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The Profitability of Norwegian Salmon Farming Companies

A study of profitability variation

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NORWEGIAN SCHOOL OF ECONOMICS

Preface

This thesis is written as part of our Master´s degree in Economics and Business Administration at the Norwegian School of Economics (NHH). Our majors are business analysis and performance management, and financial economics.

We both started at Norwegian School of Economics at the same year and got to know each from the introduction week. We have learnt a lot in these five years, and through several courses we have gained specific knowledge about business analysis, management accounting and finance. We both have been particularly interested in these academic fields since these fields are highly relevant and applicable, especially for small and medium sized enterprises. Their relevance and application was confirmed as we worked with our thesis.

It has been very interesting to analyse an industry in detail, involving both governmental institutions and a private analyst company to collect data. The Norwegian salmon farming industry and its environment are very dynamic, and it is with great interest we follow the news for this industry.

Our work has been challenging and time consuming, yet fruitful. We have spent much time discussing, drawing from knowledge gained from several past courses. This has given us a deeper understanding of the industry. It is with some sadness to realise that this thesis ends our time as students at NHH. We are happy, honoured and proud to be NHH students, and humble to be able to study at NHH with so many fine fellow students and educators.

We want to thank the Norwegian Directorate of Fisheries to have provided us confidential data about the Norwegian salmon farming industry, for which we could not have done without. We also want to thank Centre for Applied Research at NHH (SNF) for giving us a comprehensive dataset and Kontali Analyse, for offering their Salmon Farming Industry report.

Finally, we want to thank our supervisor Endre Bjørndal who gave us direction for our thesis.

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Summary

The conditions in the Norwegian salmon farming industry are constantly changing. Locally and globally, regulations, consolidation and technological advancements are some of the factors having a deep impact on the current industry. To ensure competitiveness, it is essential to emphasise on profitability and taking the correct strategic decisions. The objective of this thesis is to indicate what may cause variation in profitability in the current Norwegian salmon farming industry, and what will be important in the future. The study has an explorative and descriptive purpose.

Our study object consists of 169 different Norwegian salmon farming companies, representing roughly 70% of the industry. To indicate possible reasons for profitability variation, we have studied the competition environment of the companies, important sources of profitability and the correlation between several factors and economic performances.

Our main findings reveals that purchasing costs and cost efficiency in terms of other operating costs seems to explain variation in relative profitability. The price of salmon naturally has a great impact on the profitability of the industry. Further on, there is also a correlation between debt ratio and relative profitability.

Chapter 1 - Introduction

1.1 Background

The Norwegian salmon farming industry is a world pioneering industry, dating back to the 1960´s. The industry has been a large contributor of high value jobs for many communities along the Norwegian coast. It supplies many consumers all over the world delicious Atlantic salmon and rainbow trout, both of which have high quality protein full of nutrients such as omega 3 and iodine. Although generally insulated from all out competition due to favourable natural conditions at home, domestic and international factors are influencing the industry. Stricter environmental regulations and technological development are playing, and will continue to play a large role for the industry.

The salmon farming industry has been hit by a few incidents the last decade. In Chile, an epidemic killed large parts of the biomass. In Norway, fish lice and escaping salmon crossbreeding with wild salmon have been a major concern and a target of massive criticism by environmental organisations. As a response, the authorities and consumers alike have demanded stricter regulations

On the demand side, consumers all over the world are demanding healthier proteins in increasing volumes. Domestic demand only account for a tiny fraction of total production, and most of the growth comes from the overseas, with the EU demand accounting for about two thirds of the total production. The market is expected to grow significantly in the future, although at a slower pace than before, most of the demand growth coming from developing countries.

On the technological aspect, better technology and equipment to increase output and productivity has been introduced. Vaccines and measures against lice and diseases have reduced the mortality and antibiotics usage dramatically. However, in the future, the Norwegian salmon farming industry´s comparative advantage, and therefore its long-term profitability may be at stake due to the increasing benefits of land based salmon farming.

There are challenges for the industry, especially environmental and regulatory ones. However, where there is a challenge, there is also an opportunity. For the industry, it will be important to identify, create and exploit opportunities. It is valuable to know what is important for the profitability of the salmon farming industry.

1.2 Purpose, problem statement and research questions

Complex environments surround the salmon farming industry, and it may be harder to run a salmon farming company in the future. In order to take the correct strategic decisions it is essential to understand what is important for the economic performance in the industry. The goal of the thesis is to explore what is important for profitability, and what may be causing variations in relative profitability in the Norwegian salmon farming industry. By deeply understanding the past, one may predict what will be important for future profitability. By analysing the competition, variation in profitability and cost and profit drivers, we hope to gain a comprehensive understanding of the industry.

The problem statement of this thesis is therefore:

What may explain variations in profitability in the current Norwegian salmon farming industry, and what will be important for the future profitability?

To answer this problem statement, five research questions have been formulated.

1. How is the competition environment in the Norwegian fish farming industry characterised by?
2. What profitability variations exist between Norwegian fish farming companies, and which areas of performance seem to be especially important for relative profitability?
3. Which factors may be of significant importance for the profitability of the Norwegian fish farming companies?
4. Which relationships exist between the characteristics of the salmon farming companies and their economic performances?
5. What will be important for profitability in the salmon farming industry in the future?

The structure of the thesis is reflected by the above research questions, and it is a step-by-step approach to answer the problem statement. The research questions are explained in detail later.

1.3 Defining the sample

The thesis shall look at all Norwegian salmon farming companies with positive equity with confidential data as supplied by the Norwegian Directorate of Fisheries in the five-year period from 2009 to 2013. The number of companies varies from year to year, but no less than 91. Listed salmon farming companies are required to value their biomass to market value which would distort the operational performance of the company despite being caused by external factors. By covering a relatively long period, we can even out possible short-term effects of salmon price fluctuations.

We analyse the economic performances of the companies and their characteristics (features) using a regression model. Qualitative and quantitative data has been collected from over 169 unique companies.

1.4 Structure

The thesis consists of nine chapters. Chapter 1 briefly introduces the relevance of the thesis, presents the problem statement and describes the definition of the sample and structure. In chapter 2 we present the theoretical frameworks, which the analysis part of the thesis are based upon, and in chapter 3 the methodology part of the thesis is described.

The competition in the salmon farming industry is analysed in chapter 4 to further understand the current conditions in which the companies compete in, and the expected future development in the industry. The competition analysis is the basis for the further analysis in the thesis later on.

In chapter 5 we analyse the variation in economic performance (profitability) among the salmon farming industry, followed by chapter 6 in which we identify factors that may be important for profitability. In chapter 7 we use regression analysis to look for relationships between the factors (from chapter 6) and economic performance (chapter 5). We try to explain possible explanations behind potential variations in economic performance. The companies are categorised based upon common features in characteristics and economic performances. In chapter 8, we discuss what may be important for future profitability, and in chapter 9 we conclude and summarise the results of this thesis.

CHAPTER 2: THEORETICAL FRAMEWORKS

In this chapter we shall present the theoretical frameworks behind this thesis. (Johnson, Whittington, & Scholes, 2011)Relevant theories mainly originate from the fields of business analysis, strategy and finance.

2.2 Theoretical frameworks on competition analysis

All external influences that affect a firm's decisions and performance, including intra-industry competition, are called the business environment. When analysing the business environment, a top-down approach may be suitable. First, one describes the highest level of environment that influences a company, known as the macro environment. By mapping out the macro environment and the conditions it imposes on the industry, one can further on analyse which factors are important to an industry, and ultimately, its profitability.

To analyse the macro environment, PESTEL is a useful and often applied framework, while Porter's Five Forces theory is a leading framework on intra-industry competition analysis (Johnson, Whittington, & Scholes, 2011). Next, we will describe the above-mentioned frameworks.

2.2.1 PESTEL - Macro Environment Analysis

The macro environment can be categorised into six factors. Political, Economical, Social, Technological, Environmental and Legal factors, which in short is known as PESTEL. These are the most significant factors that every industry more or less must face (Johnson, Whittington, & Scholes, 2011). (Porter M., 1980)See below figure.

Figure 1 PESTEL framework

The framework is not dogmatic. It is merely a good suggestion on what is important for most industries, and can be modified. Analysing these six factors is helpful for indicating key drivers of change in the future. Below describes each factor in detail.

