. This implies that the investors appreciate IC, and invest accordingly. VAIC explains 35% of the variation in the P/B variable, retaining its explanatory power to a solid 23% in year t-3. These findings are in accordance with our tests on the economic and financial models, where we concluded that VAIC has a positive relationship with company performance.

However, the AR variable explains a mere 3% of the variance in year t, declining to 0.11% in year t-3. Even though VAIC is significant at the 95% level in year t, it explains very little of annual return. This might be due partly to our measurement of annual return, using a specific closing date for each year, not fully reflecting the variance throughout the year. Nevertheless, VAIC is a poor indicator of annual return, especially in forecasting values.

Considering that P/B is a proxy for value not recorded in the financial statements, we can perceive VAIC as a potent proxy for intellectual capital. Earlier on we hypothesized that much of the mismatch in market value and book value stems from the valuation of IC. The findings from this analysis give credibility to this claim.

The findings from regression 1 leads us to keep H3-a and H3-d.

Panel A, regression 2:

VACA is statistically significant in all time-periods for the P/B variable, as opposed to VAIN, which is weakly statistically significant for all periods except for t-1. VAIN values are weakly negative, indicating investors punish what they deem to be excess labour costs. However, as mentioned, our standard deviations might be skewed, and as such, the values on the coefficient might be wrong. This could indicate that the coefficients are in fact positive (considering the low negative values), or more negative, meaning we should put little emphasis on the estimated value.

However, VACA is clearly significant, indicating investors primarily measure the efficiency of tangible assets in their valuation of the firms. The R^2 drops quite significantly on the lagged values for our model, compared with regression 1. This might indicate that the aggregate measure for IC is perceived by investors as more important than the division into lesser units of IC. However, the division clearly shows the main focus of the investors, namely the efficiency of tangible assets.

The same interpretation of AR in regression 1 follows for regression 2, which is in line with previous studies (Chen, Cheng and Hwang 2005; Zéghal and Maaloul 2010). The findings from regression 2 lead us to partly reject H3-b, due to the drop in explanatory power from regression 1 in the lagged variables, and the poor explaining power of AR.

Panel A, regression 3:

VACA remains the key explaining variable for P/B after introducing R&D/B. R^2

increases marginally in year t and t-1, and declines to the level of regression 1 in the remaining years. This could to some degree indicate that R/D is well perceived and rewarded by investors.

Interestingly, we observe that the explanatory power of R&D for the AR variable increases throughout the years, starting at 3% and increasing to 6% in year t-3. Comparing this to regression 2, we see that R/D explains 6% of future stock performance. We also witness a sharp increase in the coefficient values throughout the years, too large to be discarded due to heteroscedasticity issues. Our findings from the previous models are yet again confirmed, R/D has a prolonged lagged effect, increasing in importance and magnitude over the years. Our findings - the lagged effect of R&D for both P/B and AR - give credibility to H3-c.

Our analysis confirms H3-a/c/d, but causes us to discard H3-b. Analysing market performance on the sample as a whole is difficult, due to the high variation in market performance. We have outliers such as BP, a well-performing company, with a sudden decline in P/B due to the Deepwater Horizon incident. This causes non-Gaussian distribution, removing some of the interpretation value of the coefficient values.

However, our findings from the previous models are to some degree confirmed. VAIC is a significant explanatory variable, with the VACA component being most appreciated, and with R/D having a significant positive lagged relationship with our proxies.

Breaking down the analysis into our two subgroups yields the following results:

Panel B: Overperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	PB	AR	PB	AR	PB	AR	PB	AR
VAIC	0,1676*	0,0726	0,1742*	-0,1293	0,1398*	-0,0231	0,0537	-0,0616
R^2	40,64 %	4,37 %	39,43 %	0,09 %	35,22 %	0,21 %	24,10 %	1,32 %
Residual Swilk	0,4475	0,6311	0,0701	0,3691	0,0026	0,4794	0,0002	0,7666
VAIN	-0,0243	0,1123	-0,0518	0,0037	-0,0479	-0,0140	-0,1501**	-0,0639
VACA	5,0049*	-1,0901	5,6597*	-0,5774	4,692*	-0,3412	4,8272*	0,0949
R^2	40,21 %	6,42 %	30,76 %	0,54 %	19,80 %	0,34 %	6,74 %	1,26 %
Residual Swilk	0,7103	0,3677	0,4897	0,1843	0,0049	0,4119	0,0001	0,7645
VAIN	0,1419*	0,1193	0,2047**	0,0053	0,2166**	0,0349	0,1836**	0,0008
VACA	3,4797*	-1,2349	3,4927*	-0,6017	2,9545**	-1,0305	2,5777**	-0,8611
R&D/B	-33,4084	46,2277	13,1580	9,1415	-73,9631	304,7434**	-0,3553	484,2035*
R^2	51,67 %	6,52 %	52,14 %	0,54 %	43,36 %	3,43 %	31,79 %	9,11 %
Residual Swilk	0,2523	0,3386	0,2743	0,1826	0,0078	0,2534	0,0041	0,7196
Significant at	*1% **5% ***10%							
Panel C: Underperformers								
	No lag bootstrap 100		1 year lag		2 year lag		3 year lag	
	PB	AR	PB	AR	PB	AR	PB	AR
VAIC	0,3094*	0,1032	0,2928*	0,0747	0,222*	0,0326	0,1341	-0,0822
R^2	27,52 %	1,59 %	22,66 %	0,69 %	14,30 %	0,13 %	6,66 %	0,77 %
Residual Swilk	0,7175	0,0003	0,0960	0,0013	0,0008	0,0007	0,0001	0,0005
VAIN	0,0200	-0,0244	-0,0196	0,1109	-0,1159	-0,0196	-0,0780	0,1798
VACA	6,617*	3,3028	7,7695***	-0,9330	8,282**	1,5122	5,0961	-7,7701
R^2	42,11 %	2,31 %	37,98 %	0,73 %	32,08 %	0,25 %	18,57 %	3,95 %
Residual Swilk	0,6715	0,0003	0,0310	0,0014	0,0011	0,0004	0,0003	0,0124
VAIN	-0,0800	-0,0342	-0,1122	0,1168	-0,142**	-0,0165	-0,1185	0,1793
VACA	6,9679*	3,9233	7,934*	-1,3994	6,916*	0,9212	4,0574	-9,3465
R&D/B	485,2381*	-112,7320	474,2179*	82,2359	497,195*	106,5693	500,3616*	308,1151**
R^2	64,79 %	2,71 %	63,27 %	0,94 %	64,48 %	0,66 %	64,54 %	7,24 %
Residual Swilk	0,0370	0,0000	0,0007	0,0024	0,0016	0,0012	0,0000	0,1129
Significant at	*1% **5% ***10%							

Table 21: Results from the regression models on stock market performance indicators, Panel B (overperformers) and Panel C (underperformers).

As expected, VAIC is a significant variable for both groups in explaining the variation in P/B. However, comparing the R^2 for the two groups, VAIC explains 13% more for the winning group than for the losing group. However, the reverse is observed in regression 2, where the underperformers retain much of their explanatory power, ending up at three times the value of the overperformers in year t-3. In addition, VACA ceases to be significant in year t-3 for the underperformers. This is a conundrum. However, part of the explanation might be the high variance in our sample of underperformers, such as BP, being amongst

the top tier before 2010, and then declining sharply. This causes the previously mentioned heteroscedasticity to become an issue. In addition, the high variability amongst the data points makes the a percentage of the variation easier to explain, due to the increase in size (both 2 independent variables compared to one, and more variability). The same is evident in regression 3, where a larger part of the variability is explained. One interesting thing of note is the significance of R&D in year t and t-1 for the underperformers. Compared to the overperformers, the losing group has a significant relationship with P/B. This stands in contrast to the overperforming group, which has a negative relationship with a positive increase towards year t-3. This might indicate short-sighted R&D expenditure, compared to the long-term expenditure we have hypothesized in the overperforming groups.

4.4.4 Summary

Table 22 shows a summary of the rejected and remaining hypotheses:

	Economic	Financial	Market
HX-a	yes	yes	yes
HX-b	yes	yes	no
HX-c	no	no	yes
HX-d	yes	yes	yes

Table 22: Summary of hypothesis testing.

We conclude that VAIC has a positive relationship with our performance proxies, both in current and future years. Dividing VAIC up in to VAIN and VACA shows the emphasis our industry has on tangible assets. However, for our financial and economic models, we establish a positive link between the VAIN factor and firm performance. R&D has a significant effect, but needs time to materialize. Our tests indicate a 2-3 year maturity process. Given that our analysis stops at 3 years, there is no telling for how many years the effects of R&D will be significant.

5 Conclusions and recommendations

The aim of the thesis was to examine the relationship between intellectual capital (IC) and competitive advantages/disadvantages within firms. A sustained competitive advantage is defined as sustained superior performance compared to peer companies.

We identified a statistically significant correlation (1% confidence level) between the proxy for intellectual capital (value added intellectual coefficient - VAIC) and company performance. This relationship holds for economic, financial and market measures. This finding accords with previous studies on the subject.

In addition, we performed vigorous statistical analysis on the panel data, confirming the positive relationship between VAIC and our proxies for performance. Dividing VAIC into value added intellectual capital coefficient (VAIN) and value added capital employed (VACA) confirmed our prior beliefs that our industry is heavily dependent on tangible assets. However, VAIN was significant in explaining some of the variance for our economic and financial measures.

Adding research and development as an independent variable to explain some of the intellectual capital increased our model's ability to explain the variance. It became apparent that R&D expenditure has an initial negative effect on company performance, before positively affecting company performance in later years. The effect of R&D effects is used by many authors as a proxy for innovation capital. As such, we argue that innovation capital is essential to value creation.

Comparing our two groups, the "winners" and "losers", yielded no clear key characteristics for either. Some indications from the dataset did, however, materialize:

- Efficiency of tangible assets is crucial in this industry. Our analysis shows that the winning group consistently generates more value per asset than the losing group.

- Research and Development seems to relate to revenue-increasing activities for the losing group, whereas the winning group seems to focus on both top line and bottom line measures. (Economic model)
- Research and Development seems to be focused on the efficiency of tangible assets for the winning group, whereas the losing group seems to focus elsewhere. (Financial model)
- Research and Development seems to be focused on short-term goals for the losing group, compared with the long-term goals of the winning group. (Financial and Market model)

As mentioned previously in this thesis, the concept of intellectual capital has been of interest to several academic disciplines (strategy, valuation and accounting). Our research is in some way positioned in between these three communities. Seen from an accounting theory perspective, the findings in this thesis show that a great deal of excess value and wealth creation above the book values that can be traced back to intellectual capital is not recognized (read: capitalized) in the financial statements. As explained in the introductory part, the main goal of financial statements is to provide investors and others stakeholders with information to help them make financial decisions. Despite much the so-called intellectual capital being expensed in the income statement due to the difficulties of fulfilling the capitalization requirements, there is evidence from both this and other studies (Mavrinac and Boyle (1996) cited in Bontis et. al. (2007)) that investors perceive these expenditures as beneficial for the future. We will not go into the discussion of whether intellectual capital should be recognized in the financial statements, but note that the financial statements' main purpose is to provide information to investors and other stakeholders. And if it is the case that investors find the information about IC elsewhere than in the balance sheet, it is not necessarily important to incorporate the reporting of IC (read: capitalize) in the regulations governing financial statements. However, we believe that this discussion will continue within the accounting community in the coming years.

5.1 Limitations of the study

Our thesis has some limitations, some more important than others. Our dataset is relatively small, due to the difficulty of standardizing the necessary variables from firms operating all over the globe. In their notes to the financial statements, some companies disclose personnel expenses post pension, some pre pension. Some do not disclose personnel expenses at all. R&D is not usually a separate line in the statement of profit and loss. The standardization issues are many, and resulted in manual extraction of key variables from annual reports. Other studies examine knowledge-intensive industries, which often report figures more relevant to the study of intellectual capital, compared with our industry, which is highly capital intensive. In addition, the capital requirements to be a global integrated oil company are very high, limiting the total population. Thus, the elimination process in the sample sizing leaves us with fewer companies than in similar studies, since their starting population is much larger. Due to this, we found it harder to obtain the same dataset sizes as those used by other studies from more defined industry sectors.

Generalizing the results from the tests to other companies not included in the analysis is difficult. Our sample consists of the eight largest integrated, global oil companies, a rather unique group of companies. The extensive capital requirements are a natural limitation, as is the fact that they compete against state-owned companies with subsidized production costs. The above-mentioned uniqueness of our sample companies makes it hard to extrapolate the results to smaller oil companies. However, our findings are in accordance with other studies performed on different industries, where the firms compete with different products, etc. This might indicate some general causation between intellectual capital and firm performance.

The dataset size weakens the statistical power of our tests, but the results are still indicative of intellectual capital's effect on competitive advantage ($N \approx 100$).