Political factors in general consider the governance of a country, the political stability and the legitimacy of the state. Also included are tax system, migration policy, trade and labour policies are considered. Some industries are more regulated by the government than others in some countries, which may be of utmost importance for the companies. Less directly influencing the industry, yet important, is the state's ability to provide satisfying education, infrastructure and health care.

Economic factors refer to the macro-economic indicators such as employment rate, growth in gross domestic product, currency trends, raw material prices and the development of related industries. Interest rate are of particular importance for capital-intensive industries, while inflation is important for the consumers.

Social factors describe the development of the country's demography and culture. Changes in demography may have adverse effects on consumption pattern and labour costs. For example, increased population may spur higher consumption in general, while an aging population may increase the labour costs. Changes in culture may have an impact on, but not limited to, career attitude, consumption, and education level. In general, social factors may influence both upstream and downstream behaviour, positively and negatively.

Technological factors may have a tremendous impact on all industries. It includes inventions and innovations that can reduce costs, improve quality, improve accessibility, increase reliability and production speed as well as reduce environmental impact. As some innovations require large investments, they may lead to a significant barrier to entry. Some innovations may even render a product or industry obsolete.

Environmental factors refer to how ecological and environmental conditions such as weather, climate and climate change may affect supply and delivery of raw materials, as well as how environmental degradation affect consumer perception of an industry.

Legal factors consider how governmental or supranational regulations impose limitations on an industry's operations, thereby affecting its production, costs and demand.

Note that the model should not be considered static. The macro environment changes over time, so findings from a PESTEL analysis may not be valid in the long term.

2.2.2 The Porter's Five Forces Framework

An often used theory of how industry structure drives competitive behaviour and hence industry profitability is called industrial organisation economics. Ranging from perfect competition to monopoly, one may describe the competition in an industry according to the concentration of firms, entry and exit barriers, product differentiation and information availability in the industry.

However, there are additionally other characteristics of an industry that determine the competition intensity and profitability. Professor Michael Porter's Five Forces theory is a widely used framework to categorise and analysing these characteristics (Porter M., 1980). Five forces of competitive pressure determine the profitability, which can be classified as three "horizontal" and two "vertical" competition forces. Horizontal forces are those that may compete with the firms in the same level in the supply chain. These are; potential entrants, substitutes and rivalry among existing firms (industry rivalry). The two vertical forces arise from the buyers and suppliers.

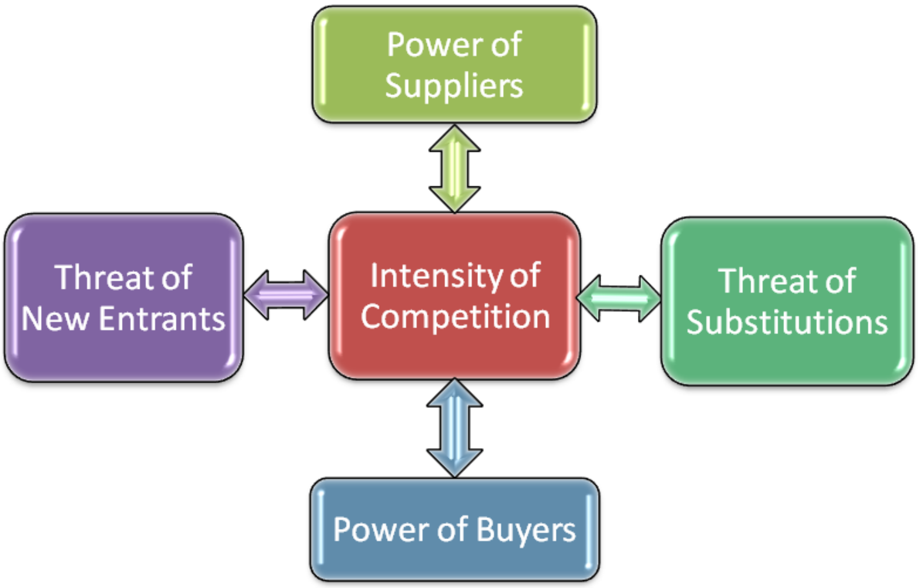


Figure 2 Porter´s Five Forces

The other four forces, as illustrated by the model, will influence industry rivalry. The internal rivalry indicates the intensity of competition, which is also a good indication on the attractiveness of the industry. Below, we shall describe each of the five forces and explain their impact on the intensity of competition.

Threat of entrants refers to whether the industry is sufficiently profitable to attract newcomers, and whether there are entry barriers to prevent them from entering. These entry barriers include high capital requirements, economies of scale, absolute cost advantage, high customer loyalty, and access to distribution channels, government and legal restrictions and retaliation from current players. Product differentiation and good access to distribution channels may appeal to newcomers, spurring increased competition.

Threat of substitutes is influenced by the buyers' propensity to substitute and the relative prices and performance of the substitutes. A good substitute is characterised by its ability to cover the customers' needs similarly to a reasonable price. The buyers' propensity to substitute is then high, which will increase the threat of substitutes, and therefore the competition intensity.

An industry is creating value for both sellers and buyers, but how this value is shared, will have an effect on the profitability of the industry. *Power of buyers* depends on two sets of factors, namely their price sensitivity and relative bargaining power. High price sensitivity and bargaining power of the customer will increase the industry's competition with its customers.

The level of price sensitivity among the buyers depends on four important factors. Firstly, it is the cost of product relative to total cost. High proportions imply that the buyers will be more sensitive to the price. Secondly, low presence of product differentiation in the industry will increase the price sensitivity. Thirdly, if the buyers are engaged in intense competition, the buyers too will expect the sellers to reduce prices.

Relative bargaining power is firstly influenced by size and concentration of buyers relative to suppliers. The fewer buyers, yet larger order size is, the more a company may lose by losing a customer. Secondly, low switching costs increase the customers' bargaining power. Thirdly, the more information the buyers have, the more bargaining power will they gain. Lastly, the buyers' ability to integrate vertically and to produce for themselves, which would threaten the existence of the other companies.

Power of suppliers is analogous with power of buyers. The difference is that now the firms in the industry are the buyers, while the suppliers are the sellers.

The last, but not least of the five competition forces, is *internal rivalry.* The competition intensity and profitability of most industries are determined by the competition within the industry. Different industries have different characteristics, some featuring intense price competition while others compete more on advertising, innovation and other non-price dimensions (Grant, 2010). The interactions between the following six factors lead to competition among established firms.

One, the number and size of existing firms (the seller concentration) will affect the competition. Few and large companies in an industry tend to face less intense competition. Two, greater diversity of competitors, in terms of origin, objectives, costs and strategies usually leads to more intense competition. Three, lower degree of product differentiation and hence lower switching costs increases price competition. Four, excess capacity and exit barriers encourages companies to offer discounts to attract more sales. Finally, the cost structure of the industry also affects the internal rivalry. When fixed costs are high compared to total costs, firms regard the fixed costs as sunk and are willing to take on marginal business at whatever price to cover the variable costs. Additionally, the presence of economies of scale encourages aggressive price competition in order to achieve the critical mass.

The five forces framework has several limitations (Besanko, Dranove, & Shanley, 2007). Firstly, it places little importance to factors that might directly affect demand. It takes into account the availability and prices of substitute and complementary products, but ignores changes in consumer income, preferences, and firm strategies for boosting demand, such as advertising. Secondly, its focus is on the industry as whole, not individual firms. This is often an effective simplification, but some companies may have unique features that shield them from some competitive forces. Thirdly, it does not explicitly take into account the role of the government and intervention, except when the government is a buyer or supplier. This is somewhat remedied in the PESTEL analysis though. Fourthly, the analysis is qualitative. It can give an indication on future trend, but cannot estimate the probability of it happening. Fifthly, while the framework describes how suppliers, distributors, customers and competitors might erode a firm´s profits, it does not consider how the very same players might enhance firm profits by co-operating (Besanko, Dranove, & Shanley, 2007). The leading figures behind this view are professors Barry Nalebuff and Adam Brandenburger. In their book *Co-opetition* from 1996, they state that business is both war and peace (Nalebuff & Brandenburger, 1996). In their modification of the five forces framework, they also include a force called *complementors,* which are organisations that produce related products and services that increase the value of the focal product.

2.3 Theoretical frameworks on analysis of cost and profitability drivers

During the 1980´s, management accounting researchers started the research on the impact on costs from other variables than volume and their importance (Banker & Johnston, 2007). While researchers initially focused on cost drivers, later on researches extended their focus to cover revenue and profit drivers. Cost drivers have also been described as revenue drivers, as the cost drivers also may create value for the customer (Banker & Johnston, 2007)**.** Different views on cost and profit drivers have been described by a number of researchers. As quoted in Banker & Johnston *"(..) there is no single, widely accepted, unifying theory or taxonomy of cost, (..) and profit drivers and their underlying relationships".* However, before we present the different frameworks, we shall shortly introduce the development in this field the last thirty years.