5.2 Further research

For further research we advise studies be performed on multiple industries, to identify industry characteristics, as opposed to firm characteristics. This might be further highlighted by expanding the time period analysed. Furthermore, future research could re-examine the basic assumptions of the VAIC method and reassess the implications drawn in studies such as this one. For example, one can use other IC measurement tools, such as EVA, and different proxies. Also, other statistical techniques might be applicable, such as the use of structural equation models to help highlight possible interaction between the variables

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7 Appendix

Appendix A: Key financial data

BP

Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	199 876	239 792	265 906	284 365	361 143	239 272	297 107	375 517	375 765	379 136	353 568	222 894
Cost of goods sold	153 237	184 118	210 976	226 681	296 165	186 974	280 826	309 763	326 700	325 878	309 282	201 830
Gross profit	46 639	55 674	54 930	57 684	64 978	52 298	16 281	65 754	49 065	53 258	44 286	21 064
R&D	439	502	395	566	595	587	780	636	674	707	663	418
Payroll	9 067	9 854	10 351	11 511	12 280	12 216	11 773	12 327	13 117	13 654	13 936	12 928
Depreciation	8 529	8 771	9 128	10 579	10 985	12 106	11 164	11 135	12 687	13 510	15 163	17 048
Operating income Core (loss)	22 556	29 503	26 689	26 965	30 722	21 733	-9 140	33 001	14 157	27 803	2 197	-10 340
Non operating income (loss)	-2 410	-2 418	-7 953	-4 646	-3 561	-3 391	-4 315	-5 833	-3 974	-2 418	-2 753	-769
EBITDA	28 675	35 856	27 864	32 898	38 146	30 448	-2 291	38 303	22 870	38 895	14 607	5 939
EBIT	20 146	27 085	18 736	22 319	27 161	18 342	-13 455	27 168	10 183	25 385	-556	-11 109
Finance expenses	175	-3	185	13	-421	-493	-463	-621	-525	-562	-840	-839
Pretax income	24 966	31 921	34 642	31 611	34 283	25 124	-4 825	38 834	18 131	30 221	4 950	-9 571
Adjusted tax	9 812	12 492	14 036	12 257	14 704	11 024	-1 958	16 170	8 497	12 659	2 273	-4 296
Adjusted income after tax	15 154	19 429	20 606	19 354	19 579	14 100	-2 867	22 664	9 634	17 562	2 677	-5 275
NOPAT	15 261	19 428	20 716	19 362	19 338	13 823	-3 142	22 302	9 355	17 236	2 223	-5 737
Dividends	6 041	7 359	7 686	8 106	10 342	10 483	2 627	4 072	5 294	5 441	5 850	6 659
Cash and Cash equivalent	1 552	3 092	2 731	3 727	8 365	8 588	20 335	14 599	20 201	23 203	30 425	26 880
Inventories	15 645	19 760	18 915	26 554	16 821	22 605	26 218	25 661	28 203	29 231	18 373	14 142
Accounts receivable	30 657	33 565	32 656	33 012	22 869	22 604	24 255	27 929	26 485	28 868	19 671	13 682
Total current assets	61 443	75 290	75 339	80 202	66 384	67 653	96 853	97 584	111 384	96 840	87 262	70 602
PPE	93 092	85 947	90 999	97 989	103 200	108 275	110 163	119 214	125 331	133 690	130 692	129 758
CAPEX	12 286	12 281	15 125	17 830	22 658	20 650	18 421	17 845	23 222	24 520	22 546	18 648
Total intangible assets	15 062	15 143	16 026	17 658	20 138	20 168	22 896	33 202	36 822	34 220	32 775	30 287
Total non-current assets	133 187	131 624	142 262	155 874	161 854	168 315	175 409	195 484	189 082	208 850	197 043	191 230
Total assets	194 630	206 914	217 601	236 076	228 238	235 968	272 262	293 068	300 466	305 690	284 305	261 832
Accounts payable and accruals	27 471	28 614	28 319	30 735	20 129	43 870	54 861	60 278	61 135	58 064	49 231	39 290
ST Debt	115	60	12 924	15 394	15 740	9 109	14 626	9 044	10 033	7 381	6 877	6 944
L Debt	2 283	721	11 086	15 651	17 464	25 518	30 710	35 169	38 767	40 811	45 977	46 224
Total current liabilities	63 126	71 497	75 352	77 231	69 793	59 320	83 879	84 318	77 175	72 812	63 615	54 724
Total non-current liabilites	53 269	54 652	56 784	64 193	66 336	74 535	92 492	96 268	103 539	102 471	108 048	108 721
Total liabilities	116 395	126 149	132 136	141 424	136 129	133 855	176 371	180 586	180 714	175 283	171 663	163 445
Adjusted equity	76 314	77 853	84 071	93 161	90 531	99 635	96 743	109 446	118 369	124 518	111 539	99 594
NOWC	-1 683	3 793	-13	2 971	-3 409	8 333	12 974	13 266	34 209	24 028	23 647	15 878
Cash from operating activites	23 378	26 721	28 172	24 709	38 095	27 716	13 616	22 154	20 479	21 100	32 754	19 133
Cash from investing activities	-11 331	-1 729	-9 518	-14 837	-22 767	-18 133	-3 960	-26 633	-13 075	-7 855	-19 574	-17 300
Change in fixed and intangible assets cash	-8 050	-9 478	-9 162	-16 081	-21 740	-18 935	-10 929	-14 345	-13 230	-6 405	-20 726	-17 582
Acquisition of fixed assets and intangibles	-12 286	-12 281	-15 125	-17 830	-22 658	-20 650	-18 421	-17 845	-23 222	-24 520	-22 546	-18 648
Cash from financing activities	-12 802	-22 476	-18 788	-8 808	-10 084	-9 551	840	482	-2 010	-10 400	-5 266	-4 535
FCF	11 504	15 918	14 719	12 111	7 665	5 279	-10 399	15 592	-1 180	6 226	-5 160	-7 337
Number of employees	102 900	96 200	97 000	98 100	92 000	80 300	79 700	83 400	85 700	83 900	84 500	79 800
Exploration	637	684	1 045	756	882	1 116	843	1 520	1 475	3 441	3 632	2 353
Exploration perc	0,33 %	0,33 %	0,48 %	0,32 %	0,39 %	0,47 %	0,31 %	0,52 %	0,49 %	1,13 %	1,28 %	0,90 %
Total Production	3 997	4 014	3 926	3 818	3 838	3 998	3 822	3 454	3 331	3 230	3 151	3 136
Sales/Production	50	60	68	74	94	60	78	109	113	117	112	71
Reserve replacement ratio	0,95	0,72	0,87	1,09	1,24	1,27	0,97	0,75	0,40	1,82	0,60	0,72
WACC	7,68 %	10,29 %	9,42 %	9,19 %	10,14 %	9,29 %	13,19 %	10,50 %	9,21 %	8,78 %	8,04 %	8,31 %
Invested capital	80 633	81 546	109 475	125 697	125 313	136 740	141 227	156 695	168 552	178 599	165 496	151 555
Residual income	9 071	11 038	10 399	7 813	6 631	1 125	-21 775	5 853	-6 170	1 557	-11 077	-18 334
Value Added	33 858	41 778	44 808	43 109	46 984	37 833	7 411	51 782	31 773	44 437	19 726	4 196
Human Capital	9 067	9 854	10 351	11 511	12 280	12 216	11 773	12 327	13 117	13 654	13 936	12 928
Structural Capital	24 791	31 924	34 457	31 598	34 704	25 617	-4 362	39 455	18 656	30 783	5 790	-8 732
Capital Employed	179 568	191 771	201 575	218 418	208 100	215 800	249 366	259 866	263 644	271 470	251 530	231 545
VAIN 2	4,47	5,00	5,10	4,48	4,56	3,77	0,04	4,96	3,01	3,95	1,71	0,32
VACA	0,19	0,22	0,22	0,20	0,23	0,18	0,03	0,20	0,12	0,16	0,08	0,02
VAIC2	4,65	5,22	5,32	4,68	4,79	3,95	0,07	5,16	3,13	4,11	1,79	0,34
Tobins Q	0,60	0,61	0,61	0,60	0,60	0,57	0,65	0,62	0,61	0,58	0,61	0,63
Return on equity (Pretax)	0,33	0,41	0,41	0,34	0,38	0,25	-0,05	0,35	0,15	0,24	0,04	-0,10
Return on assets (Pretax)	0,13	0,15	0,16	0,13	0,15	0,11	-0,02	0,13	0,06	0,10	0,02	-0,04
EBIT/Total assets	0,10	0,13	0,09	0,09	0,12	0,08	-0,05	0,09	0,03	0,08	-0,00	-0,04
Total share return Indexed	100,00	126,29	120,12	135,64	123,25	151,95	119,89	123,74	120,26	146,11	130,10	120,16
P/B	3,33	3,35	3,15	3,00	2,00	2,22	1,87	1,71	1,59	1,57	1,46	1,41
Adjusted P/E	12,44	10,06	10,11	11,21	6,81	10,95	-	5,25	11,92	6,53	31,16	-
Revenue growth	-	19,97	10,89	6,94	27,00	-33,75	24,17	26,39	0,07	0,90	-6,74	-36,96
Employee turnover	-	-0,07	0,01	0,01	-0,06	-0,13	-0,01	0,05	0,03	-0,02	0,01	-0,06
Current R&D Density	0,0022	0,0021	0,0015	0,0020	0,0016	0,0025	0,0026	0,0017	0,0018	0,0019	0,0019	0,0019
Inventory turnover	9,79	9,32	11,15	8,54	17,61	8,27	10,71	12,07	11,58	11,15	16,83	14,27
Production - N.America	1 572	1 497	1 444	1 390	1 420	1 117	999	775	678	621	673	582
Production - Africa	161	233	248	236	361	412	342	286	304	320	308	368
Production - Middle East	162	181	198	207	222	-	-	-	-	-	-	-
Production - Europe	624	1 553	1 461	1 299	1 274	1 261	1 227	1 194	1 171	1 094	1 113	1 162
Production - Asia	190	233	287	358	268	549	582	622	640	617	273	551
Production - L.America	473	503	538	537	576	660	660	165	178	191	222	220
MC World	0,22	0,19	0,21	0,24	0,27	0,35	0,38	0,39	0,42	0,48	0,55	0,57

Chevron												
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	144 750	184 922	195 341	203 970	255 112	159 293	189 607	236 286	222 580	211 664	192 308	122 566
Cost of goods sold	121 036	158 135	161 613	171 094	213 177	139 102	158 318	192 026	181 115	178 080	166 103	118 493
Gross profit	23 714	26 787	33 728	32 876	41 935	20 191	31 289	44 260	41 465	33 584	26 205	4 073
R&D	242	316	468	562	835	603	526	627	648	750	707	601
Payroll	2 950	3 657	4 387	5 080	6 239	5 357	5 756	6 495	6 771	7 388	7 586	5 495
Depreciation	4 935	5 913	7 506	8 708	9 528	12 110	13 063	12 911	13 413	14 186	16 793	21 037
Operating income Core (loss)	18 460	21 216	27 271	25 627	35 010	14 322	25 375	38 299	35 013	27 213	19 726	-3 710
Non operating income (loss)	-2 176	-4 077	-4 775	-6 647	-8 047	-4 206	-6 680	-9 335	-11 319	-8 692	-11 476	-8 552
EBITDA	21 219	23 052	30 002	27 688	36 491	22 226	31 758	41 875	37 107	32 707	25 043	8 775
EBIT	16 284	17 139	22 496	18 980	26 963	10 116	18 695	28 964	23 694	18 521	8 250	-12 262
Finance expenses	-207	-216	-71	219	192	73	79	145	166	136	145	119
Pretax income	20 636	25 293	32 046	32 274	43 057	18 528	32 055	47 634	46 332	35 905	31 202	4 842
Adjusted tax	8 110	9 898	12 985	12 514	18 468	8 130	13 008	19 834	21 712	15 040	14 326	2 173
Adjusted income after tax	12 526	15 395	19 061	19 760	24 589	10 398	19 047	27 800	24 620	20 865	16 876	2 669
NOPAT	12 400	15 264	19 019	19 894	24 699	10 439	19 094	27 885	24 708	20 944	16 954	2 734
Dividends	3 236	3 778	4 396	4 791	5 162	5 302	5 674	6 136	6 844	7 474	7 928	7 992
Cash and Cash equivalent	10 742	11 144	11 446	8 094	9 560	8 822	14 215	16 113	21 205	16 508	13 207	11 332
Inventories	2 983	4 121	4 656	5 310	6 854	5 529	5 493	5 543	6 144	6 380	6 505	6 334
Accounts receivable	12 429	17 184	17 628	22 446	15 856	17 703	20 759	21 793	20 997	21 622	16 736	12 860
Total current assets	28 503	34 336	36 304	39 377	36 470	37 216	48 841	53 234	55 720	50 250	42 232	35 347
PPE	44 458	63 690	68 858	78 610	91 780	96 468	104 504	122 608	141 348	164 829	183 173	188 396
CAPEX	6 310	8 701	13 813	16 678	19 666	19 843	19 612	26 500	30 938	37 985	35 407	29 504
Total intangible assets	-	4 636	4 623	4 637	4 619	4 618	4 617	4 642	4 640	4 639	4 593	4 588
Total non-current assets	64 705	91 497	96 324	109 409	124 695	127 405	135 928	156 240	177 262	203 503	223 794	230 756
Total assets	93 208	125 833	132 628	148 786	161 165	164 621	184 769	209 474	232 982	253 753	266 026	266 103
Accounts payable and accruals	10 747	16 074	16 675	21 756	16 580	25 754	28 694	31 982	32 743	31 244	26 846	20 367
ST Debt	816	739	2 159	1 162	2 818	384	187	340	127	374	3 790	4 928
L Debt	10 456	12 131	7 679	6 070	6 083	10 130	11 289	9 812	12 065	20 057	24 028	33 664
Total current liabilities	18 795	25 011	28 409	33 798	32 023	26 211	29 012	33 600	34 212	33 018	31 926	26 464
Total non-current liabilites	29 011	37 946	35 075	37 696	42 025	45 849	49 946	53 693	60 938	70 308	77 909	85 753
Total liabilities	47 806	62 957	63 484	71 494	74 048	72 060	78 958	87 293	95 150	103 326	109 835	112 217
Adjusted equity	44 600	64 172	71 067	78 364	87 775	92 476	105 834	123 086	136 273	149 869	153 826	151 968
NOWC	9 708	9 325	7 895	5 579	4 447	11 005	19 829	19 634	21 508	17 232	10 306	8 883
Cash from operating activites	14 690	20 105	24 323	24 977	29 632	19 373	31 359	41 095	38 812	35 002	31 475	19 456
Cash from investing activities	-3 499	-11 561	-12 219	-13 933	-17 081	-16 572	-20 915	-27 489	-24 796	-35 609	-29 893	-23 808
Change in fixed and intangible assets cash	-2 639	-6 020	-12 824	-13 340	-18 175	-17 279	-17 617	-22 983	-28 161	-36 842	-29 678	-23 765
Acquisition of fixed assets and intangibles	-6 310	-8 701	-13 813	-16 678	-19 666	-19 843	-19 612	-26 500	-30 938	-37 985	-35 407	-29 504
Cash from financing activities	-6 183	-7 430	-11 788	-14 218	-10 301	-3 546	-5 170	-11 769	-8 980	-3 821	-4 999	2 815
FCF	11 025	12 476	12 712	11 924	14 561	2 706	12 545	14 296	7 183	-2 855	-1 660	-5 733
Number of employees	47 265	53 440	55 882	59 162	61 675	59 963	58 267	61 189	61 942	64 550	64 715	61 494
Exploration	697	743	1 364	1 323	1 169	1 342	1 147	1 216	1 728	1 861	1 985	3 340
Exploration perc	0,75 %	0,59 %	1,03 %	0,89 %	0,73 %	0,82 %	0,62 %	0,58 %	0,74 %	0,73 %	0,75 %	1,26 %
Total Production	2 369	2 406	2 585	2 619	2 530	2 704	2 763	2 673	2 610	2 597	2 571	2 622
Sales/Production	61	77	76	78	101	59	69	88	85	82	75	47
Reserve replacement ratio	0,18	1,75	0,69	0,11	1,46	1,12	0,24	1,71	1,12	0,85	0,89	1,07
WACC	7,18 %	8,89 %	9,65 %	10,50 %	10,60 %	10,92 %	10,74 %	10,34 %	10,56 %	9,95 %	8,91 %	9,58 %
Invested capital	56 674	75 746	78 982	84 524	96 018	103 075	117 287	132 333	150 024	170 858	184 009	192 478
Residual income	8 331	8 528	11 394	11 020	14 523	-819	6 496	14 198	8 870	3 936	560	-15 703
Value Added	23 793	29 166	36 504	37 135	49 104	23 812	37 732	53 984	52 937	43 157	38 643	10 218
Human Capital	2 950	3 657	4 387	5 080	6 239	5 357	5 756	6 495	6 771	7 388	7 586	5 495
Structural Capital	20 843	25 509	32 117	32 055	42 865	18 455	31 976	47 489	46 166	35 769	31 057	4 723
Capital Employed	93 208	121 197	128 005	144 149	156 546	160 003	180 152	204 832	228 342	249 114	261 433	261 515
VAIN 2	8,94	8,85	9,20	8,17	8,74	5,22	7,40	9,19	8,69	6,67	5,90	2,32
VACA	0,26	0,24	0,29	0,26	0,31	0,15	0,21	0,26	0,23	0,17	0,15	0,04
VAIC2	9,20	9,09	9,49	8,43	9,06	5,37	7,61	9,46	8,92	6,84	6,05	2,36
Tobins Q	0,51	0,50	0,48	0,48	0,46	0,44	0,43	0,42	0,41	0,41	0,42	0,43
Return on equity (Pretax)	0,46	0,39	0,45	0,41	0,49	0,20	0,30	0,39	0,34	0,24	0,20	0,03
Return on assets (Pretax)	0,22	0,20	0,24	0,22	0,27	0,11	0,17	0,23	0,20	0,14	0,12	0,02
EBIT/Total assets	0,17	0,14	0,17	0,13	0,17	0,06	0,10	0,14	0,10	0,07	0,03	-0,05
Total share return Indexed	100,00	111,51	149,15	194,72	159,06	171,95	211,40	254,28	267,20	318,82	296,56	248,48
P/B	2,45	2,19	2,48	2,71	1,82	1,76	1,81	1,80	1,59	1,65	1,40	1,13
Adjusted P/E	8,33	8,63	9,38	10,57	6,30	14,64	9,58	7,86	8,06	11,17	10,99	36,57
Revenue growth	-	27,75	5,63	4,42	25,07	-37,56	19,03	24,62	-5,80	-4,90	-9,14	-36,27
Employee turnover	-	0,13	0,05	0,06	0,04	-0,03	-0,03	0,05	0,01	0,04	0,00	-0,05
Current R&D Density	0,0017	0,0017	0,0024	0,0028	0,0033	0,0038	0,0028	0,0027	0,0029	0,0035	0,0037	0,0049
Inventory turnover	40,58	38,37	34,71	32,22	31,10	25,16	28,82	34,64	29,48	27,91	25,53	18,71
Production - N.America	888	816	837	806	735	771	762	748	724	728	664	789
Production - Africa	326	333	358	351	352	433	469	459	451	431	434	412
Production - Middle East	-	-	-	-	-	-	-	-	-	-	-	-
Production - Europe	242	216	193	188	182	179	159	139	114	94	80	83
Production - Asia	586	716	872	920	883	878	872	834	874	862	846	847
Production - L.America	91	96	90	93	132	135	115	111	106	112	112	101
MC World	0,19	0,17	0,18	0,20	0,22	0,24	0,31	0,29	0,36	0,45	0,49	0,55

ENI												
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	71 598	91 734	108 181	119 610	158 977	116 055	130 702	149 948	163 589	152 354	145 930	75 192
Cost of goods sold	57 884	71 790	84 882	94 879	132 811	106 445	91 745	101 646	125 688	131 329	110 929	72 608
Gross profit	13 714	19 944	23 299	24 731	26 166	9 610	38 957	48 303	37 901	21 025	35 001	2 584
R&D	351	241	292	306	306	298	295	247	278	271	226	152
Payroll	4 427	3 953	4 807	5 591	5 644	6 018	6 383	6 145	6 119	7 304	6 488	3 159
Depreciation	5 721	6 854	7 731	9 635	12 388	12 218	11 782	10 798	12 265	12 514	13 245	10 715
Operating income Core (loss)	15 427	20 936	24 282	25 864	27 236	16 810	21 373	23 397	19 322	11 806	10 518	-3 079
Non operating income (loss)	-826	-682	-1 337	-1 590	-1 078	-25	-569	-1 360	-2 024	-6 743	764	1 524
EBITDA	20 322	27 109	30 676	33 909	38 546	29 003	32 586	32 834	29 562	17 578	24 527	9 160
EBIT	14 601	20 255	22 945	24 274	26 158	16 785	20 804	22 036	17 298	5 064	11 282	-1 555
Finance expenses	-116	-26	-190	-598	-	-350	-630	-938	-894	-699	-728	-
Pretax income	16 253	21 618	25 619	27 454	28 315	16 835	21 942	24 757	21 346	18 549	9 754	-4 603
Adjusted tax	6 388	8 460	10 380	10 646	12 144	7 387	8 904	10 308	10 003	7 770	4 478	-2 066
Adjusted income after tax	9 866	13 158	15 239	16 809	16 170	9 448	13 038	14 449	11 342	10 779	5 275	-2 537
NOPAT	9 795	13 143	15 126	16 443	16 170	9 252	12 664	13 901	10 868	10 373	4 882	-2 537
Dividends	3 827	7 824	6 071	6 282	7 222	5 809	4 805	5 145	4 938	5 246	5 322	3 837
Cash and Cash equivalent	2 876	3 196	6 538	6 694	7 221	2 803	2 581	2 284	10 558	7 813	8 314	11 420
Inventories	3 794	4 216	6 267	7 926	8 486	7 875	8 807	9 817	11 212	10 947	9 142	4 243
Accounts receivable	15 017	16 686	20 087	22 763	-	22 128	23 902	23 804	28 752	30 646	26 046	-
Total current assets	26 871	29 857	39 595	49 922	51 231	45 388	47 353	49 799	65 006	72 747	66 384	62 563
PPE	47 937	53 264	58 443	73 115	82 679	90 539	90 092	95 357	83 756	87 923	87 074	69 320
CAPEX	8 442	8 160	7 712	11 696	18 110	19 097	18 400	18 711	17 381	17 002	16 261	12 827
Total intangible assets	3 402	3 779	4 950	6 319	10 740	11 546	14 932	14 191	5 921	5 345	4 410	2 644
Total non-current assets	62 426	69 363	76 880	98 183	111 563	123 043	128 891	135 458	119 278	118 012	110 526	83 645
Total assets	89 298	99 220	116 475	148 105	162 794	168 431	176 244	185 257	184 284	190 758	176 910	146 209
Accounts payable and accruals	8 701	9 668	13 885	16 175	28 625	26 750	30 221	31 865	33 148	33 487	28 837	17 755
ST Debt	5 692	6 325	5 658	12 396	9 639	9 653	9 995	8 418	6 841	6 460	7 956	9 109
L Debt	8 150	9 056	9 772	16 523	19 435	25 888	27 140	29 940	25 442	28 785	23 372	21 072
Total current liabilities	23 944	26 604	31 323	44 249	48 689	44 088	46 627	46 210	45 328	45 516	45 180	39 664
Total non-current liabilites	23 589	26 210	30 815	41 343	46 419	52 615	55 131	60 777	56 194	61 062	56 457	48 268
Total liabilities	47 533	52 814	62 137	85 592	95 108	96 703	101 758	106 987	101 522	106 578	101 638	87 932
Adjusted equity	42 848	48 630	57 996	65 599	70 876	75 087	79 143	83 166	84 090	88 105	78 833	65 531
NOWC	2 928	3 253	8 272	5 673	2 542	1 300	726	3 589	19 678	27 231	21 204	22 899
Cash from operating activites	15 553	18 584	21 360	21 271	32 067	15 528	19 493	20 026	15 908	14 646	20 073	13 212
Cash from investing activities	-8 232	-8 479	-8 859	-27 549	-24 943	-14 299	-17 200	-15 620	-10 661	-14 586	-11 881	-12 407
Change in fixed and intangible assets cash	-8 095	-8 036	-7 414	-11 460	-17 642	-18 573	-17 964	-18 440	-15 722	-16 298	-16 121	-12 318
Acquisition of fixed assets and intangibles	-8 442	-8 160	-7 712	-11 696	-18 110	-19 097	-18 400	-18 711	-17 381	-17 002	-16 261	-12 827
Cash from financing activities	-8 565	-9 724	-8 979	4 404	-5 781	-1 650	-2 424	-4 497	2 825	-3 331	-6 722	-1 514
FCF	7 074	11 837	15 145	14 383	10 448	2 373	6 045	5 988	5 751	5 885	1 866	-4 649
Number of employees	70 348	72 258	73 572	75 862	78 880	78 417	79 941	78 686	79 405	83 887	84 405	30 970
Exploration	866	729	1 416	934	703	2 233	1 599	1 566	2 438	1 130	1 706	1 823
Exploration perc	0,97 %	0,73 %	1,22 %	0,63 %	0,43 %	1,33 %	0,91 %	0,85 %	1,32 %	0,59 %	0,96 %	1,25 %
Total Production	1 624	1 737	1 770	1 736	1 797	1 769	1 815	1 581	1 701	1 619	1 598	1 760
Sales/Production	44	53	61	69	88	66	72	95	96	94	91	43
Reserve replacement ratio	0,90	0,39	0,38	1,36	1,35	0,47	1,25	1,42	1,13	0,46	1,62	1,07
WACC	0,09 %	8,81 %	9,28 %	8,81 %	8,74 %	7,76 %	10,38 %	8,86 %	8,74 %	9,80 %	8,20 %	8,13 %
Invested capital	55 607	61 786	69 767	91 431	96 760	107 269	111 621	116 627	115 046	119 425	106 601	88 458
Residual income	9 746	7 699	8 654	8 387	7 712	924	1 078	3 567	810	-1 333	-3 859	-9 728
Value Added	20 796	25 597	30 616	33 643	33 959	23 203	28 955	31 840	28 358	26 551	16 970	-1 444
Human Capital	4 427	3 953	4 807	5 591	5 644	6 018	6 383	6 145	6 119	7 304	6 488	3 159
Structural Capital	16 369	21 644	25 809	28 052	28 315	17 185	22 572	25 695	22 239	19 247	10 482	-4 603
Capital Employed	85 896	95 440	111 525	141 786	152 054	156 884	161 312	171 066	178 363	185 414	172 500	143 565
VAIN 2	5,48	7,32	7,21	6,85	6,85	4,60	5,32	5,99	5,42	4,36	3,23	2,73
VACA	0,24	0,27	0,27	0,24	0,22	0,15	0,18	0,19	0,16	0,14	0,10	-0,01
VAIC2	5,73	7,59	7,49	7,09	7,07	4,74	5,50	6,17	5,58	4,50	3,33	2,72
Tobins Q	0,56	0,56	0,56	0,60	0,62	0,61	0,61	0,61	0,58	0,58	0,59	0,62
Return on equity (Pretax)	0,38	0,44	0,44	0,42	0,40	0,22	0,28	0,30	0,25	0,21	0,12	-0,07
Return on assets (Pretax)	0,18	0,22	0,22	0,19	0,17	0,10	0,12	0,13	0,12	0,10	0,06	-0,03
EBIT/Total assets	0,16	0,20	0,20	0,16	0,16	0,10	0,12	0,12	0,09	0,03	0,06	-0,01
Total share return Indexed	100,00	117,27	149,37	171,78	117,75	135,00	123,15	124,78	155,84	164,35	127,15	114,57
P/B	2,62	2,61	2,73	2,63	1,66	1,70	1,46	1,30	1,15	1,11	0,90	0,98
Adjusted P/E	10,80	9,52	10,73	9,85	6,61	15,13	9,39	7,88	8,77	12,80	36,88	-
Revenue growth	-	28,12	17,93	10,56	32,91	-27,00	12,62	14,73	9,10	-6,87	-4,22	-48,47
Employee turnover	-	0,03	0,02	0,03	0,04	-0,01	0,02	-0,02	0,01	0,06	0,01	-0,63
Current R&D Density	0,0049	0,0026	0,0027	0,0026	0,0019	0,0026	0,0023	0,0016	0,0017	0,0018	0,0015	0,0020
Inventory turnover	15,25	17,03	13,54	11,97	15,65	13,52	10,42	10,35	11,21	12,00	12,13	17,11
Production - N.America	44	33	32	69	87	119	110	98	88	82	92	147
Production - Africa	571	823	927	921	980	933	1 002	808	931	888	892	1 003
Production - Middle East	-	-	-	-	-	-	-	-	-	-	-	-
Production - Europe	332	653	635	484	448	416	405	402	378	341	369	354
Production - Asia	209	140	137	236	235	250	258	218	220	213	186	230
Production - L.America	-	33	34	47	27	33	34	30	26	39	88	96
MC World	0,31	0,24	0,23	0,26	0,26	0,31	0,38	0,36	0,41	0,49	0,51	0,57