Traditionally, in both economics and accounting, theoretical models of cost behaviour assumed that volume was a sufficiently appropriate cost driver. In the 1980´s, researchers realised that non-volume variables were of fundamental and strategic importance to managers and the design of management accounting information systems (Banker & Johnston, 2007). According to strategic cost management, costs are driven by many different factors; some of them interrelated, in a complex relationship. Volume is an important cost driver, but for strategic analysis, it is usually not the most useful way of explaining cost behaviour (Shank & Govindarajan, 1993).

The fact that non-volume variables may affect the costs and profitability dramatically is important. Firstly, a manager may take better strategic decisions when he or she takes several variables into account. Sound knowledge about the underlying cost drivers may enable the company to increase its profits and support the company´s overall goal (Banker & Johnston, 2007).

Secondly, it has profoundly affected the management accounting systems. The utility of traditional management accounting systems (MAS), such as budgets, was first questioned by the American professors Thomas Johnson and Robert Kaplan. They argued that the traditional MAS lost their relevance in an increasingly dynamic environment (Johnson & Kaplan, 1987). Managers relied on data that came too late, were too aggregated and too influenced by external reporting requirements. This was not particularly useful for supporting decisions such as what and how to produce, and part of the solution was to include a broader set of cost and profitability variables.

The following paragraphs will describe several frameworks by Michael Porter and Daniel Riley respectively. They have been in forefront in developing the cost and profit driver theories.

2.3.1 Porter´s ten major categories of cost drivers

In 1985, Porter developed a strategic management framework based on industrial economics theory. He was one of the pioneers in using the concept of *cost drivers* to

Porter´s ten categories:

1. Scale
2. Learning and spillovers
3. Capacity utilisation
4. Linkages between activities within the firm
5. Linkages between activities across the extended value chain
6. Linkages with business units within the firm
7. Timing
8. Policy choices
9. Geographic locations
10. Institutional factors

describe and analyse cost behaviour (Porter M., 1985) and placed great importance in considering the costs across a firm´s entire value chain by using *cost drivers*. He defined a cost driver as "*the structural determinants of the costs of activities*". Each activity and their costs should be analysed separately with its own cost drivers if they accounted for a large and growing percentage of operating costs, had different cost drivers, and/or consisted of value-creating activities that competitors executed differently.

Cost driver analysis provides the firm a better understanding of the cause and effect of cost behaviours. According to Porter (1985), the firm may then be in a better position to control the cost drivers, especially in the strategic planning phase. Aligning the activities and their costs with the company´s overall goal and strategy, enables it to optimise the profits.

Porter defined ten categories of cost drivers of major importance. Those are: 1) Scale, 2) learning and spillovers, 3) capacity utilisation, 4) linkages between activities within the firm 5) linkages between activities across the extended value chain 6) linkages with business units within the firm, 7) Timing, 8) Policy choices, 9) Geographic locations, 10) Institutional factors

Scale is the first category of cost drivers. Scale is a variable that may bring economies or diseconomies of scale to the activity. Economies of scale may occur when activities are performed differently or more rational at large scale production, and from less than proportional increases in capital expenditures or overhead costs required to support an activity as it grows. Diseconomies of scale also exists if increased scale leads to more than proportional increases in complexity and coordination costs when more people and divisions must communicate and interact.

Learning and spillovers is the second category. Over time, the costs of an activity may fall due to learning. For example, learning reduces costs from redesigning the factory layout, better aggregated production planning and lot size planning, improved labour productivity, improved product design and process innovation. Learning may also reduce the costs of building entire factories or sales outlets. By *spillovers*, the companies may reduce costs by learning from external sources, such as suppliers, consultants, former employees and reverse engineering. Note that in the case where spillover effects are an industry-wide phenomena, sustainable competitive cost advantage will not be achieved for one particular company. Rather, it will lower the costs for the whole industry, depending on the leakage rate.

Capacity utilisation as a cost driver is important in the cases where there are significant levels of fixed costs in the activity. In order for a company to be profitable in the long term, the price should at least cover all costs, including the fixed costs. These fixed costs will often be allocated across the products, but the exact amount depends on the capacity utilisation. At low capacity, the company will allocate the fixed cost on fewer products, raising the product´s unit costs. The ratio between fixed and variable costs related to an activity indicates how sensitive the activity is towards the capacity utilisation (the cost of capacity).

Linkages are a type of cost driver that is neither easily observable nor imitable. The costs of one activity are often influenced by how *other* activities are performed. By coordination and optimisation, a firm may lower the total costs of the linked activities. Michael Porter divides linkages into two: 1) *Linkages within the firm* and 2) *Linkages across the extended value chain (vertical linkages)*. An example of the second linkage is the linkage between manufacturer and distributor/retailers. By improving the sales information from the stores to the purchasing, the firm may significantly reduce their inventory.

*Linkages (*or interrelationship, cooperation) *within the business units* affect the costs. A group may share an activity among two or more business units, e.g. marketing or a distribution network, which raises the production volume in the activity. Another way of reducing costs by linking business units is what Porter refers to as "intangible interrelationship". Here, one shares the knowledge and skills in one activity to improve another, similar activity. E.g., effective cost reducing measures gained in one division can be effective in another division.

Integration may affect the costs of the activity significantly. All activities use or may use purchased input and must therefore implicitly or explicitly consider whether to integrate. Integration may reduce costs in many ways, e.g. by reducing the transportation costs, avoiding suppliers with bargaining power or by enjoying interaction benefits. On the other hand, integration may also increase costs - by reducing flexibility, increasing activity costs compared to outsourcing or by increasing the costs of exiting. The firm is advised to thoroughly consider the gains and losses of integration or disintegration.

The costs of an activity are often reflected through the *timing*. Sometimes, a firm may gain first-mover advantages by taking the initiative. For example, it can have lower costs of creating and maintaining a brand name. On the other hand, there might be a disadvantage of being first, as latecomers can imitate and learn from the mistakes. Additionally, a latecomer may benefit from a younger workforce and they may also tailor their value chain to the existing input factor costs. In many cases, the timing is not in the control of the firm, but rather on the market conditions. E.g., the timing of purchasing an oilrig has a big effect, not only on interest costs, but also on the price of the oilrig itself.

The costs of an activity also depends heavily on a company´s *policy choices*, which reflects its strategy. These policy choices often involve deliberate trade-offs between costs and differentiation. E.g., raw material quality, product mix, lead-time, target segment and process technology are relevant policy choices. A concrete example would be no-frills low cost carriers versus legacy carriers. Policy choices are often of greater importance for firms pursuing differentiation strategies. Differentiation is often based on strategic a choice that makes the firm unique through the execution of one or several activities, which the company incurs costs to achieve.

Location of an activity may affect its costs, likewise, the activity´s relative location to other activities. Location often reflects a strategic choice, however, historic reasons, the location of the input factors and other factors may also explain a particular location of an activity. Different locations imply different upstream access to core resources, e.g. knowledge workers, energy or other input. Similarly, location has an impact on costs of selling to customers.

Institutional factors, such as government regulations, unionisation, tariffs and levies, is the final category. The major feature of this category is that they are outside the control of the firm. Although these cost drivers are outside firm control, be aware that there are methods to influence them or position yourself to minimise the effect.

Each and every category of cost driver includes factors that affect the costs, and ultimately the profitability, both on the short and long term. A firm should be aware that one activity´s costs may be driven by several cost drivers and that they may interact with each other. They should also try to quantify the relationship between the cost drivers and the activity´s costs if possible. Identifying and quantifying the cost drivers, not only at one particular time, but also changes throughout time (cost dynamics) is an important job for the firm. Those with this insight may be able to predict these changes and react quickly to them (Porter, 1985).

2.3.2 Riley´s structural and operational cost drivers

Porter was one of the pioneers in using the concept of *cost drivers* and was the inspiration behind Daniel Riley´s structural and operational cost drivers, which is suggested as a better alternative to Porter´s cost drivers (Shank J., 1989). Riley used Porter´s cost drivers as basis, and categorised them into two main categories - structural and executional cost drivers.