Exxon												
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	263 989	328 213	335 086	358 600	425 071	275 564	341 578	433 526	419 100	390 247	364 763	236 810
Cost of goods sold	213 170	263 845	262 693	284 586	341 457	232 569	284 629	362 358	353 502	335 093	316 414	210 903
Gross profit	50 819	64 368	72 393	74 014	83 614	42 995	56 949	71 168	65 598	55 154	48 349	25 907
R&D	649	712	733	814	847	1 050	1 012	1 044	1 042	1 044	971	1 008
Payroll	8 331	9 064	9 425	9 994	8 993	8 089	8 406	9 027	8 228	8 469	8 431	7 491
Depreciation	9 767	10 253	11 416	12 250	12 379	11 917	14 760	15 583	15 888	17 182	17 297	18 048
Operating income Core (loss)	35 872	49 002	56 939	57 655	66 290	26 239	40 122	54 104	49 881	40 301	34 082	12 883
Non operating income (loss)	-6 145	-11 229	-11 514	-13 824	-17 107	-8 538	-12 837	-19 153	-28 845	-17 410	-17 548	-9 083
EBITDA	39 494	48 026	56 841	56 081	61 562	29 618	42 045	50 534	36 924	40 073	33 831	21 848
EBIT	29 727	37 773	45 425	43 831	49 183	17 701	27 285	34 951	21 036	22 891	16 534	3 800
Finance expenses	-638	-496	-654	-400	727	-369	-141	-112	-210	78	-211	-265
Pretax income	42 017	60 231	68 453	71 479	83 397	34 777	52 959	73 257	78 726	57 711	51 630	21 966
Adjusted tax	16 513	23 570	27 736	27 716	35 770	15 260	21 490	30 502	36 893	24 174	23 706	9 860
Adjusted income after tax	25 504	36 661	40 717	43 763	47 627	19 517	31 469	42 755	41 833	33 537	27 924	12 106
NOPAT	25 117	36 359	40 328	43 518	48 042	19 310	31 385	42 689	41 721	33 583	27 810	11 960
Dividends	6 896	7 185	7 628	7 621	8 058	8 023	8 498	9 020	10 092	10 875	11 568	12 090
Cash and Cash equivalent	18 531	28 671	28 244	34 500	32 007	10 862	7 827	12 664	9 582	4 644	4 616	3 705
Inventories	9 487	9 321	10 714	11 089	11 646	11 553	12 976	15 024	14 542	16 135	16 678	16 245
Accounts receivable	25 359	27 484	28 942	36 450	18 707	22 186	25 439	30 044	28 373	25 993	18 541	13 243
Total current assets	60 377	73 342	75 777	85 963	72 266	55 235	58 984	72 963	64 460	59 308	52 910	42 623
PPE	108 639	107 010	113 687	120 869	121 346	139 116	199 548	214 664	226 949	243 650	252 668	251 605
CAPEX	11 986	13 839	15 462	15 387	19 318	22 491	26 871	30 975	34 271	33 669	32 952	26 490
Total intangible assets	-	-	-	-	-	-	-	-	-	-	-	-
Total non-current assets	134 879	134 993	143 238	156 119	155 786	178 088	243 526	258 089	269 335	287 500	296 583	294 135
Total assets	195 256	208 335	219 015	242 082	228 052	233 323	302 510	331 052	333 795	346 808	349 493	336 758
Accounts payable and accruals	18 186	22 788	39 082	45 275	21 190	49 585	59 846	69 794	60 486	55 916	47 165	35 214
ST Debt	3 280	1 771	1 702	2 383	2 400	2 476	2 787	7 711	3 653	15 808	17 468	18 762
L Debt	5 013	6 220	6 645	7 183	7 025	7 129	12 227	9 322	7 928	6 891	11 653	19 925
Total current liabilities	42 981	46 307	48 817	58 312	49 100	52 061	62 633	77 505	64 139	71 724	64 633	53 976
Total non-current liabilites	46 567	47 315	56 354	57 726	61 429	65 870	87 198	92 803	97 996	94 589	103 796	105 972
Total liabilities	89 548	93 622	105 171	116 038	110 529	117 931	149 831	170 308	162 135	166 313	168 429	159 948
Adjusted equity	105 882	115 244	118 865	129 197	119 930	115 629	153 688	162 439	168 613	181 452	176 468	172 766
NOWC	17 396	27 035	26 960	27 651	23 166	3 174	-3 649	-4 542	321	-12 416	-11 723	-11 353
Cash from operating activites	41 327	48 138	49 286	52 002	59 725	28 438	48 413	55 345	56 170	44 914	45 116	30 344
Cash from investing activities	-14 910	-10 270	-14 230	-9 728	-15 499	-22 419	-24 204	-22 165	-25 601	-34 201	-26 975	-23 824
Change in fixed and intangible assets cash	-9 232	-7 803	-12 382	-11 183	-13 333	-20 946	-23 610	-19 842	-26 616	-30 962	-28 917	-24 101
Acquisition of fixed assets and intangibles	-11 986	-13 839	-15 462	-15 387	-19 318	-22 491	-26 871	-30 975	-34 271	-33 669	-32 952	-26 490
Cash from financing activities	-17 838	-25 967	-35 478	-37 397	-43 233	-27 283	-26 924	-28 256	-33 868	-15 476	-17 888	-7 037
FCF	22 898	32 773	36 282	40 381	41 103	8 736	19 274	27 297	23 338	17 096	12 155	3 518
Number of employees	85 900	83 700	82 100	80 800	79 900	80 700	83 600	82 100	76 900	75 000	75 300	73 500
Exploration	1 098	964	1 191	1 502	1 463	2 034	11 636	5 464	4 740	7 155	3 689	2 680
Exploration perc	0,56 %	0,46 %	0,54 %	0,62 %	0,64 %	0,87 %	3,85 %	1,65 %	1,42 %	2,06 %	1,06 %	0,80 %
Total Production	4 215	4 065	4 237	4 180	3 921	3 933	4 447	4 506	4 239	4 175	3 969	4 098
Sales/Production	63	81	79	86	108	70	77	96	99	93	92	58
Reserve replacement ratio	0,81	1,55	1,36	0,72	0,43	2,26	2,09	1,07	1,15	1,03	1,04	0,67
WACC	7,65 %	9,80 %	10,71 %	10,89 %	10,41 %	9,68 %	9,31 %	9,98 %	10,21 %	9,37 %	8,74 %	9,12 %
Invested capital	114 001	122 704	125 995	135 610	126 948	124 997	167 693	177 777	183 241	203 194	210 185	215 497
Residual income	16 401	24 333	26 838	28 755	34 826	7 214	15 779	24 941	23 019	14 549	9 442	-7 687
Value Added	50 986	69 791	78 532	81 873	91 663	43 235	61 506	82 396	87 164	66 102	60 272	29 722
Human Capital	8 331	9 064	9 425	9 994	8 993	8 089	8 406	9 027	8 228	8 469	8 431	7 491
Structural Capital	42 655	60 727	69 107	71 879	82 670	35 146	53 100	73 369	78 936	57 633	51 841	22 231
Capital Employed	195 256	208 335	219 015	242 082	228 052	233 323	302 510	331 052	333 795	346 808	349 493	336 758
VAIN 2	6,96	8,57	9,21	9,07	11,09	6,16	8,18	10,02	11,50	8,68	8,01	4,72
VACA	0,26	0,33	0,36	0,34	0,40	0,19	0,20	0,25	0,26	0,19	0,17	0,09
VAIC2	7,22	8,91	9,57	9,41	11,50	6,34	8,38	10,27	11,76	8,87	8,18	4,80
Tobins Q	0,48	0,47	0,48	0,50	0,50	0,53	0,51	0,53	0,50	0,50	0,50	0,49
Return on equity (Pretax)	0,40	0,52	0,58	0,55	0,70	0,30	0,34	0,45	0,47	0,32	0,29	0,13
Return on assets (Pretax)	0,22	0,29	0,31	0,30	0,37	0,15	0,18	0,22	0,24	0,17	0,15	0,07
EBIT/Total assets	0,15	0,18	0,21	0,18	0,22	0,08	0,09	0,11	0,06	0,07	0,05	0,01
Total share return Indexed	100,00	112,27	156,13	196,84	166,01	148,63	162,85	192,70	198,41	240,30	229,12	198,67
P/B	3,11	3,05	3,93	4,12	3,40	2,83	2,42	2,53	2,26	2,43	2,18	1,84
Adjusted P/E	13,05	9,75	11,47	12,91	9,03	17,24	11,76	10,05	8,77	13,61	12,24	20,25
Revenue growth	-	24,33	2,09	7,02	18,54	-35,17	23,96	26,92	-3,33	-6,88	-6,53	-35,08
Employee turnover	-	-0,03	-0,02	-0,02	-0,01	0,01	0,04	-0,02	-0,06	-0,02	0,00	-0,02
Current R&D Density	0,0025	0,0022	0,0022	0,0023	0,0020	0,0038	0,0030	0,0024	0,0025	0,0027	0,0027	0,0043
Inventory turnover	22,47	28,31	24,52	25,66	29,32	20,13	21,94	24,12	24,31	20,77	18,97	12,98
Production - N.America	1 399	1 266	1 139	1 095	973	971	1 199	1 397	1 366	1 361	1 374	1 446
Production - Africa	572	666	781	721	657	688	630	509	490	470	490	530
Production - Middle East	-	-	-	-	-	-	-	-	-	-	-	-
Production - Europe	1 352	1 385	1 343	1 318	1 265	1 201	974	845	744	732	653	585
Production - Asia	455	684	918	1 045	1 025	1 072	1 530	1 755	1 639	1 612	1 452	1 537
Production - L.America	-	-	-	-	-	-	-	-	-	-	-	-
MC World	0,26	0,22	0,24	0,28	0,29	0,34	0,33	0,41	0,49	0,56	0,63	0,70

OMV												
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	12 229	19 385	23 834	27 474	37 570	24 984	30 941	47 416	54 842	56 339	47 710	25 005
Cost of goods sold	10 089	14 969	19 151	22 165	30 805	20 800	25 780	41 202	48 007	50 532	43 636	24 976
Gross profit	2 140	4 415	4 683	5 308	6 766	4 185	5 161	6 214	6 835	5 807	4 074	29
R&D	26	14	17	22	20	20	21	21	28	23	30	28
Payroll	724	1 282	1 393	1 530	1 587	1 477	1 481	1 372	1 483	1 610	1 578	1 373
Depreciation	524	850	1 017	1 340	1 902	1 848	2 093	2 264	2 618	3 050	4 063	5 720
Operating income Core (loss)	1 138	2 512	2 714	3 136	3 667	1 990	3 099	3 476	3 997	3 463	1 407	-2 227
Non operating income (loss)	-124	89	5	-171	271	342	498	384	323	420	240	-108
EBITDA	1 538	3 451	3 736	4 305	5 840	4 180	5 689	6 124	6 937	6 932	5 710	3 386
EBIT	1 014	2 601	2 719	2 965	3 938	2 332	3 596	3 860	4 319	3 883	1 647	-2 334
Finance expenses	-31	-158	-77	-175	-314	-415	-446	-490	-484	-316	-437	-239
Pretax income	1 262	2 423	2 709	3 307	3 396	1 648	2 601	3 092	3 674	3 043	1 166	-2 119
Adjusted tax	496	948	1 098	1 282	1 457	723	1 055	1 288	1 722	1 275	536	-951
Adjusted income after tax	766	1 475	1 611	2 024	1 940	925	1 546	1 805	1 952	1 768	631	-1 168
NOPAT	748	1 379	1 565	1 917	1 760	692	1 281	1 519	1 696	1 585	394	-1 299
Dividends	134	167	474	668	805	468	442	615	805	587	608	588
Cash and Cash equivalent	1 989	2 311	2 564	1 886	1 951	1 543	1 736	962	2 249	2 009	2 942	3 904
Inventories	1 707	1 897	2 675	3 564	3 032	3 332	3 767	4 081	4 226	3 387	2 698	2 035
Accounts receivable	2 004	2 074	2 535	3 513	2 790	2 773	3 917	4 589	5 044	4 510	3 681	2 789
Total current assets	6 004	6 656	7 944	9 383	8 210	8 057	10 083	10 178	12 466	11 317	10 153	9 356
PPE	8 974	8 092	10 198	13 436	14 541	16 295	17 273	18 120	18 934	23 512	22 384	17 864
CAPEX	735	1 510	3 164	5 645	5 217	3 077	2 769	3 429	3 195	6 333	5 093	3 306
Total intangible assets	258	170	258	345	1 127	1 164	4 028	4 442	4 592	4 960	4 269	3 559
Total non-current assets	11 938	11 627	15 537	21 605	21 615	22 634	25 228	26 646	27 810	32 599	30 912	26 137
Total assets	17 943	18 284	23 482	30 988	29 826	30 690	35 311	36 824	40 276	43 915	41 065	35 493
Accounts payable and accruals	1 616	1 741	2 113	3 202	2 987	3 886	5 570	5 617	6 961	8 017	6 415	3 673
ST Debt	614	683	2 310	4 681	2 821	1 686	1 294	725	496	1 372	724	538
L Debt	2 314	1 478	1 375	1 471	4 082	4 868	6 690	5 554	5 824	5 376	5 616	4 990
Total current liabilities	3 820	4 213	6 129	9 948	8 116	6 781	8 314	8 412	9 603	11 594	10 759	8 750
Total non-current liabilites	6 312	4 967	5 251	5 962	8 646	9 528	11 874	11 041	11 498	12 265	12 637	11 206
Total liabilities	10 132	9 180	11 379	15 910	16 761	16 309	20 189	19 452	21 101	23 859	23 397	19 956
Adjusted equity	7 720	9 016	11 977	14 938	11 890	14 509	15 447	17 674	19 375	20 281	17 825	15 589
NOWC	2 185	2 443	1 816	-565	95	1 276	1 769	1 766	2 863	-277	-606	605
Cash from operating activites	1 293	2 623	2 547	2 832	4 728	2 575	3 829	3 501	4 903	5 478	4 870	3 146
Cash from investing activities	-1 105	-1 660	-2 797	-4 898	-5 007	-1 687	-3 814	-4 325	-2 931	-5 288	-4 509	-3 189
Change in fixed and intangible assets cash	-474	-1 325	-2 759	-5 473	-4 825	-940	-2 717	-3 154	-2 959	-6 215	-4 861	-3 091
Acquisition of fixed assets and intangibles	-735	-1 510	-3 164	-5 645	-5 217	-3 077	-2 769	-3 429	-3 195	-6 333	-5 093	-3 306
Cash from financing activities	1 279	-455	317	907	307	-917	340	29	-846	-851	-454	841
FCF	537	718	-581	-2 388	-1 555	-537	604	354	1 118	-1 699	-636	1 115
Number of employees	57 480	49 919	40 993	33 665	41 282	34 676	31 398	29 800	28 658	26 863	26 618	24 817
Exploration	93	156	225	325	471	344	317	458	645	707	559	771
Exploration perc	0,52 %	0,85 %	0,96 %	1,05 %	1,58 %	1,12 %	0,90 %	1,24 %	1,60 %	1,61 %	1,36 %	2,17 %
Total Production	126	121	324	321	318	316	318	288	304	288	309	303
Sales/Production	97	160	73	86	118	79	97	165	180	196	154	83
Reserve replacement ratio	22,72	0,20	0,49	0,36	0,90	0,84	0,69	0,80	0,88	1,48	0,94	1,10
WACC	6,16 %	7,41 %	9,77 %	10,90 %	9,44 %	7,79 %	8,64 %	9,69 %	10,10 %	10,21 %	9,31 %	8,25 %
Invested capital	10 739	11 265	15 787	21 230	18 875	20 935	23 107	23 651	25 495	26 804	24 008	21 064
Residual income	86	543	22	-396	-22	-939	-715	-772	-879	-1 152	-1 842	-3 038
Value Added	2 017	3 864	4 179	5 011	5 297	3 540	4 528	4 954	5 641	4 969	3 181	-507
Human Capital	724	1 282	1 393	1 530	1 587	1 477	1 481	1 372	1 483	1 610	1 578	1 373
Structural Capital	1 293	2 582	2 786	3 481	3 710	2 063	3 047	3 582	4 158	3 359	1 603	-1 880
Capital Employed	17 685	18 114	23 223	30 643	28 699	29 526	31 283	32 382	35 684	38 955	36 796	31 934
VAIN 2	3,43	3,68	3,67	3,97	4,04	2,98	3,73	4,33	4,54	3,76	2,52	3,34
VACA	0,11	0,21	0,18	0,16	0,18	0,12	0,14	0,15	0,16	0,13	0,09	-0,02
VAIC2	3,54	3,90	3,85	4,13	4,22	3,10	3,87	4,49	4,70	3,89	2,61	3,32
Tobins Q	0,68	0,62	0,61	0,62	0,69	0,62	0,66	0,62	0,61	0,64	0,66	0,64
Return on equity (Pretax)	0,16	0,27	0,23	0,22	0,29	0,11	0,17	0,17	0,19	0,15	0,07	-0,14
Return on assets (Pretax)	0,07	0,13	0,12	0,11	0,11	0,05	0,07	0,08	0,09	0,07	0,03	-0,06
EBIT/Total assets	0,06	0,14	0,12	0,10	0,13	0,08	0,10	0,10	0,11	0,09	0,04	-0,07
Total share return Indexed	100,00	227,13	201,14	264,96	91,53	156,09	164,22	128,54	157,40	206,52	136,23	169,57
P/B	1,20	1,97	1,42	1,66	0,66	1,00	1,11	0,77	0,81	1,04	0,65	0,78
Adjusted P/E	9,53	11,19	9,71	11,24	3,90	16,53	10,10	6,35	6,73	10,15	18,48	-
Revenue growth	-	58,51	22,95	15,27	36,75	-33,50	23,84	53,25	15,66	2,73	-15,32	-47,59
Employee turnover	-	-0,13	-0,18	-0,18	0,23	-0,16	-0,09	-0,05	-0,04	-0,06	-0,01	-0,07
Current R&D Density	0,0021	0,0007	0,0007	0,0008	0,0005	0,0008	0,0007	0,0004	0,0005	0,0004	0,0006	0,0011
Inventory turnover	5,91	7,89	7,16	6,22	10,16	6,24	6,84	10,10	11,36	14,92	16,17	12,27
Production - N.America	-	-	-	-	-	-	-	-	-	-	-	-
Production - Africa	32	35	36	40	43	37	39	47	68	55	74	-
Production - Middle East	18	19	19	20	20	21	21	29	27	27	31	-
Production - Europe	54	52	256	247	241	234	233	212	209	206	204	-
Production - Asia	10	7	8	14	-	-	25	-	-	-	-	-
Production - L.America	-	-	-	-	-	-	-	-	-	5	7	12
MC World		0,17	0,21	0,23	0,20	0,22	0,23	0,15	0,17	0,20	0,08	0,43

Repsol												
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	47 620	59 752	64 522	71 416	89 090	66 464	77 922	71 188	73 948	62 263	61 287	44 110
Cost of goods sold	43 633	55 059	61 037	67 010	83 789	63 717	69 371	67 360	70 163	61 915	58 020	43 622
Gross profit	3 987	4 693	3 485	4 406	5 301	2 747	8 551	3 828	3 785	348	3 267	488
R&D	79	75	94	113	117	108	85	97	109	123	106	98
Payroll	1 815	1 819	2 205	2 729	2 851	3 004	3 216	3 337	2 605	2 809	2 102	2 325
Depreciation	2 946	3 048	3 887	4 417	4 582	5 048	5 236	2 881	3 213	2 019	2 386	3 317
Operating income Core (loss)	5 830	7 666	7 427	7 962	7 384	4 524	10 110	4 942	4 714	1 274	104	-2 708
Non operating income (loss)	613	753	431	158	703	533	1 236	1 100	981	-429	-1 387	-395
EBITDA	9 390	11 467	11 745	12 536	12 669	10 104	16 583	8 923	8 909	2 864	1 103	213
EBIT	6 444	8 418	7 857	8 119	8 087	5 056	11 347	6 042	5 695	845	-1 283	-3 104
Finance expenses	-473	-490	-432	-414	-630	-680	-674	-564	-732	-437	-294	-
Pretax income	5 217	6 913	6 996	7 804	6 681	3 991	8 874	3 842	3 733	1 703	1 491	-2 313
Adjusted tax	2 050	2 705	2 835	3 026	2 865	1 751	3 601	1 600	1 749	713	684	-1 038
Adjusted income after tax	3 167	4 208	4 161	4 778	3 815	2 240	5 273	2 242	1 984	990	806	-1 275
NOPAT	2 880	3 909	3 904	4 524	3 456	1 858	4 872	1 913	1 595	736	647	-1 275
Dividends	666	847	1 037	1 301	2 365	2 698	1 069	1 856	1 218	624	2 274	542
Cash and Cash equivalent	4 873	3 725	3 751	4 158	4 772	4 329	9 533	4 343	8 338	8 370	8 653	4 004
Inventories	3 576	4 414	5 109	6 818	5 080	6 066	7 802	9 432	7 260	6 809	4 757	3 100
Accounts receivable	7 154	8 095	8 986	11 316	5 899	6 655	7 746	8 495	8 025	4 439	3 730	2 833
Total current assets	15 969	16 927	18 350	22 666	19 339	21 171	29 242	26 346	26 606	24 511	20 620	13 855
PPE	27 523	27 576	30 961	34 527	36 409	45 716	44 890	47 640	37 251	22 098	20 741	30 900
CAPEX	2 976	3 948	6 806	6 070	7 244	6 063	6 445	4 946	4 384	2 646	3 462	3 225
Total intangible assets	5 283	5 651	6 038	6 309	5 976	9 771	9 962	10 087	7 277	2 384	2 249	4 914
Total non-current assets	37 839	37 247	41 266	46 113	49 120	62 068	61 153	65 614	59 070	52 082	42 166	54 684
Total assets	53 808	54 174	59 616	68 779	68 459	83 239	90 396	91 960	85 676	76 594	62 786	68 539
Accounts payable and accruals	7 524	9 210	10 010	12 888	4 429	11 197	14 056	14 736	11 794	7 719	6 772	6 540
ST Debt	4 259	3 196	2 052	2 189	2 585	5 166	5 944	6 642	5 205	11 813	4 995	7 686
L Debt	9 941	7 379	9 282	9 693	14 556	21 881	19 788	19 618	19 892	7 970	9 104	11 497
Total current liabilities	12 431	13 382	13 288	16 559	15 058	17 187	21 082	22 167	17 565	22 075	12 394	15 722
Total non-current liabilites	18 852	16 800	17 988	19 292	24 094	35 396	34 581	34 746	31 856	16 668	16 325	21 635
Total liabilities	31 283	30 182	31 276	35 851	39 152	52 583	55 663	56 913	49 421	38 743	28 719	37 357
Adjusted equity	22 688	24 317	28 575	33 336	29 364	30 721	33 780	34 236	35 589	38 581	32 731	31 269
NOWC	3 538	3 545	5 062	6 107	4 281	3 984	8 160	4 180	9 041	2 437	8 226	-1 867
Cash from operating activites	4 617	6 843	6 837	7 084	8 983	5 562	6 209	1 700	5 631	2 770	3 304	4 627
Cash from investing activities	-4 337	-3 897	-6 561	-5 612	-6 884	-10 952	-97	-4 669	-3 715	413	1 503	-9 850
Change in fixed and intangible assets cash	-2 651	-3 225	-6 159	-4 317	-7 094	-5 543	-6 218	-4 802	-4 313	-2 537	-3 350	-2 834
Acquisition of fixed assets and intangibles	-2 976	-3 948	-6 806	-6 070	-7 244	-6 063	-6 445	-4 946	-4 384	-2 646	-3 462	-3 225
Cash from financing activities	-2 190	-3 521	-812	-1 265	-2 118	4 575	-659	-5 245	1 982	-1 020	-6 434	2 727
FCF	2 850	3 010	985	2 871	793	843	3 664	-152	425	109	-429	-1 183
Number of employees	33 337	35 909	36 994	37 565	36 302	41 014	43 298	46 575	29 985	30 296	24 167	27 566
Exploration	432	487	684	871	805	671	670	639	727	920	986	1 669
Exploration perc	0,80 %	0,90 %	1,15 %	1,27 %	1,18 %	0,81 %	0,74 %	0,69 %	0,85 %	1,20 %	1,57 %	2,44 %
Total Production	1 166	1 139	1 128	1 039	913	330	344	299	335	346	355	559
Sales/Production	41	52	57	69	98	201	227	238	221	180	173	79
Reserve replacement ratio	-0,19	-2,84	-0,74	0,45	0,44	0,62	1,02	1,30	-6,25	2,75	1,19	5,08
WACC	5,91 %	8,23 %	9,56 %	10,58 %	11,19 %	7,16 %	7,38 %	8,72 %	7,77 %	9,45 %	9,07 %	7,75 %
Invested capital	36 725	34 567	39 674	44 811	46 448	57 702	60 465	61 307	61 352	57 634	48 165	50 365
Residual income	708	1 066	112	-214	-1 743	-2 274	411	-3 431	-3 172	-4 710	-3 721	-5 178
Value Added	7 504	9 222	9 632	10 947	10 162	7 675	12 764	7 743	7 069	4 949	3 886	12
Human Capital	1 815	1 819	2 205	2 729	2 851	3 004	3 216	3 337	2 605	2 809	2 102	2 325
Structural Capital	5 690	7 403	7 428	8 218	7 310	4 671	9 548	4 406	4 465	2 140	1 784	-2 313
Capital Employed	48 525	48 522	53 578	62 471	62 483	73 468	80 434	81 874	78 399	74 210	60 536	63 626
VAIN 2	4,89	5,87	5,14	4,76	4,28	3,16	4,72	2,89	3,35	2,19	2,31	0,00
VACA	0,15	0,19	0,18	0,18	0,16	0,10	0,16	0,09	0,09	0,07	0,06	0,00
VAIC2	5,05	6,06	5,32	4,94	4,45	3,27	4,88	2,98	3,44	2,26	2,37	0,01
Tobins Q	0,59	0,57	0,54	0,54	0,60	0,66	0,64	0,67	0,59	0,51	0,46	0,55
Return on equity (Pretax)	0,23	0,28	0,24	0,23	0,23	0,13	0,26	0,11	0,10	0,04	0,05	-0,07
Return on assets (Pretax)	0,10	0,13	0,12	0,11	0,10	0,05	0,10	0,04	0,04	0,02	0,02	-0,03
EBIT/Total assets	0,12	0,16	0,13	0,12	0,12	0,06	0,13	0,07	0,07	0,01	-0,02	-0,05
Total share return Indexed	100,00	133,85	144,87	137,27	88,72	120,71	137,72	162,44	117,92	147,40	139,18	97,55
P/B	1,85	1,97	1,90	1,65	1,12	1,57	1,36	1,49	0,91	0,93	0,80	0,59
Adjusted P/E	10,61	9,30	10,81	10,03	6,90	14,93	5,43	12,70	9,70	135,84	12,17	-
Revenue growth	-	25,48	7,98	10,68	24,75	-25,40	17,24	-8,64	3,88	-15,80	-1,57	-28,03
Employee turnover	-	0,08	0,03	0,02	-0,03	0,13	0,06	0,08	-0,36	0,01	-0,20	0,14
Current R&D Density	0,0017	0,0012	0,0015	0,0016	0,0013	0,0016	0,0011	0,0014	0,0015	0,0020	0,0017	0,0022
Inventory turnover	12,20	12,47	11,95	9,83	16,49	10,50	8,89	7,14	9,66	9,09	12,20	14,07
Production - N.America	0	0	0	0	3	23	3	27	30	32	34	140
Production - Africa	68	66	88	73	65	52	50	19	52	36	19	14
Production - Middle East	-	-	-	-	-	-	-	-	-	-	-	-
Production - Europe	4	3	3	2	3	4	4	4	3	5	5	27
Production - Asia	-	-	-	-	-	-	-	-	3	14	16	77
Production - L.America	301	277	258	247	246	255	248	842	964	1 038	1 070	1 094
MC World	0,37	0,51	0,20	0,21	0,07	0,08	0,10	0,21	0,28	0,29	0,39	0,49