Riley´s cost drivers:

Structural drivers

1. Scale
2. Scope
3. Experience
4. Technology
5. Complexity

Executional drivers:

6. Employees´ commitment to continuous improvements
7. Total quality management
8. Capacity utilisation
9. Product design configuration
10. Linkages with suppliers and customers

The structural factors drew upon the industrial organisation literature (Scherer, 1980). This view has at least five strategic decisions by the firm regarding its underlying economic structure that drive cost position for any given product group.

Scale is a strategic decision that drives costs. Examples are the level of investment in capital expenditures, research and development and marketing. Also part of the scale factor is the level of horizontal integration.

Scope is the degree of vertical integration.

Experience is the third cost driver. Costs fall as experience is gained. However, in a dynamic environment, a high level of experience may not help the firm, as it may increase structural inertia. Decision makers should therefore be aware of the importance of experience.

Which te*chnology* to employ in the different links of the value chain may affect costs significantly. Especially important strategy wise is the choice of being a leader or a follower of technological solutions.

Complexity, in terms of product or service range offered to the customer, is large driver of costs. Some products incur more indirect costs than other, which may not be easily observable, thereby underestimating the costs of producing it. Cooper & Kaplan´s (1998) activity based calculation, which we will not further describe, especially emphasised complexity as a cost driver (Cooper & Kaplan, 1988).

The second main category, the executional cost drivers, captures the firm´s ability to execute the chosen strategy efficiently. In contrast to the structural drivers, "more is always better" for the executional drivers (Shank J., 1989).

The first driver is the *workforce commitment to continuous improvements*. The company´s costs are influenced by how committed and active the employees are in continuously improving the operations.

The second, *total quality management* reflects how the firm is being organised and lead to improve the product quality.

Capacity utilisation is important in industries with high fixed costs. Low capacity utilisation implies higher unit cost. This driver is also mentioned in Porter´s cost drivers.

Plant layout efficiency may drive costs. The construction or the layout of the factory affects the plant´s ability to produce efficiently. The better layout, the higher the efficiency will be, which lowers the costs.

Product design configuration reflects the fact that the design of a product has significant impact on costs. E.g. the usage of common parts, the shape of the product may significantly reduce production and transportation costs respectively.

The last of Riley´s cost drivers is the *linkages with suppliers and customers*, which is similar to the Porter´s linkages.

Below is Porter and Riley's theories summarised. Later, other researchers have expanded the field of research to include drivers of value, revenue and profits. On the other hand, factors described earlier as cost drivers have been mentioned as possible drivers of value since the cost drivers may be of value for the customers (Banker & Johnston, 2007).

Porter (1985)	Riley (1987)
Ten categories 1. Scale 2. Learning and spillovers 3. Capacity utilization 4. Linkages between the activities within the firm 5. Integration 6. Cooperation 7. Timing 8. Policy choices 9. Geographic locations 10. Institutional factors	***Structural drivers:*** 1. Scale 2. Scope 3. Experience 4. Technology 5. Complexity **Executional drivers:** 6. Workforce commitment to continuous improvements 7. Total quality management 8. Capacity utilization 9. Plant layout efficiency 10. Product design configuration 11. Linkages with suppliers and customers

Table 1 Comparison of the cost driver taxonomies (Banker & Johnston, 2007)

2.4 Finance theory

2.4.1 Miller-Modigliani theorem

Companies must finance their investments and assets through different sources of financing. The composition will vary between companies, industries and the phase of the company and the industry. The question whether a capital or financial structure affects a company´s financing costs and the value of the firm has been thoroughly debated in academia. Firstly we will present the two main sources of financing before tackling the relevance of the capital structure for a company.

2.4.1.2 The cost of debt

The cost of debt is relatively easy to observe, assuming efficient financial markets in which the creditor is being paid for the exposed risk. The creditor should be compensated for being exposed to the risk that the borrower partially or wholly defaults on his loan and agreed interest payments, which could incur great costs to the creditor. Higher risk for default and the expected implies a higher interest rate required as compensation. As most people are risk averse, it is necessary to give the creditors extra incentives to issue risky debt. The interest rate will also depend on supply and demand of money. Low supply of money increases the interest rate as the creditors gain more bargaining power.

2.4.1.3 The cost of equity

The shareholders in a company own the equity, which gives them the right to the profit of the company. The profit may be back-ploughed to the company, which would be used to invest in profitable projects, or it can be shared among the shareholders as dividends or repurchase of shares. The equity-holders are therefore buying the rights of uncertain future cash flows of a company, which consists of dividends plus potential capital gains related to the share. The biggest difference between debt and equity is that the debt holders have a contractual claim to their cash flows, while the equity holders have a residual claim. Since the risk is higher for equity holders, they require higher risk premium than the creditors.

2.4.1.4 Capital structure irrelevance theorem

A company is usually both equity and debt financed, both of which have different costs. The question whether the capital structure has an effect on firm value was discussed by Merton Miller and Franco Modigliani in 1958, often known as Miller-Modigliani or capital structure irrelevance theorem, a paper which awarded them the Nobel Prize in Economics in 1985 (Modigliani & Miller, 1958) . Their answer was that the capital structure is irrelevant, given certain assumptions. It does not matter whether a company is fully equity-financed or heavily leveraged; the firm value is the same. Using an analogy, if a company´s profits is symbolised by a pizza, the pizza has the same size regardless of capital structure. It is just distributed differently under different capital structure.

The assumptions required for capital structure irrelevance, are as follows:

1) Equal borrowing costs for both companies and investors

2) No taxes, transaction and bankruptcy costs

3) No information asymmetry between companies and investors

4) No effect of debt on company´s earnings before interest and taxes.

If these conditions were met, Miller and Modigliani demonstrated that the firm value is equal to the market value of the cash flows generated from the company´s assets, and that this value was independent of the choice of capital structure. The reason is that in efficient markets, an investor may substitute the company´s choice of leverage with his own choice of leverage. This is called *homemade leverage.* As long as the investor can borrow to the same conditions as the company without transaction costs, the investor can replace the company´s financing decision by borrowing or lending out money, depending on desired position. The differences in capital structure change the distribution of the company´s cash flows and risk between creditors and shareholders, but it does not affect the overall cash flow generated from the company´s assets nor the risk related to it. Theoretically, the value of a firm is equal to the total future cash flows discounted using a required rate of return that reflect the overall risk, both to equity and debt. This combined required rate of return is often called *weighted average cost of capital,* or *WACC.*

2.4.2 *The trade-off theory*

In reality, the assumptions behind the capital structure irrelevance are not met. Companies have to pay tax. There are transaction costs related to buy and sell stocks or issuing debt or equity. Bankruptcy costs can be very dear, especially in industries with little tangible assets, as the assets are harder to sell for the creditor, and the costs of litigation, consultants and lawyers can amount to a significantly large figure (Berk & DeMarzo, 2010).

The trade-off theory takes into account that there are taxes, transaction and bankruptcy costs and that there are asymmetric information. Therefore, in practise, leverage does matter (Berk & DeMarzo, 2010).

Corporation pay taxes on their profits after interest payments are deducted. Interest expense reduces the amount of tax, which gives the companies and incentive to leverage. However, the risk of bankruptcy costs is an important consequence of leverage.

In the event of bankruptcy, the creditors take over the firm. In addition to the direct costs of bankruptcy as mentioned above, there are indirect costs, while more difficult to measure, they are often much larger than the direct costs. Examples of such indirect bankruptcy costs are: Loss of customers, suppliers, employees and receivables. In addition, fire sale of assets, delayed liquidation and costs to creditors, which may have to wait several years to get their money, may destroy value substantially. The debt holders know this, and will therefore require higher compensation for the loan, the higher costs being transferred to the equity holders (Berk & DeMarzo, 2010).

History has many examples of managers wanting to expand the business (empire building), often unprofitably, when they have access to an abundance of cash. At the expense of the investors, they seek to raise their own status and fringe benefits by pursuing empire building. This is also known as the free cash flow hypothesis. By increasing the leverage, the free cash flows of the companies are reduced. The managers will be motivated to run the firm as efficiently as possible when access to cash is tight. Hence, leverage may lead to more well managed firms (Berk & DeMarzo, 2010).