Shell												
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	265 190	306 731	318 845	355 782	458 361	278 188	368 056	470 171	467 153	451 235	421 105	264 960
Cost of goods sold	221 678	252 622	262 989	296 697	395 639	228 376	307 634	396 502	395 940	381 585	357 316	222 739
Gross profit	43 512	54 109	55 856	59 085	62 722	49 812	60 422	73 669	71 213	69 650	63 789	42 221
R&D	553	588	885	1 167	1 230	1 125	1 019	1 125	1 314	1 318	1 222	1 093
Payroll	9 795	10 111	10 744	10 021	10 581	10 608	10 667	11 158	11 133	12 047	13 092	12 558
Depreciation	12 273	11 981	12 615	13 180	13 656	12 658	15 595	13 228	14 615	21 509	24 499	26 714
Operating income Core (loss)	26 280	37 341	37 678	40 752	43 645	14 621	26 244	42 715	37 722	26 870	19 879	-3 261
Non operating income (loss)	-6 105	-7 226	-6 950	-9 824	-7 175	-6 399	-9 100	-12 945	-12 790	-6 722	-8 435	-5 308
EBITDA	32 448	42 096	43 343	44 108	50 126	20 880	32 739	42 998	39 547	41 657	35 943	18 145
EBIT	20 175	30 115	30 728	30 928	36 470	8 222	17 144	29 770	24 932	20 148	11 444	-8 569
Finance expenses	-782	-205	-152	117	-169	-158	-843	-409	-470	-374	-554	-1 888
Pretax income	32 385	44 567	44 628	50 576	50 820	21 020	35 344	55 660	50 512	33 592	28 314	2 047
Adjusted tax	12 727	17 440	18 083	19 611	21 797	9 223	14 342	23 175	23 671	14 071	13 000	919
Adjusted income after tax	19 658	27 127	26 545	30 965	29 023	11 797	21 002	32 485	26 841	19 521	15 314	1 128
NOPAT	19 183	27 002	26 455	31 036	28 926	11 708	20 501	32 246	26 591	19 304	15 014	88
Dividends	8 490	12 207	8 142	9 001	9 516	10 526	9 584	6 877	7 390	7 198	9 444	9 370
Cash and Cash equivalent	8 459	11 730	9 002	9 656	15 188	9 719	13 444	11 292	18 550	9 696	21 607	31 752
Inventories	15 391	19 776	23 215	31 503	19 342	27 410	29 348	28 976	30 781	30 009	19 701	15 822
Accounts receivable	23 626	29 822	59 668	42 308	30 813	29 872	37 436	48 307	40 210	39 094	28 393	-
Total current assets	61 848	97 892	91 885	115 397	116 570	96 457	112 894	119 777	114 734	103 343	99 778	93 358
PPE	88 940	87 558	100 988	101 521	112 038	131 619	142 705	152 081	172 293	191 897	192 472	182 838
CAPEX	12 734	15 904	22 922	24 576	35 065	26 516	26 940	26 301	32 576	40 145	31 854	26 131
Total intangible assets	4 890	4 350	4 808	5 366	5 021	5 356	5 039	4 521	4 470	4 394	7 076	6 283
Total non-current assets	130 963	121 624	143 391	154 073	165 831	195 724	209 666	225 480	235 560	254 169	253 338	246 799
Total assets	192 811	219 516	235 276	269 470	282 401	292 181	322 560	345 257	350 294	357 512	353 116	340 157
Accounts payable and accruals	18 716	24 372	26 509	36 349	25 705	58 595	66 548	76 621	76 378	74 811	63 107	61 003
ST Debt	7 113	5 338	6 060	5 736	9 497	4 171	9 951	6 712	7 833	8 344	7 208	5 530
L Debt	8 600	7 578	9 713	12 363	13 772	30 862	34 381	30 463	29 921	36 218	38 332	52 849
Total current liabilities	60 664	84 964	76 748	94 384	105 529	84 789	100 552	102 659	96 979	93 258	86 212	70 948
Total non-current liabilites	42 262	36 628	43 583	49 118	48 006	69 257	72 228	71 595	77 133	83 106	94 118	105 088
Total liabilities	102 926	121 592	120 331	143 502	153 535	154 046	172 780	174 254	174 112	176 364	180 330	176 036
Adjusted equity	91 360	99 740	116 048	125 602	131 612	137 414	150 655	172 570	176 311	184 298	173 226	163 310
NOWC	1 184	12 928	15 137	21 013	11 041	11 668	12 342	17 118	17 755	10 085	13 566	22 410
Cash from operating activites	24 687	29 852	31 397	34 451	43 559	20 970	26 174	35 302	44 905	39 308	43 738	28 356
Cash from investing activities	-5 643	-9 986	-21 858	-15 795	-29 927	-26 618	-22 108	-20 639	-28 646	-40 321	-19 831	-22 695
Change in fixed and intangible assets cash	-7 656	-13 594	-21 311	-16 010	-30 328	-25 191	-23 615	-19 311	-26 230	-38 933	-21 981	-21 411
Acquisition of fixed assets and intangibles	-12 734	-15 904	-22 922	-24 576	-35 065	-26 516	-26 940	-26 301	-32 576	-40 145	-31 854	-26 131
Cash from financing activities	-13 335	-18 750	-13 590	-11 198	-8 263	73	-155	-16 466	-9 202	-7 671	-11 310	5 554
FCF	18 722	23 079	16 148	19 640	7 517	-2 150	9 156	19 173	8 630	668	7 659	671
Number of employees	113 000	109 000	108 000	104 000	102 000	101 000	97 000	90 000	87 000	92 000	94 000	93 000
Exploration	1 809	1 286	1 562	1 822	1 995	2 178	2 036	2 266	3 104	5 278	4 224	5 719
Exploration perc	0,94 %	0,59 %	0,66 %	0,68 %	0,71 %	0,75 %	0,63 %	0,66 %	0,89 %	1,48 %	1,20 %	1,68 %
Total Production	3 772	3 518	3 473	3 315	3 248	3 142	3 314	3 215	3 262	3 199	3 080	2 954
Sales/Production	70	87	92	107	141	89	111	146	143	141	137	90
Reserve replacement ratio	0,18	0,67	1,26	0,17	1,07	3,74	1,11	0,99	0,45	1,48	0,48	-0,05
WACC	7,78 %	8,81 %	9,24 %	9,21 %	8,94 %	7,77 %	10,06 %	8,82 %	8,47 %	8,40 %	8,17 %	7,37 %
Invested capital	105 598	110 840	130 718	144 067	152 135	173 168	194 112	208 178	213 936	225 710	218 326	222 500
Residual income	10 962	17 237	14 380	17 767	15 318	-1 740	966	13 884	8 477	346	-2 828	-16 310
Value Added	42 962	54 883	55 524	60 480	61 570	31 786	46 854	67 227	62 115	46 013	41 960	16 493
Human Capital	9 795	10 111	10 744	10 021	10 581	10 608	10 667	11 158	11 133	12 047	13 092	12 558
Structural Capital	33 167	44 772	44 780	50 459	50 989	21 178	36 187	56 069	50 982	33 966	28 868	3 935
Capital Employed	187 921	215 166	230 468	264 104	277 380	286 825	317 521	340 736	345 824	353 118	346 040	333 874
VAIN 2	5,16	6,24	5,97	6,87	6,65	3,66	5,16	6,86	6,40	4,56	3,89	1,55
VACA	0,23	0,26	0,24	0,23	0,22	0,11	0,15	0,20	0,18	0,13	0,12	0,05
VAIC2	5,39	6,50	6,22	7,10	6,87	3,77	5,31	7,06	6,58	4,69	4,01	1,60
Tobins Q	0,56	0,59	0,55	0,54	0,55	0,53	0,54	0,51	0,50	0,50	0,51	0,52
Return on equity (Pretax)	0,35	0,45	0,38	0,40	0,39	0,15	0,23	0,32	0,29	0,18	0,16	0,01
Return on assets (Pretax)	0,17	0,20	0,19	0,19	0,18	0,07	0,11	0,16	0,14	0,09	0,08	0,01
EBIT/Total assets	0,10	0,14	0,13	0,11	0,13	0,03	0,05	0,09	0,07	0,06	0,03	-0,03
Total share return Indexed	100,00	128,93	138,71	154,83	104,25	126,65	158,58	188,34	182,17	190,00	214,72	174,74
P/B	1,41	1,29	1,18	1,26	0,75	0,81	0,82	0,80	0,76	0,78	0,79	0,58
Adjusted P/E	2,76	8,07	8,88	8,48	6,13	14,85	10,10	7,35	8,07	13,67	14,25	73,94
Revenue growth	-	15,66	3,95	11,58	28,83	-39,31	32,30	27,74	-0,64	-3,41	-6,68	-37,08
Employee turnover	-	-0,04	-0,01	-0,04	-0,02	-0,01	-0,04	-0,07	-0,03	0,06	0,02	-0,01
Current R&D Density	0,0021	0,0019	0,0028	0,0033	0,0027	0,0040	0,0028	0,0024	0,0028	0,0029	0,0029	0,0041
Inventory turnover	14,40	12,77	11,33	9,42	20,45	8,33	10,48	13,68	12,86	12,72	18,14	14,08
Production - N.America	712	642	634	636	570	666	653	624	672	544	702	696
Production - Africa	462	438	417	433	404	362	481	471	437	329	371	359
Production - Middle East	-	-	-	-	-	-	-	-	-	-	-	-
Production - Europe	1 203	1 172	1 104	1 001	1 177	1 057	965	814	790	918	662	609
Production - Asia	598	629	660	642	645	811	1 130	1 071	1 126	1 082	1 241	1 246
Production - L.America	44	-	28	53	64	82	48	51	48	71	55	73
MC World	0,19	0,17	0,18	0,21	0,21	0,25	0,26	0,34	0,39	0,46	0,55	0,63

	Total											
Row Labels	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	125 020	145 644	166 709	187 558	235 829	156 390	186 357	231 906	234 414	228 012	212 018	143 421
Cost of goods sold	104 259	115 572	136 392	153 312	200 988	136 182	162 497	199 820	207 627	206 644	203 898	130 304
Gross profit	20 761	30 072	30 317	34 246	34 841	20 208	23 860	32 086	26 787	21 368	8 120	13 117
R&D	464	510	569	594	612	650	715	775	805	1 260	1 353	1 068
Payroll	5 057	5 610	5 828	6 058	6 014	6 177	6 246	6 579	7 135	9 424	9 690	8 088
Depreciation	7 799	7 032	6 649	8 526	9 120	9 365	10 216	10 926	11 582	12 308	12 880	12 457
Operating income Core (loss)	20 761	30 071	30 317	35 169	34 841	20 646	25 711	34 631	28 633	23 651	10 481	4 723
Non operating income (loss)	-3 774	-922	-2 174	-1 993	-2 077	-2 195	-2 194	-2 483	-1 960	-2 611	-2 383	-1 716
EBITDA	24 786	36 182	34 792	41 702	41 884	27 816	33 733	43 074	38 255	33 347	20 978	15 464
EBIT	16 987	29 150	28 143	33 176	32 764	18 451	23 517	32 148	26 673	21 039	8 098	3 007
Finance expenses	-205	-357	-457	-739	-775	-601	-443	-613	-734	-805	-640	-873
Pretax income	24 535	30 993	32 490	37 162	36 918	22 841	27 905	37 113	30 592	26 262	12 864	6 439
Adjusted tax	9 642	12 129	13 165	14 410	15 835	10 022	11 324	15 453	14 336	11 001	5 906	2 890
Adjusted income after tax	14 893	18 865	19 326	22 752	21 083	12 819	16 582	21 660	16 256	15 262	6 958	3 549
NOPAT	14 768	18 647	19 054	22 300	20 641	12 481	16 318	21 303	15 866	14 794	6 611	3 068
Dividends	5 341	4 367	5 024	6 182	7 274	7 092	6 763	7 157	6 666	7 129	7 308	2 845
Cash and Cash equivalent	5 879	5 505	3 266	10 576	17 452	16 792	20 528	18 366	21 857	20 358	25 650	29 459
Inventories	12 558	15 016	15 492	20 199	13 424	19 873	20 851	23 486	22 959	22 094	15 196	13 116
Accounts receivable	19 012	23 207	22 940	27 896	21 330	28 426	29 495	34 269	32 574	32 057	23 987	10 629
Total current assets	44 653	51 773	56 432	70 345	65 660	71 307	77 798	82 507	89 102	84 591	77 977	70 236
PPE	47 319	48 004	53 516	60 471	64 382	73 934	73 465	83 536	91 497	104 464	106 876	109 518
CAPEX	9 211	11 009	12 451	14 461	17 446	16 523	18 323	24 994	25 595	29 754	26 320	25 132
Total intangible assets	4 305	5 188	6 205	6 781	7 452	10 768	11 918	16 087	16 969	18 396	14 682	14 549
Total non-current assets	72 968	73 827	81 791	95 231	99 418	111 776	114 295	130 100	136 862	154 635	151 821	154 248
Total assets	117 621	125 600	138 779	165 577	165 078	183 083	192 093	212 608	225 964	239 227	229 798	224 484
Accounts payable and accruals	15 823	19 413	19 755	26 516	20 671	32 047	35 662	40 420	39 858	40 844	32 387	20 928
ST Debt	5 364	4 678	7 825	6 815	10 995	10 023	12 902	12 539	14 538	11 191	10 942	12 659
L Debt	15 303	16 321	18 694	21 694	22 591	27 510	27 541	29 045	29 380	34 242	44 537	44 464
Total current liabilities	36 299	39 555	44 212	52 006	47 896	49 310	54 063	60 526	64 697	61 771	53 673	50 975
Total non-current liabilites	37 377	36 958	21 456	46 927	47 486	57 046	56 136	62 154	65 635	74 163	82 594	78 100
Total liabilities	73 676	76 513	65 370	98 933	95 383	106 356	110 199	122 679	130 332	135 933	136 267	129 075
Adjusted equity	45 316	52 681	58 444	71 328	75 202	77 767	84 453	94 495	98 246	107 344	96 245	93 871
NOWC	8 355	12 218	12 220	18 340	17 764	21 997	23 735	21 981	24 405	22 821	24 304	19 261
Cash from operating activites	18 243	18 251	20 179	9 038	27 460	17 235	24 533	27 202	28 883	28 523	25 608	19 946
Cash from investing activities	-9 595	-12 575	-12 029	-13 936	-16 261	-14 318	-15 862	-22 227	-21 952	-28 038	-24 319	-20 449
Change in fixed and intangible assets cash	-8 931	-10 668	-11 932	-13 681	-17 255	-16 330	-16 288	-22 990	-23 772	-27 989	-22 878	-22 509
Acquisition of fixed assets and intangibles	-9 211	-11 009	-12 451	-14 461	-17 446	-16 523	-18 323	-24 994	-25 595	-29 754	-26 320	-25 132
Cash from financing activities	-9 235	-5 916	-4 504	-7 376	-2 097	-3 999	-4 441	-6 000	-4 816	-1 521	5 909	1 060
FCF	13 356	14 671	13 252	16 366	12 314	5 324	8 211	7 235	1 852	-2 652	-6 829	-9 607
Number of employees	111 401	112 877	95 070	98 799	100 307	96 019	92 855	96 104	97 126	98 799	100 307	96 019
Exploration	414	431	634	877	764	698	864	1 019	1 446	2 169	1 964	1 991
Exploration perc	0,35 %	0,34 %	0,46 %	0,53 %	0,46 %	0,38 %	0,45 %	0,48 %	0,64 %	0,91 %	0,85 %	0,89 %
Total Production	2 585	2 489	2 356	2 391	2 341	2 281	2 378	2 346	2 300	2 299	2 146	2 347
Sales/Production	48	59	71	78	101	69	78	99	102	99	99	61
Reserve replacement ratio	0,73	0,95	1,02	0,23	1,01	1,03	1,24	1,85	0,93	1,19	1,00	1,07
WACC	7,09 %	7,71 %	8,95 %	9,63 %	9,60 %	8,29 %	10,70 %	9,56 %	7,88 %	8,40 %	8,66 %	7,40 %
Invested capital	64 613	70 086	80 430	95 153	103 282	114 260	122 338	131 512	139 550	148 727	149 010	152 532
Residual income	10 188	13 247	11 851	13 142	10 729	3 006	3 234	8 731	4 864	2 294	-6 291	-8 214
Value Added	29 797	36 961	38 776	43 959	43 707	29 619	34 594	44 305	38 461	36 491	23 194	15 400
Human Capital	5 057	5 610	5 828	6 058	6 014	6 177	6 246	6 579	7 135	9 424	9 690	8 088
Structural Capital	24 740	31 351	32 948	37 901	37 693	23 442	28 348	37 726	31 326	27 067	13 504	7 312
Capital Employed	63 757	62 818	69 340	80 771	81 972	95 253	95 972	105 107	111 267	124 881	125 501	129 116
VAIN 2	6,65	7,44	7,50	8,12	8,13	5,59	6,36	7,59	6,21	4,61	2,98	2,38
VACA	0,46	0,59	0,56	0,54	0,53	0,31	0,36	0,42	0,35	0,29	0,18	0,12
VAIC2	7,12	8,02	8,06	8,66	8,66	5,90	6,72	8,01	6,55	4,91	3,16	2,50
Tobins Q	0,64	0,62	0,62	0,60	0,59	0,59	0,58	0,59	0,58	0,58	0,61	0,59
Return on equity (Pretax)	0,54	0,59	0,56	0,52	0,49	0,29	0,33	0,39	0,31	0,24	0,13	0,07
Return on assets (Pretax)	0,21	0,25	0,23	0,22	0,22	0,12	0,15	0,17	0,14	0,11	0,06	0,03
EBIT/Total assets	0,14	0,23	0,20	0,20	0,20	0,10	0,12	0,15	0,12	0,09	0,04	0,01
Total share return Indexed	100,00	103,90	106,79	110,09	97,02	104,30	101,98	103,57	105,65	114,58	115,16	178,38
P/B	3,48	3,50	2,60	3,34	2,11	2,30	1,79	1,63	1,55	1,71	1,56	1,35
Adjusted P/E	0,01	9,61	11,17	10,42	7,94	12,22	8,48	6,68	8,51	12,35	27,65	20,31
Revenue growth	-	2,66	14,46	12,51	25,74	-33,68	19,16	24,44	1,08	-2,73	-7,01	-32,35
Employee turnover	-	0,85	-0,16	0,04	0,02	-0,04	-0,03	0,03	0,01	0,02	0,02	-0,04
Current R&D Density	0,0037	0,0035	0,0034	0,0032	0,0026	0,0042	0,0038	0,0033	0,0034	0,0055	0,0064	0,0074
Inventory turnover	8,30	7,70	8,80	7,59	14,97	6,85	7,79	8,51	9,04	9,35	13,42	9,93
Production - N.America	61	41	16	20	14	24	65	67	69	73	90	103
Production - Africa	804	766	719	806	783	749	756	659	713	670	657	678
Production - Middle East	406	393	406	390	432	438	527	570	493	536	391	492
Production - Europe	803	779	736	693	642	637	603	631	622	619	613	664
Production - Asia	235	238	253	243	246	251	248	231	221	235	238	258
Production - L.America	152	157	166	182	188	179	131	136	230	226	247	207
MC World	0,43	0,34	0,39	0,42	0,47	0,51	0,50	0,52	0,65	0,86	1,02	1,14

Appendix B: Stata Do Files

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```
**Dag til dag analyse

[redacted]

xtset CompanyID Date

pwcorr Marketcapitalization Totalreturn OilPrice, star(.01)

log close

clear all

**År til år analyse

[redacted]

drop Costofgoodssold Costofgoodsperc Grossprofit GrossProfitperc Depreciation
Depreciationperc OperatingincomeCoreloss Coreoperatingincomeperc Nonoperatingincomeloss
Nonoperatingincomeperc Financeexpenses Financeexpperc Taxbenefit Incomeaftertax
Incomeaftertaxperc Adjustedtaxrate Adjustedincomeaftertax AdjustedIncomeaftertaxperc
Inventories Inventories2 Accountsreceivable Accountsreceivableperc Totalcurrentassets
TotalCurrentassetsperc PPE PPEperc Totalintangibleassets TotalIntangibleassetsperc
Totalnoncurrentassets Totalnoncurrentassets2 Accountspayableandaccruals
Accountspayableandaccrualspe STDebt STDebtperc LDebt LDebt2 Totalcurrentliabilities
Totalcurrentliabilities2 Totalnoncurrentliabilites Totalnoncurrentliabilities
Adjustedequity Adjustedequityperc Totalliabilitiesandequity Cashfromoperatingactivites
Cashfromoperatingperc Cashfrominvestingactivities Cashfrominvestingperc
Changeinfixedandintangiblea Changeinfixedandintperc Acquisitionoffixedassetsand
Acquistionoffixedassetsandi Cashfromfinancingactivities Cashfromfinancingperc
AverageNOPATMarginofsample WACC AverageWACCofsample Sharesoutstanding
drop if CompanyCode>8

destring Year, replace

xtset CompanyCode Year

 rename ReturnonequityPretax ROE
 rename ReturnonassetsPretax ROA
 rename Marketcapitalization MC
 rename Bookvalue BV
 rename RDIntensity RD_BV
 rename HumanCapitalEfficiency HCE
 rename StructuralCapitalEfficiency SCE
 rename CapitalEmployedEfficiency CEE
 rename Reservereplacementratio RRR

 *Winsorisere variabler
winsor HCE, generate(HCE_trim) p(0.05)
winsor SCE, generate(SCE_trim) p(0.05)
winsor CEE, generate(CEE_trim) p(0.05)
winsor VAIN, generate(VAIN_trim) p(0.05)
winsor VACA, generate(VACA_trim) p(0.05)
winsor VAIC, generate(VAIC_trim) p(0.05)
winsor ROE, generate(ROE_trim) p(0.05)
winsor ROA, generate(ROA_trim) p(0.05)
winsor Annualreturn, generate(Annualreturn_trim) p(0.05)
winsor PB, generate(PB_trim) p(0.05)
winsor RD_BV, generate(RD_BV_trim) p(0.05)
winsor EBITDAperc , generate(EBITDAperc_trim) p(0.05)
winsor EBITperc , generate(EBITperc_trim) p(0.05)
egen std_rev = std(Revenue)
```

Page 1

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```
egen std_ar = std(Annualreturn)
winsor Growthofrevenue, generate (GR_trim) p(0.05)


*Se på fordeling
histogram HCE_trim, normal bin(20)
histogram SCE_trim , normal bin(20)
histogram CEE_trim , normal bin(20)
histogram VAIN_trim , normal bin(20)
histogram VACA_trim , normal bin(20)
histogram VAIC_trim , normal bin(20)
histogram ROE_trim , normal bin(20)
histogram ROA_trim , normal bin(20)
histogram PB_trim , normal bin(20)
histogram RD_BV_trim , normal bin(20)
histogram Annualreturn_trim , normal bin(20)
histogram EBITDAperc_trim , normal bin(20)
histogram EBITperc_trim , normal bin(20)
histogram std_rev , normal bin(20)


* Se på fordeling
summarize VAIN_trim VACA_trim VAIC_trim ROE_trim ROA_trim Annualreturn_trim PB_trim
RD_BV_trim EBITDAperc_trim Revenue
pwcorr VAIN_trim VACA_trim VAIC_trim ROE_trim PB_trim EBITDAperc_trim RD_BV_trim , star(
.01)


*Se på fordeling mellom gruppene
summarize VAIN_trim VACA_trim VAIC_trim ROE_trim ROA_trim Annualreturn_trim PB_trim
RD_BV_trim EBITDAperc_trim Revenue if Dummy > 0
summarize VAIN_trim VACA_trim VAIC_trim ROE_trim ROA_trim Annualreturn_trim PB_trim
RD_BV_trim EBITDAperc_trim Revenue if Dummy < 1
ttest VACA_trim, by(Dummy)

*Korrelasjon per selskap, vinnere 2, 4, 7, 8
bysort CompanyCode: pwcorr VAIN_trim VACA_trim ROE_trim ROA_trim Annualreturn_trim PB_trim
 RD_BV_trim EBITDAperc_trim EBITperc_trim Revenue, star(5)



*   TESTENE

*Stock market performance
*PB
bootstrap, reps(100): xtreg PB_trim VAIC_trim, vce(robust) re
predict r, e
swilk r
drop r
bootstrap, reps(100): xtreg PB_trim VAIN_trim VACA_trim, vce(robust) re
bootstrap, reps(100): xtreg PB_trim VAIN_trim VACA_trim RD_BV_trim , vce(robust) re
 *1 år lag
xtreg PB_trim L.VAIC_trim, vce(robust) re
xtreg PB_trim L.VAIN_trim L.VACA_trim, vce(robust) re
xtreg PB_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim , vce(robust) re
*2 år lag
xtreg PB_trim L2.VAIC_trim, vce(robust) re
xtreg PB_trim L2.VAIN_trim L2.VACA_trim, vce(robust) re
xtreg PB_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim , vce(robust) re
*3 år lag
xtreg PB_trim L3.VAIC_trim, vce(robust) re
xtreg PB_trim L3.VAIN_trim L3.VACA_trim, vce(robust) re
xtreg PB_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim , vce(robust) re

*std Annual return
bootstrap, reps(100): xtreg std_ar VAIC_trim, vce(robust) re
predict r, e
swilk r
drop r
bootstrap, reps(100): xtreg std_ar VAIN_trim VACA_trim, vce(robust) re
bootstrap, reps(100): xtreg std_ar VAIN_trim VACA_trim RD_BV_trim , vce(robust) re
*1 år lag
xtreg std_ar L.VAIC_trim, vce(robust) re
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Page 2

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xtreg std_ar L.VAIN_trim L.VACA_trim, vce(robust) re
xtreg std_ar L.VAIN_trim L.VACA_trim L.RD_BV_trim , vce(robust) re
*2 år lag
xtreg std_ar L2.VAIC_trim, vce(robust) re
xtreg std_ar L2.VAIN_trim L2.VACA_trim, vce(robust) re
xtreg std_ar L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim , vce(robust) re
*3 år lag
xtreg std_ar L3.VAIC_trim, vce(robust) re
xtreg std_ar L3.VAIN_trim L3.VACA_trim, vce(robust) re
xtreg std_ar L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim , vce(robust) re

*Economic performance
*EBITDA
bootstrap, reps(100): xtreg EBITDAperc_trim VAIC_trim, vce(robust) re
predict r, e
swilk r
drop r
bootstrap, reps(100): xtreg EBITDAperc_trim VAIN_trim VACA_trim, vce(robust) re
bootstrap, reps(100): xtreg EBITDAperc_trim VAIN_trim VACA_trim RD_BV_trim , vce(robust) re
*1 år lag
xtreg EBITDAperc_trim L.VAIC_trim, vce(robust) re
xtreg EBITDAperc_trim L.VAIN_trim L.VACA_trim, vce(robust) re
xtreg EBITDAperc_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim , vce(robust) re
*2 år lag
xtreg EBITDAperc_trim L2.VAIC_trim, vce(robust) re
xtreg EBITDAperc_trim L2.VAIN_trim L2.VACA_trim, vce(robust) re
xtreg EBITDAperc_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim , vce(robust) re
*3 år lag
xtreg EBITDAperc_trim L3.VAIC_trim, vce(robust) re
xtreg EBITDAperc_trim L3.VAIN_trim L3.VACA_trim, vce(robust) re
xtreg EBITDAperc_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim , vce(robust) re


* Standardized Revenue
bootstrap, reps(100): xtreg std_rev VAIC_trim, vce(robust) re
predict r, e
swilk r
drop r
bootstrap, reps(100): xtreg std_rev VAIN_trim VACA_trim, vce(robust) re
bootstrap, reps(100): xtreg std_rev VAIN_trim VACA_trim RD_BV_trim , vce(robust) re
*1 år lag
xtreg std_rev L.VAIC_trim, vce(robust) re
xtreg std_rev L.VAIN_trim L.VACA_trim, vce(robust) re
xtreg std_rev L.VAIN_trim L.VACA_trim L.RD_BV_trim , vce(robust) re
*2 år lag
xtreg std_rev L2.VAIC_trim, vce(robust) re
xtreg std_rev L2.VAIN_trim L2.VACA_trim, vce(robust) re
xtreg std_rev L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim , vce(robust) re
*3 år lag
xtreg std_rev L3.VAIC_trim, vce(robust) re
xtreg std_rev L3.VAIN_trim L3.VACA_trim, vce(robust) re
xtreg std_rev L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim , vce(robust) re


*Financial
*ROE
bootstrap, reps(100): xtreg ROE_trim VAIC_trim, vce(robust) re
predict r, e
swilk r
drop r
bootstrap, reps(100): xtreg ROE_trim VAIN_trim VACA_trim, vce(robust) re
bootstrap, reps(100): xtreg ROE_trim VAIN_trim VACA_trim RD_BV_trim , vce(robust) re
*1 år lag
xtreg ROE_trim L.VAIC_trim, vce(robust) re
xtreg ROE_trim L.VAIN_trim L.VACA_trim, vce(robust) re
xtreg ROE_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim , vce(robust) re
*2 år lag
xtreg ROE_trim L2.VAIC_trim, vce(robust) re
xtreg ROE_trim L2.VAIN_trim L2.VACA_trim, vce(robust) re
xtreg ROE_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim , vce(robust) re
*3 år lag
xtreg ROE_trim L3.VAIC_trim, vce(robust) re
xtreg ROE_trim L3.VAIN_trim L3.VACA_trim, vce(robust) re
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```
198  xtreg ROE_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim , vce(robust) re
199
200  *ROA
201  bootstrap, reps(100): xtreg ROA_trim VAIC_trim, vce(robust) re
202  predict r, e
203  swilk r
204  drop r
205  bootstrap, reps(100): xtreg ROA_trim VAIN_trim VACA_trim, vce(robust) re
206  bootstrap, reps(100): xtreg ROA_trim VAIN_trim VACA_trim RD_BV_trim , vce(robust) re
207  *1 år lag
208  xtreg ROA_trim L.VAIC_trim, vce(robust) re
209  xtreg ROA_trim L.VAIN_trim L.VACA_trim, vce(robust) re
210  xtreg ROA_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim , vce(robust) re
211  *2 år lag
212  xtreg ROA_trim L2.VAIC_trim, vce(robust) re
213  xtreg ROA_trim L2.VAIN_trim L2.VACA_trim, vce(robust) re
214  xtreg ROA_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim , vce(robust) re
215  *3 år lag
216  xtreg ROA_trim L3.VAIC_trim, vce(robust) re
217  xtreg ROA_trim L3.VAIN_trim L3.VACA_trim, vce(robust) re
218  xtreg ROA_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim , vce(robust) re
219
220
221  * Test KUN VINNERGRUPPENE
222
223  *Stock market performance
224  *PB
225  bootstrap, reps(100): xtreg PB_trim VAIC_trim if Dummy > 0, vce(robust) re
226  predict r, e
227  swilk r
228  drop r
229  bootstrap, reps(100): xtreg PB_trim VAIN_trim VACA_trim if Dummy > 0, vce(robust) re
230  bootstrap, reps(100): xtreg PB_trim VAIN_trim VACA_trim RD_BV_trim if Dummy > 0 , vce(
     robust) re
231   *1 år lag
232  xtreg PB_trim L.VAIC_trim if Dummy > 0, vce(robust) re
233  xtreg PB_trim L.VAIN_trim L.VACA_trim if Dummy > 0, vce(robust) re
234  xtreg PB_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy > 0 , vce(robust) re
235  *2 år lag
236  xtreg PB_trim L2.VAIC_trim if Dummy > 0, vce(robust) re
237  xtreg PB_trim L2.VAIN_trim L2.VACA_trim if Dummy > 0, vce(robust) re
238  xtreg PB_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy > 0 , vce(robust) re
239  *3 år lag
240  xtreg PB_trim L3.VAIC_trim if Dummy > 0, vce(robust) re
241  xtreg PB_trim L3.VAIN_trim L3.VACA_trim if Dummy > 0, vce(robust) re
242  xtreg PB_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy > 0 , vce(robust) re
243
244
245  *std_ar
246  bootstrap, reps(100): xtreg std_ar VAIC_trim if Dummy > 0, vce(robust) re
247  predict r, e
248  swilk r
249  drop r
250  bootstrap, reps(100): xtreg std_ar VAIN_trim VACA_trim if Dummy > 0, vce(robust) re
251  bootstrap, reps(100): xtreg std_ar VAIN_trim VACA_trim RD_BV_trim if Dummy > 0 , vce(
     robust) re
252  *1 år lag
253  xtreg std_ar L.VAIC_trim if Dummy > 0, vce(robust) re
254  xtreg std_ar L.VAIN_trim L.VACA_trim if Dummy > 0, vce(robust) re
255  xtreg std_ar L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy > 0 , vce(robust) re
256  *2 år lag
257  xtreg std_ar L2.VAIC_trim if Dummy > 0, vce(robust) re
258  xtreg std_ar L2.VAIN_trim L2.VACA_trim if Dummy > 0, vce(robust) re
259  xtreg std_ar L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy > 0 , vce(robust) re
260  *3 år lag
261  xtreg std_ar L3.VAIC_trim if Dummy > 0, vce(robust) re
262  xtreg std_ar L3.VAIN_trim L3.VACA_trim if Dummy > 0, vce(robust) re
263  xtreg std_ar L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy > 0 , vce(robust) re
264
265
266
267  *Economic performance
268  *EBITDA
```