Miller-Modigliani theorem assumes symmetric information between the companies and the stakeholders, which is not the case in reality. Companies and investors have different information. For example, managers have better information regarding the company´s future performance. However, outsiders may get a signal about the firm´s future by looking at how it seeks funding, assuming the managers are rational. If a company commits to future large debt payments, this will be taken as a signal that the management has complete faith in the company´s future. If a company issues equity, it might be viewed negatively. Well-performing firms try to avoid issuing equity, while bad firms are willing. Buyers of newly issued equity are therefore only willing to do so at a heavily discounted price, due to the lemon principle. The lemon principle refers to the sale of a product where the seller has superior information about its condition. Because the buyer does not have prior knowledge of the true state of the product, he or she will not buy it unless given a substantial discount (Berk & DeMarzo, 2010).

The trade-off theory takes into account the different benefits and disadvantages of leverage. It suggests that firms increase their leverage until the marginal benefit of leverage equals the marginal costs. Hence, it explains why firms issue debt, but not to the point where it can fully exploit the interest tax shield, due to the cost of leverage. There are differences in the use of leverage across industries due to differences in relative bankruptcy costs (Berk & DeMarzo, 2010).

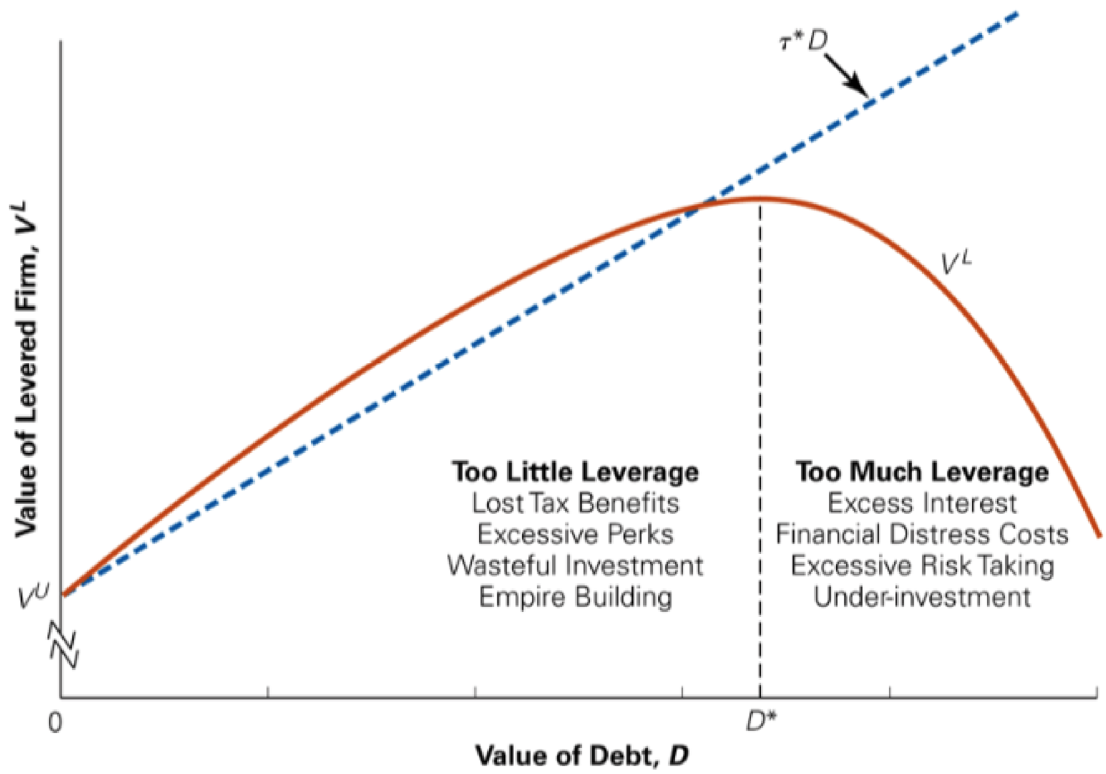


Table 2 Overview of the trade-off theory and optimal debt levels

2.5 Summing up and the application of the theoretical frameworks

In this chapter we have described the theoretical background and frameworks of this thesis. Its theoretical foundation largely stems from the strategy and management accounting fields. Theories on competition analysis and cost and profit drivers have been introduced.

When analysing the competition arena, a natural approach is to first consider the macro environment, and then take a closer look into the focal industry. In a macro environment analysis, the most relevant factors would be political, economic, social, technological, environmental and legal factors. For an in-depth analysis of the industry, the Porter´s five forces framework is widely acclaimed. It looks into how forces in an industry´s environment affect the intensity of competition and profitability. Porter´s five forces comprises of entry threats, threats from substitutes, power of suppliers and buyers and internal rivalry.

Within the strategic cost management field, several theories on cost and profit driver analysis may be used to analyse what causes costs and profits in a firm or industry. Among major contributors in this field, Porter, Riley and Cooper & Kaplan, the latter of which not introduced in this thesis, stand out. However, up to this day, there is no single and widely accepted theory of cost and profit drivers.

Chapter 3 - Methodology

In this chapter we shall present the methodology in our thesis. The approach of gathering data about the reality is called the methodology and it shall help us to describe the reality (Jacobsen, 2000). It is important that the result and the findings of the study are not affected by the chosen method. In order to ensure that the findings of the study correctly reflect the reality, we need to wisely choose the method used in the study.

The methodology is chosen to answer the problem statement of the thesis and the research questions in an orderly approach. The problem statement of the thesis is as follows:

What may explain variations in profitability in the current Norwegian salmon farming industry, and what will be important for the future profitability?

To answer this problem statement, five research questions have been formulated.

1. How is the competition environment in the Norwegian fish farming industry characterised by?
2. What profitability variations exist between Norwegian fish farming companies, and which areas of performance seem to be especially important for relative profitability?
3. Which factors may be of significant importance for the profitability of the Norwegian fish farming companies?
4. Which relationships exist between the characteristics of the salmon farming companies and their economic performances?
5. What will be important for future profitability in the salmon farming industry?

We start by presenting the object of study in this thesis and the design of the research, followed by evaluating the data material. Lastly, we discuss the research techniques and the limitations of the study.

3.1 The object of study: Norwegian salmon farming companies

The object of study in this thesis are salmon farming companies in Norway that were requested by and reported in their income statements and balance sheets to the Norwegian Directorate of Fisheries in the period 2009-2013. The questionnaire is sent out to companies on an annual basis. In addition, they had to report in operational figures such as the volume Atlantic salmon and rainbow trout harvested, the volume and value of fish feed in kilos, number of full-time equivalent employed, business location(s) and biomass of living and frozen fish in kilos and number.

The representability of the survey is high. The sample included all sorts of salmon farming companies, ranging from integrated to stand-alone companies and small, medium and large sized companies. In 2014, 119 salmon farming companies were requested to respond to the profitability survey for the previous year. 112 companies responded, however only 91 companies responded satisfactorily to the survey. They accounted for 688 licenses. All companies requested by the Directorate are obliged to respond the survey, but seven companies did not. Additionally, 15 other companies, which responded, were not included in the survey due to several reasons. Three of them did not have income or production that year. Another three had incomplete information, while five companies had a high share of other activities that disqualifies them as a salmon farming company. The last four companies were not included due to other circumstances, and all in all, 22 companies fell out of the survey. Note that the number of companies in our sample varies from year to year.

According to statistics from the Norwegian Directorate of Fisheries, there were 1018 licenses running in 2013, 7 of which were running inland production or research in the counties of Akershus, Hedmark, Oslo and Telemark (Norwegian Directorate of Fisheries, 2014). These licenses are excluded in the total relevant population of for-profit salmon farming companies, which in total consists of 1011 licenses. Our sample of 688 licenses therefore accounted for 68.1 per cent of the total relevant population in year 2013. A closer look at the data tells us that the same companies accounted for 72.9 per cent of total harvested Atlantic salmon and 99.8 per cent of all rainbow trout harvested (Norwegian Directorate of Fisheries, 2014). During the period of 2009-2013, there were 169 unique companies present in the data set at least once. If we only look at the period 2009-2012, there were 157 unique companies present. Note that the largest salmon farming company in the world, Marine Harvest, has not been included in the survey in the period.

As for the business location, we see that Hordaland County had the most licenses with 140, not including companies with licenses in several places. Nordland was on second place with 106 licenses.