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```
269  bootstrap, reps(100): xtreg EBITDAperc_trim VAIC_trim if Dummy > 0, vce(robust) re
270  predict r, e
271  swilk r
272  drop r
273  bootstrap, reps(100): xtreg EBITDAperc_trim VAIN_trim VACA_trim if Dummy > 0, vce(robust)
     re
274  bootstrap, reps(100): xtreg EBITDAperc_trim VAIN_trim VACA_trim RD_BV_trim if Dummy > 0 ,
     vce(robust) re
275  *1 år lag
276  xtreg EBITDAperc_trim L.VAIC_trim if Dummy > 0, vce(robust) re
277  xtreg EBITDAperc_trim L.VAIN_trim L.VACA_trim if Dummy > 0, vce(robust) re
278  xtreg EBITDAperc_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy > 0 , vce(robust) re
279  *2 år lag
280  xtreg EBITDAperc_trim L2.VAIC_trim if Dummy > 0, vce(robust) re
281  xtreg EBITDAperc_trim L2.VAIN_trim L2.VACA_trim if Dummy > 0, vce(robust) re
282  xtreg EBITDAperc_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy > 0 , vce(robust) re
283  *3 år lag
284  xtreg EBITDAperc_trim L3.VAIC_trim if Dummy > 0, vce(robust) re
285  xtreg EBITDAperc_trim L3.VAIN_trim L3.VACA_trim if Dummy > 0, vce(robust) re
286  xtreg EBITDAperc_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy > 0 , vce(robust) re
287
288
289  * Standardized Revenue
290  bootstrap, reps(100): xtreg std_rev VAIC_trim if Dummy > 0, vce(robust) re
291  predict r, e
292  swilk r
293  drop r
294  bootstrap, reps(100): xtreg std_rev VAIN_trim VACA_trim if Dummy > 0, vce(robust) re
295  bootstrap, reps(100): xtreg std_rev VAIN_trim VACA_trim RD_BV_trim if Dummy > 0 , vce(
     robust) re
296  *1 år lag
297  xtreg std_rev L.VAIC_trim if Dummy > 0, vce(robust) re
298  xtreg std_rev L.VAIN_trim L.VACA_trim if Dummy > 0, vce(robust) re
299  xtreg std_rev L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy > 0 , vce(robust) re
300  *2 år lag
301  xtreg std_rev L2.VAIC_trim if Dummy > 0, vce(robust) re
302  xtreg std_rev L2.VAIN_trim L2.VACA_trim if Dummy > 0, vce(robust) re
303  xtreg std_rev L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy > 0 , vce(robust) re
304  *3 år lag
305  xtreg std_rev L3.VAIC_trim if Dummy > 0, vce(robust) re
306  xtreg std_rev L3.VAIN_trim L3.VACA_trim if Dummy > 0, vce(robust) re
307  xtreg std_rev L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy > 0 , vce(robust) re
308
309
310  *Financial
311  *ROE
312  bootstrap, reps(100): xtreg ROE_trim VAIC_trim if Dummy > 0, vce(robust) re
313  predict r, e
314  swilk r
315  drop r
316  bootstrap, reps(100): xtreg ROE_trim VAIN_trim VACA_trim if Dummy > 0, vce(robust) re
317  bootstrap, reps(100): xtreg ROE_trim VAIN_trim VACA_trim RD_BV_trim if Dummy > 0 , vce(
     robust) re
318  *1 år lag
319  xtreg ROE_trim L.VAIC_trim if Dummy > 0, vce(robust) re
320  xtreg ROE_trim L.VAIN_trim L.VACA_trim if Dummy > 0, vce(robust) re
321  xtreg ROE_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy > 0 , vce(robust) re
322  *2 år lag
323  xtreg ROE_trim L2.VAIC_trim if Dummy > 0, vce(robust) re
324  xtreg ROE_trim L2.VAIN_trim L2.VACA_trim if Dummy > 0, vce(robust) re
325  xtreg ROE_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy > 0 , vce(robust) re
326  *3 år lag
327  xtreg ROE_trim L3.VAIC_trim if Dummy > 0, vce(robust) re
328  xtreg ROE_trim L3.VAIN_trim L3.VACA_trim if Dummy > 0, vce(robust) re
329  xtreg ROE_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy > 0 , vce(robust) re
330
331  *ROA
332  bootstrap, reps(100): xtreg ROA_trim VAIC_trim if Dummy > 0, vce(robust) re
333  predict r, e
334  swilk r
335  drop r
336  bootstrap, reps(100): xtreg ROA_trim VAIN_trim VACA_trim if Dummy > 0, vce(robust) re
337  bootstrap, reps(100): xtreg ROA_trim VAIN_trim VACA_trim RD_BV_trim if Dummy > 0 , vce(
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```
      robust) re
  338 *1 år lag
  339 xtreg ROA_trim L.VAIC_trim if Dummy > 0, vce(robust) re
  340 xtreg ROA_trim L.VAIN_trim L.VACA_trim if Dummy > 0, vce(robust) re
  341 xtreg ROA_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy > 0 , vce(robust) re
  342 *2 år lag
  343 xtreg ROA_trim L2.VAIC_trim if Dummy > 0, vce(robust) re
  344 xtreg ROA_trim L2.VAIN_trim L2.VACA_trim if Dummy > 0, vce(robust) re
  345 xtreg ROA_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy > 0 , vce(robust) re
  346 *3 år lag
  347 xtreg ROA_trim L3.VAIC_trim if Dummy > 0, vce(robust) re
  348 xtreg ROA_trim L3.VAIN_trim L3.VACA_trim if Dummy > 0, vce(robust) re
  349 xtreg ROA_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy > 0 , vce(robust) re
  350
  351
  352 **********TEST KUN TAPERE
  353
  354 *Stock market performance
  355 *PB
  356 bootstrap, reps(100): xtreg PB_trim VAIC_trim if Dummy < 1, vce(robust) re
  357 predict r, e
  358 swilk r
  359 drop r
  360 bootstrap, reps(100): xtreg PB_trim VAIN_trim VACA_trim if Dummy < 1, vce(robust) re
  361 bootstrap, reps(100): xtreg PB_trim VAIN_trim VACA_trim RD_BV_trim if Dummy < 1 , vce(
      robust) re
  362  *1 år lag
  363 xtreg PB_trim L.VAIC_trim if Dummy < 1, vce(robust) re
  364 xtreg PB_trim L.VAIN_trim L.VACA_trim if Dummy < 1, vce(robust) re
  365 xtreg PB_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy < 1 , vce(robust) re
  366 *2 år lag
  367 xtreg PB_trim L2.VAIC_trim if Dummy < 1, vce(robust) re
  368 xtreg PB_trim L2.VAIN_trim L2.VACA_trim if Dummy < 1, vce(robust) re
  369 xtreg PB_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy < 1 , vce(robust) re
  370 *3 år lag
  371 xtreg PB_trim L3.VAIC_trim if Dummy < 1, vce(robust) re
  372 xtreg PB_trim L3.VAIN_trim L3.VACA_trim if Dummy < 1, vce(robust) re
  373 xtreg PB_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy < 1 , vce(robust) re
  374
  375
  376 *std_ar
  377 bootstrap, reps(100): xtreg std_ar VAIC_trim if Dummy < 1, vce(robust) re
  378 predict r, e
  379 swilk r
  380 drop r
  381 bootstrap, reps(100): xtreg std_ar VAIN_trim VACA_trim if Dummy < 1, vce(robust) re
  382 bootstrap, reps(100): xtreg std_ar VAIN_trim VACA_trim RD_BV_trim if Dummy < 1 , vce(
      robust) re
  383 *1 år lag
  384 xtreg std_ar L.VAIC_trim if Dummy < 1, vce(robust) re
  385 xtreg std_ar L.VAIN_trim L.VACA_trim if Dummy < 1, vce(robust) re
  386 xtreg std_ar L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy < 1, vce(robust) re
  387 *2 år lag
  388 xtreg std_ar L2.VAIC_trim if Dummy < 1, vce(robust) re
  389 xtreg std_ar L2.VAIN_trim L2.VACA_trim if Dummy < 1, vce(robust) re
  390 xtreg std_ar L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy < 1 , vce(robust) re
  391 *3 år lag
  392 xtreg std_ar L3.VAIC_trim if Dummy < 1, vce(robust) re
  393 xtreg std_ar L3.VAIN_trim L3.VACA_trim if Dummy < 1, vce(robust) re
  394 xtreg std_ar L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy < 1 , vce(robust) re
  395
  396
  397
  398 *Economic performance
  399 *EBITDA
  400 bootstrap, reps(100): xtreg EBITDAperc_trim VAIC_trim if Dummy < 1, vce(robust) re
  401 predict r, e
  402 swilk r
  403 drop r
  404 bootstrap, reps(100): xtreg EBITDAperc_trim VAIN_trim VACA_trim if Dummy < 1, vce(robust)
      re
  405 bootstrap, reps(100): xtreg EBITDAperc_trim VAIN_trim VACA_trim RD_BV_trim if Dummy < 1 ,
      vce(robust) re
```

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```
406   *1 år lag
407   xtreg EBITDAperc_trim L.VAIC_trim if Dummy < 1, vce(robust) re
408   xtreg EBITDAperc_trim L.VAIN_trim L.VACA_trim if Dummy < 1, vce(robust) re
409   xtreg EBITDAperc_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy < 1, vce(robust) re
410   *2 år lag
411   xtreg EBITDAperc_trim L2.VAIC_trim if Dummy < 1, vce(robust) re
412   xtreg EBITDAperc_trim L2.VAIN_trim L2.VACA_trim if Dummy < 1, vce(robust) re
413   xtreg EBITDAperc_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy < 1 , vce(robust) re
414   *3 år lag
415   xtreg EBITDAperc_trim L3.VAIC_trim if Dummy < 1, vce(robust) re
416   xtreg EBITDAperc_trim L3.VAIN_trim L3.VACA_trim if Dummy < 1, vce(robust) re
417   xtreg EBITDAperc_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy < 1 , vce(robust) re
418
419
420   * Standardized Revenue
421   bootstrap, reps(100): xtreg std_rev VAIC_trim if Dummy < 1, vce(robust) re
422   predict r, e
423   swilk r
424   drop r
425   bootstrap, reps(100): xtreg std_rev VAIN_trim VACA_trim if Dummy < 1, vce(robust) re
426   bootstrap, reps(100): xtreg std_rev VAIN_trim VACA_trim RD_BV_trim if Dummy < 1, vce(
      robust) re
427   *1 år lag
428   xtreg std_rev L.VAIC_trim if Dummy < 1, vce(robust) re
429   xtreg std_rev L.VAIN_trim L.VACA_trim if Dummy < 1, vce(robust) re
430   xtreg std_rev L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy < 1 , vce(robust) re
431   *2 år lag
432   xtreg std_rev L2.VAIC_trim if Dummy < 1, vce(robust) re
433   xtreg std_rev L2.VAIN_trim L2.VACA_trim if Dummy < 1, vce(robust) re
434   xtreg std_rev L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy < 1 , vce(robust) re
435   *3 år lag
436   xtreg std_rev L3.VAIC_trim if Dummy < 1, vce(robust) re
437   xtreg std_rev L3.VAIN_trim L3.VACA_trim if Dummy < 1, vce(robust) re
438   xtreg std_rev L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy < 1 , vce(robust) re
439
440
441   *Financial
442   *ROE
443   bootstrap, reps(100): xtreg ROE_trim VAIC_trim if Dummy < 1, vce(robust) re
444   predict r, e
445   swilk r
446   drop r
447   bootstrap, reps(100): xtreg ROE_trim VAIN_trim VACA_trim if Dummy < 1, vce(robust) re
448   bootstrap, reps(100): xtreg ROE_trim VAIN_trim VACA_trim RD_BV_trim if Dummy < 1 , vce(
      robust) re
449   *1 år lag
450   xtreg ROE_trim L.VAIC_trim if Dummy < 1, vce(robust) re
451   xtreg ROE_trim L.VAIN_trim L.VACA_trim if Dummy < 1, vce(robust) re
452   xtreg ROE_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy < 1 , vce(robust) re
453   *2 år lag
454   xtreg ROE_trim L2.VAIC_trim if Dummy < 1, vce(robust) re
455   xtreg ROE_trim L2.VAIN_trim L2.VACA_trim if Dummy < 1, vce(robust) re
456   xtreg ROE_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy < 1, vce(robust) re
457   *3 år lag
458   xtreg ROE_trim L3.VAIC_trim if Dummy < 1, vce(robust) re
459   xtreg ROE_trim L3.VAIN_trim L3.VACA_trim if Dummy < 1, vce(robust) re
460   xtreg ROE_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy < 1 , vce(robust) re
461
462   *ROA
463   bootstrap, reps(100): xtreg ROA_trim VAIC_trim if Dummy < 1, vce(robust) re
464   predict r, e
465   swilk r
466   drop r
467   bootstrap, reps(100): xtreg ROA_trim VAIN_trim VACA_trim if Dummy < 1, vce(robust) re
468   bootstrap, reps(100): xtreg ROA_trim VAIN_trim VACA_trim RD_BV_trim if Dummy < 1 , vce(
      robust) re
469   *1 år lag
470   xtreg ROA_trim L.VAIC_trim if Dummy < 1, vce(robust) re
471   xtreg ROA_trim L.VAIN_trim L.VACA_trim if Dummy < 1, vce(robust) re
472   xtreg ROA_trim L.VAIN_trim L.VACA_trim L.RD_BV_trim if Dummy < 1 , vce(robust) re
473   *2 år lag
474   xtreg ROA_trim L2.VAIC_trim if Dummy < 1, vce(robust) re
475   xtreg ROA_trim L2.VAIN_trim L2.VACA_trim if Dummy < 1, vce(robust) re
```

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```
476   xtreg ROA_trim L2.VAIN_trim L2.VACA_trim L2.RD_BV_trim if Dummy < 1 , vce(robust) re
477   *3 år lag
478   xtreg ROA_trim L3.VAIC_trim if Dummy < 1, vce(robust) re
479   xtreg ROA_trim L3.VAIN_trim L3.VACA_trim if Dummy < 1, vce(robust) re
480   xtreg ROA_trim L3.VAIN_trim L3.VACA_trim L3.RD_BV_trim if Dummy < 1 , vce(robust) re
481
482
483   **********************
484   *Tester forskjeller mellom de to gruppene
485
486   ttest RD_BV, by(Dummy)
487   ttest VAIN_trim, by( Dummy)
488   ttest VAIC_trim, by( Dummy)
489   ttest Annualreturn_trim, by(Dummy)
490   ttest EBITDAperc_trim , by(Dummy)
491   ttest PB_trim , by(Dummy)
492   ttest ROE_trim , by(Dummy)
493   ttest ROA_trim , by(Dummy)
494   ttest Annualreturn, by(Dummy)
495   ttest Payrollexpense , by(Dummy)
496   ttest Numberofemployees , by(Dummy)
497   ttest Exploration , by(Dummy)
498   ttest Explorationperc , by(Dummy)
499   ttest RRR , by(Dummy)
500   ttest Size , by(Dummy)
501   ttest Leverage , by(Dummy)
502   ttest CEE_trim, by(Dummy)
503
504
505   ttest ProductionNAmerica , by(Dummy)
506   *mer prod i N.Amerika
507   ttest ProductionAfrica , by(Dummy)
508   *mer i afrika
509   ttest ProductionAfrica , by(Dummy)
510   *mer i middleeast
511   ttest ProductionEurope , by(Dummy)
512   *mer i europa
513   ttest ProductionAsia , by(Dummy)
514   *mer i asia
515   ttest ProductionLAmerica , by(Dummy)
516   *Mindre i L amerika
517
518
519
520
521
522
523
524
525
526
527
528   log close
529
530
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