Regions	In operation	Sample	Sample in %
National level	1 011	688	68.1
Finnmark	53	37	69.8
Troms	67	63	94.0
Nordland	106	90	84.9
Nord-Trøndelag	42	39	71.4
Sør-Trøndelag	16	10	62.5
Møre og Romsdal	36	23	63.9
Sogn og Fjordane	44	40	90.0
Hordaland	149	119	85.0
Rogaland og Agder	46	27	58.7
Several regions	461	249	54.0

Table 3 The geographical distribution of the salmon farming companies

3.2 The research design

The research design describes how to conduct a research to answer the problem statement of the thesis and achieve the objective of the research (Johannesen, Kristoffersen, & Tufte, 2004). The research design of the thesis can be described by looking into its *research approach, the objective of the research* and the *method of data collection.*

3.2.1 Research approach

Data collection is often divided into a *deductive* and *inductive approach.* A deductive research approach implies that the researcher based on theory approaches empirical evidence. Data is then collected to consider whether the expectations correspond to the reality. This approach has been criticised for encouraging the researcher to look for information that supports the initial expectations. If access to information is limited, there is a risk that meaningful information will be overlooked (Jacobsen, 2000).

An *inductive approach* implies the opposite. The researcher tries to look at the actual facts on the ground and then try to theorise it. Without prior expectations he or she starts to gather information, which is then systemised to formulate the theories. The limits of this approach is that human has bounded rationality to collect all information, and it is difficult to be entire open-minded (Jacobsen, 2000).

In this thesis we shall use a deductive research approach. Based upon theory, we try to explain what affects the economic performances among the Norwegian salmon farming companies. We have expectations about factors that may be important, and we then gather data to see whether the expectations coincide with reality.

3.2.2 The objective of the research

The type of research objective depends on the objective of the thesis. Often we separate between three types of research objectives: *explorative, descriptive* and *explanatory* objective (Gripsrud, Olsson, & Silkoset, 2010). The objective of this thesis is to explain variation in profitability among Norwegian salmon farming companies. Ideally an explanatory objective would be most favourable. Explanatory research tries to discover a relationship between a cause and an effect. Proving causality in what drives economic performance is difficult in many cases, and we can only look at the correlation, which can only give us an *indication* on possible important factors leading to profitability.

Since it is hard to map out the causal relationship, our study has an explorative and descriptive motive. Explorative motive is used in areas where prior knowledge is limited, and the main objective is to understand and interpret the relevant phenomena. Descriptive motives are used where we want to describe specific situations or objects in order to gain better insight (Gripsrud, Olsson, & Silkoset, 2010). E.g., looking into the relationship between two variables can be a descriptive motive. A thesis of such character is often limited to describe the situation given a certain time period (Jacobsen, 2000).

In research question 1, we analyse the competition among the salmon farming industry. This research question is mostly of descriptive motive, since we describe the current competition and slightly explorative since we try to make educated guesses on what will be the future trends. In research question 2, we look at the historic variation in profitability in the period of 2009-2013, which will be of descriptive character. In research question 3, we have both explorative and descriptive motives. We look at possible profitability factors and how they correlate with each other. The motive is exploratory since we analyse possible important factors, and descriptive since we look at the relationship between the factors. Research question 4 will have a descriptive motive since we try to identify and describe the relationship between the factors and profitability. Research question 5 is exploratory since we try to make educated guesses about the future.

3.2.3 Method of data collection

The data we have collected comes from three main sources. Our main source is from the profitability survey by the Norwegian Directorate of Fisheries (Norwegian Directorate of Fisheries, 2015). This source includes not only accounting data from a sample of salmon farming companies, but also some of their operational data, which is the reason why this data set is confidential.

Our second source is from the Centre for Applied Research at NHH (SNF), which has detailed accounting data about all Norwegian companies (SNF, 2014). From this source, we only have data from 2009 to 2012, which affected our data material for location and technology.

The third and last source is from Kontali Analyse, a private Norwegian analyst firm specialising in the salmon farming industry. This report is not free of charge and is subject to copyright (Kontali Analyse, 2014).

Most of the data in all three sources are quantitative, with some qualitative data regarding the operations of the company, mainly regarding factors such as location, workforce commitment to continuous improvements etc. Our data is exclusively secondary of nature, which means that the original data was collected by someone else (Johannesen, Kristoffersen, & Tufte, 2004). The sources in our thesis mainly come from annual financial reports, but also newspapers, reports and books.

3.3 Evaluating the data material

The quality of the data material can be evaluated according to three criteria; reliability, validity and whether the findings can be generalised. These terms are used when describing how well you measure a phenomena (Gripsrud, Olsson, & Silkoset, 2010).

3.3.1 Reliability

Reliability means how trustworthiness of a data material. It can be measures according to what data is used, how they are collected and how they have been processed (Johannesen, Kristoffersen, & Tufte, 2004)

The quantitative analysis of the thesis uses accounting data from the annual reports of the salmon farming companies. The figures have been revised by accountants and auditors, and can thus be considered reliable.

As for the quantitative and qualitative data on operational figures given by the companies to the Directorate of Fisheries, there is a risk that the companies give inaccurate or false data. Since the data is given to a government entity, the purpose is for research and the data is confidential, we see little risk for substantially inaccurate data. We thus consider them reliable.

The data used from Kontali Analyse is also mainly based on annual reports. The only information used, which is not in other sources, is qualitative data about whether a company is family owned or not. We thus also consider this source as reliable.

3.3.2 Validity

Validity in quantitative research is about how well one measures what you intend to measure. High reliability does not imply high validity. For example, you may measure something very precise, but something else than you originally wanted to measure. (Gripsrud, Olsson, & Silkoset, 2010).

Our objective in this thesis is to give an indication on what causes variation in profitability. We hereby specify that we want to give an indication on *long-term* variation in profitability. In the short term, all sorts of coincident, both within the firm and in the surroundings, may affect a company´s performance. We increase the validity by analysing over a long period of five years. Optimally, we would analyse over an even longer period, but the Norwegian Directorate of Fisheries changed their approach to measuring profitability in 2009 from an economic perspective to a commercial perspective, meaning that data from before 2008 is not comparable (Norwegian Directorate of Fisheries, 2015).

For some factors later in chapter 6, we have used some indicator proxies whose validity could be questioned. For the factor *technology,* we measure it by looking at value of research and development and patents as a share of total assets. For the factor *workforce commitment for continuous improvements,* we look at whether the companies are manager-owned, family-owned or owned by individuals as a proxy to workforce commitment. These factors are far from perfect, and can only be regarded as indicator proxies.

3.3.3 Is it generalizable?

Whether a study is generalizable means if the findings of the study could describe the same in other parts of the industry (Gripsrud, Olsson, & Silkoset, 2010). It is also known as external validity.

The findings will be generalizable to other parts of the Norwegian salmon farming industry. Our sample represents about 70 per cent of the whole industry and consists of all sorts of companies, ranging from individual to integrated companies, from small, medium sized enterprises to large companies. The number of companies is large enough, and the diversity of companies broad enough to be highly representative. The sample comes from all places in Norway that has commercial production of Atlantic salmon and rainbow trout. The findings will not be generalizable to salmon farming industries of other nations though, due to the large variation in input costs and technology.

3.4 Research techniques for the quantitative data material

3.4.1 Econometrics

In a controlled experiment, individuals are *randomly* assigned into different groups. The individuals may have unobserved traits which could affect the results, but as the groups are randomly assigned, the only *systematic* difference between the groups is how they are treated differently in the experiment.

When a controlled experiment would be too unrealistic, expensive or otherwise impossible to conduct, we have to use observational data. While data collected from the real world may be more realistic, we can never completely control the variation like in an experiment. This leads to violations of the assumptions of standard statistical models. The problems that this leads to, and the techniques for solving them, are the main focus of econometrics (Kennedy, 2008, p. 1).

In the case of this master thesis, it is difficult to imagine an experiment that would both be possible to execute, and which would realistically answer our questions about fish farming profitability. We will therefore use econometric methods to analyze observational data. To avoid confusion, we will consistently use the notation of Wooldridge (2014).

3.4.1.1 Multiple Regression

According to Greene (2008), linear regression is the most useful econometric tool. It is a good starting point, even if other methods are better suited to the data. A multiple linear regression model can be expressed as

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + u,$$

where y is the dependent variable, and $\beta_1, \ldots, \beta_k$ are the coefficients of the independent variables $x_1, \ldots, x_k$. u is the error term, or disturbance, and contains all the factors affecting y which are not included in the model. k is the number of independent, or explanatory, variables in the model.

The dependent variable y is what we are trying to explain. The independent variables are factors that the researcher, based on theory or intuitive reasoning, believes to have an effect on y.

3.4.1.2 The Classical Linear Model assumptions

This section will briefly describe the assumptions of the classical linear model.

CLM 1:

The relationship being modeled is linear *in the parameters.* That is, it can be written as

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + u.$$

There are no restrictions on the relationship between x or y from the model, and the actual variables we wish to investigate. For example, we can define y as the square of some observed variable, and x_1 as the log of some other variable. In this way, several nonlinear relationships fit into the model (Wooldridge, 2014, p. 71)

CLM 2:

We have a *random* sample of n observations from the population.

CLM 3:

There is no exact linear relationship between any of the independent variables.

CLM 4:
No perfect multicollinearity: For any value of the independent variables, the expected value of the error term u is zero.

CLM 5:
Homoskedasticity: The variance of the error term is the same for any value of the independent variables.

CLM 6:
The error term u is *normally distributed,* with expected value 0 and variance σ^2.

3.4.1.3 Estimators

After formulating a model, we use regression to estimate the parameters $\beta_1, \ldots, \beta_k$, the intercept β_0 and the error term u. The estimated model is denoted

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \cdots + \hat{\beta}_k x_k,$$

where $\hat{\beta}_1$ is an estimate of the true β_1, which is zero if factor x_1 does not affect y.

For each observation i, we can calculate a fitted value

$$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_k x_{ik},$$

and the differences $\hat{u}_i = y_i - \hat{y}_i$ are called the residuals.

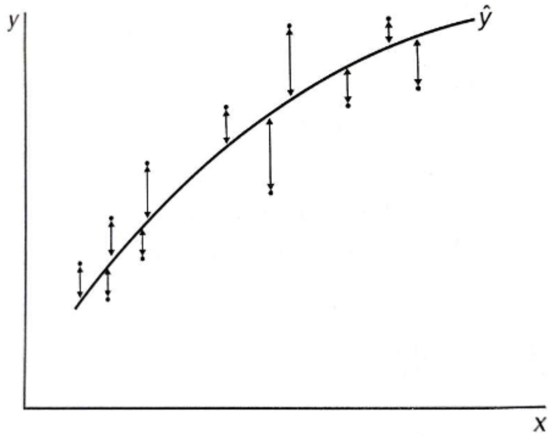


Figure 0-1: Regression line showing the estimated $\hat{y}$ for each x. The dots are actual observations, and the arrows indicate the residuals. (Kennedy, 2008, p. 12)

Performing a regression means estimating the parameters, by identifying the values that would minimize a *weighted sum* of the residuals. The chosen *estimator* determines how the residuals are weighted, thereby affecting the parameter values which would minimize the weighted sum.

Estimators can be considered “recipes” for making estimates from the data (Kennedy, 2008, p. 4). There is an infinite number of possible estimators, but only a few of them are routinely used. The estimators have different statistical properties, making them suitable for different data and situations.

3.4.1.4 Some criteria for estimators

There are several criteria for choosing between estimators. In this section, only the ones that will be used later are mentioned.

Unbiasedness means that the *expected* value of the estimated $\hat{\beta}$ is equal to the true parameter β (Kennedy, 2008, p. 16) If the sample collection could be repeated a large number of times, the average of the $\hat{\beta}$ estimates, or the *mean of the sampling distribution*, equals β if the estimator is unbiased.

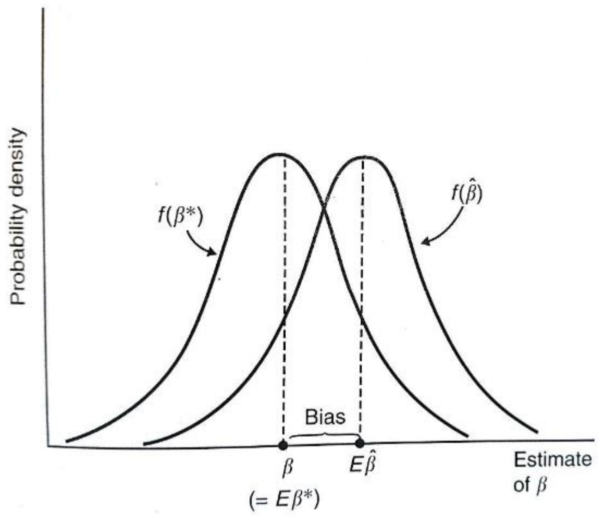


Figure 0-2: Sampling distributions of an unbiased estimator β^* and a biased estimator $\hat{\beta}$. (Kennedy, 2008, p. 15)

The term "best" means having the lowest variance among the estimators fulfilling some requirement or constraint.

Best Linear Unbiased Estimator, or BLUE, is a very popular criteria (Kennedy, 2008, p. 17). It is the linear, unbiased estimator with the lowest variance.

Ordinary Least Squares

According to Kennedy (2008, p. 13), Ordinary Least Squares is probably the most popular estimator for empirical work. The estimator emphasizes large deviations by squaring the residuals before adding them together. OLS is easy to understand, and easy to use. More importantly, it has some statistical advantages. Under CLM 1-5, known as the Gauss-Markov assumptions, OLS is the best linear unbiased estimator (Wooldridge, 2014, p. 134). Adding the final assumption of normally distributed error terms, OLS is the best among all unbiased estimators, not restricted to linear models.

3.4.1.5 Panel data

Cross-sectional data contain information about a group of units, or individuals, at a certain time. Time series data observe just one unit over several periods. Pooled cross-sections and panels both contain data for several units over several periods. While the units of an independently pooled cross-section are randomly selected each period, a panel data set follows the same individuals through time (Wooldridge, 2014, p. 360).

An advantage of panels, is that they contain more information. Unfortunately, they also bring additional problems. With data about the same individual in more than a period, there could be "unobserved effects", something that we cannot measure, but which affects the dependent variable. This can be solved by including dummy variables for each year and individual in the panel, and run a normal OLS regression (Wooldridge, 2014, p. 361). This method is simple, and is usually sufficient to remove the unobserved effect. A major drawback is that the many dummy variables can significantly reduce the degrees of freedom.

3.3.1.6 Fixed effect models

To create a fixed effect model, take the time mean of the equation for each individual in the regression model. The normal regression equation is then subtracted from the mean equation. Assuming that the unobserved effect is "fixed", that is, not correlated with the independent variables, the mean equation will equal the equation for each year, and the unobserved "fixed effect" will be gone. This accomplishes the same as the dummy variable method without making any dummy variables, saving degrees of freedom. A drawback is that dummy variables disappear. If the coefficient of a dummy variable is what you are looking for, this method will not be useful.

Throwing away data is inefficient, and if the unobserved effect is not correlated with the independent variable, it is not necessary. In this case a fixed effect model should be used instead.

Chapter 4 Competition analysis

This chapter shall explore the competition environment in the Norwegian fish farming industry by analysing the macro environment and the industry-specific competition forces. The objective of the competition analysis is to provide a wholly picture of the industry´s attractiveness or profitability. It will be the basis of further exploration of the performance in the industry.

We hereby try to answer research question no. 1 with subquestions.

1. How is the competition environment in the Norwegian fish farming industry characterised by?
    a. Which factors in the macro environment affects the fish farming industry?
    b. How do industry specific forces affect the intensity of competition?

In the first part, applying the PESTEL framework, we look at how the macro environment imposes conditions onto the industry. In the second part, we focus on industry specific conditions and its intensity of competition and profitability using the Porter´s framework and the five competition forces.

4.1 The macro environment of the fish farming environment

Norway is a small, open economy which means that development trends in the rest of the world has a great impact in the country. It is especially influenced by the European countries due to the proximity and the economic integration with them. We shall describe political, economic, social and technological factors in order to get an overview of the macro environment.

4.1.1 Political and legal factors

The political environment in Norway is stable and the government largely enjoys the legitimacy among the Norwegian population. It consistently scores high in terms of voice and accountability, political stability, governmental effectiveness, regulatory quality, rule of law and control of corruption (World Bank, 2014). A stable, reliable and fair political environment is vital for providing security for Norwegian companies, and it facilitates continuous operations and further investments.

The government affects the fish farming industry in a number of ways. First and foremost, it is the government who allocates the fishing quotas. Secondly, reflecting public sentiments, stricter regulatory requirements have been implemented in the fish farming industry to reduce and prevent environmental catastrophes. "Green salmon farming quotas" have also been allotted. This has lead to increased costs for the industry, which might force out the smaller players who cannot compete. Thirdly, government assists the industry in facilitating export and promoting Norwegian seafood across the world (NSC, 2014), mainly through Norwegian Seafood Counsel. Norwegian seafood is a prominent Norwegian export article and is vulnerable to trade wars, last seen being boycotted by the Russian Federation.

4.1.2 Economic factors

Norway has a strong economy and has remained largely unscathed from the financial crisis of 2008 and 2009. The unemployment rate is low compared to other countries. Projected GDP growth rate in Norway for 2014 and 2015 are 1.8 and 1.9% respectively (Central Statistics Bureau, 2015).

As domestic consumption only accounts for a small share of the total consumption,

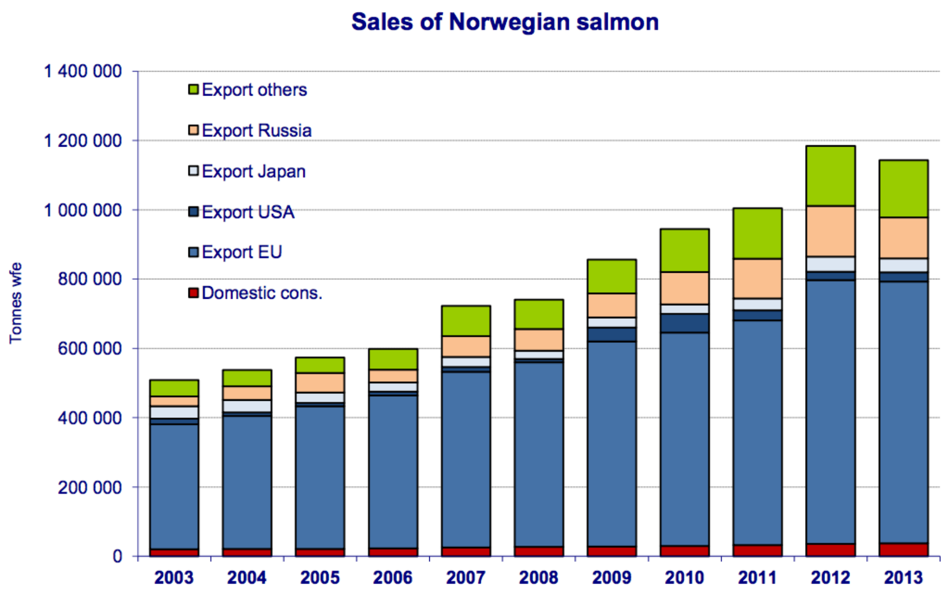


Figure 3 Sales of Norwegian Salmon

global economic factors influence the industry to a larger extent. While the EU and other advanced countries are now undergoing an economic downturn, rising demand from emerging economies may continue to increase the net consumption in the future. A strong Norwegian Krone (NOK) discourages foreign partners to buy, but as the oil price fall, and with it the interest rate and a devaluation of the NOK, one possible scenario is a weak NOK which favours the industry. Some Norwegian economists have speculated that the Norwegian economy peaked in the autumn 2014. Along with low interest rate, this additionally helps the industry as it is relatively capital intensive.

4.1.3 Social factors

There are social factors that will significantly affect the consumption pattern and labour costs into the future.

It is expected that the Norwegian population will be increasing over the next decades, partly due to immigration. Increased population means that the supply of labour rises, potentially decreasing the labour costs. Likewise, the global population is expected to grow strongly the next decades, which should increase the consumption of marine protein products. By 2050, the world population will grow to approximately 9.6 billion, according to UN estimates (UN, 2013). If the protein consumption per capita stays the same, this would imply a 40% increase in the demand for protein. However, the actual demand is increase more than the population as developing countries eat more protein per capita. At the same time, people are becoming more health and environment conscious. Fish has high content of high quality proteins, omega 3 and a wide range of vitamins and important minerals, such as iodine and selenium. It is also highly energy efficient to raise one kilo of fish compared to land-based animal. Fish do not spend energy keep themselves warm, as they are cold-blooded, nor do they have to use energy to stand upright in contrast to land-based animals. E.g., for every 100 kilos of feed spent, it will provide 57 kilo edible meat for fish, while this number is 4-10, 21 and 17 kilos for cattle, chicken and pork respectively. The feed conversion ratio, which tells us how many kilos of feed needed to increase the animal's bodyweight by one kg, is 4-10 for cattle, 2.2 for chicken, 3 for pork and only 1.2 for fish (MHG, 2014). These factors argue for a higher consumption of salmon and an upward price pressure for salmon, ceteris paribus. Increased population means that the supply of labour rises, potentially decreasing the labour costs.

On the other hand, Norway is facing an increasingly aging population, which may increase the labour costs in the future. By 2060, one of five Norwegian is 70 years old or older (SSB, 2014). Higher level of automation may compensate for increased labour, however. As for today, the farming process is relatively highly automated in Norway, while the value-added processing, such as cutting and packing is relatively labour intensive. As a consequence, many companies have outsourced the cutting and packing to abroad. This is likely to change in the future due to improved technology in cutting and packing processes, which we are already seeing (Nofima, 2014). This may lead to reshoring of these processes. Public sentiments on environment will likely lead to even stricter regulations in the future, driving the operating costs higher.

4.1.4 Technological factors

For the last decades, we have seen tremendous development in technology, which is only continuing at a faster pace. Norway has been in the forefront in farming fish, develop feed, vaccines and in other areas in the fish farming industry (Forskningsrådet, 2006)

The state supports innovation in the fish farming industry through the governmental organisation "Innovation Norway". Through an initiative called "Marine Value-creation Program", it assists companies that deliver technology and services to fishing, fish farming and value-added processing companies. In addition, it sends trainees to the largest fish consumer markets in order to improve the understanding of the markets.

To support and strengthen the Norwegian fish farming industry, SINTEF, the largest independent research organisation in Norway, founded CREATE, the Centre for Research-based Innovation in Aquaculture Technology. CREATE´s goal is to provide innovation and knowledge leading to a technology platform standing on three research pillars. First is the innovation in equipment and construction, which is the physical equipment used to farm fish. New cage materials, feeding systems and surveillance system are examples of this. Second is the process of executing and carrying out operations necessary to farm fish in a daily basis. This includes for example feeding time, feed amount and how to handle the fish. Third is the so-called farming intelligence, which represents a new area in fish farming. They believe that the future fish farms will collect digitalised information about everything related to the growth and welfare of the fish, which can be used to better understand the fish farming process and improve decision making in feeding (SINTEF, 2007).

The above-mentioned innovations aim to improve financial viability, fish welfare and biology, human health and safety, and environmental sustainability.

In addition, there are a number of company-specific initiatives. Marine Harvest Group and Botngaard are both experimenting with so-called enclosed fish cages. Some companies are experimenting with offshore cages, which would enable companies and countries without access to fjords and calm waters to produce salmon at open sea and stormy waters (NRK, 2013)

4.1.5 Summary of macro analysis

This subchapter has answered the subquestion 1.1: *Which factors in the macro environment affects the fish farming industry?* In the analysis, we have looked into political, economic, social and technological factors to get an overview on important features of the industry´s macro environment. It has shown that the political institutions of Norway hold legitimacy among the Norwegian and that the government has shapes the industry in several ways, namely by allocating quotas, deciding environmental standards and helps promoting the industry and improve/block market access. As for economic factors, though hard to predict, there are arguments that the NOK will remain at its level or weaken, while the interest rate is expected to remain low, both of which benefits the industry. The social factors tell us that the demand for fish will increase significantly, that both government and customers alike demand higher environmental and product quality, yet the industry may deliver that without sacrificing the profitability due to technology. The technological factors has shown us that there are many forces in place driving innovation in the fish farming industry precisely to reduce environmental impact, increase product quality and profitability from the industry themselves and the government. This is important for the industry to sustain the competitive advantage it possesses today.

4.2 Introduction of the Norwegian fish farming industry

Salmon is the widely used name for several species of fish of the Salmonidae family. It includes both fish species with the name salmon, e.g. Atlantic salmon and Pacific salmon, while other species are called trout, e.g. rainbow trout (Norw: *regnbueørret*). Salmons thrive in low temperatures, which is why countries with cold seawater, such as Norway and Chile, dominate the industry.

The history of land-based fish farming stretches many thousands years back. It was during the 1960´s the Vik brothers in Sykkelven, Norway discovered that the rainbow trout could gradually be accustomed to salt water. In 1969, the Grøntvedt brothers of Hitra, Norway released salmon smolt into fish cages (Norw: *merd*), which they invented. This was the start of the sea-based fish-farming industry, which has grown to a multi-billion kroner industry today (SNL, 2014).

The value chain process is illustrated below.

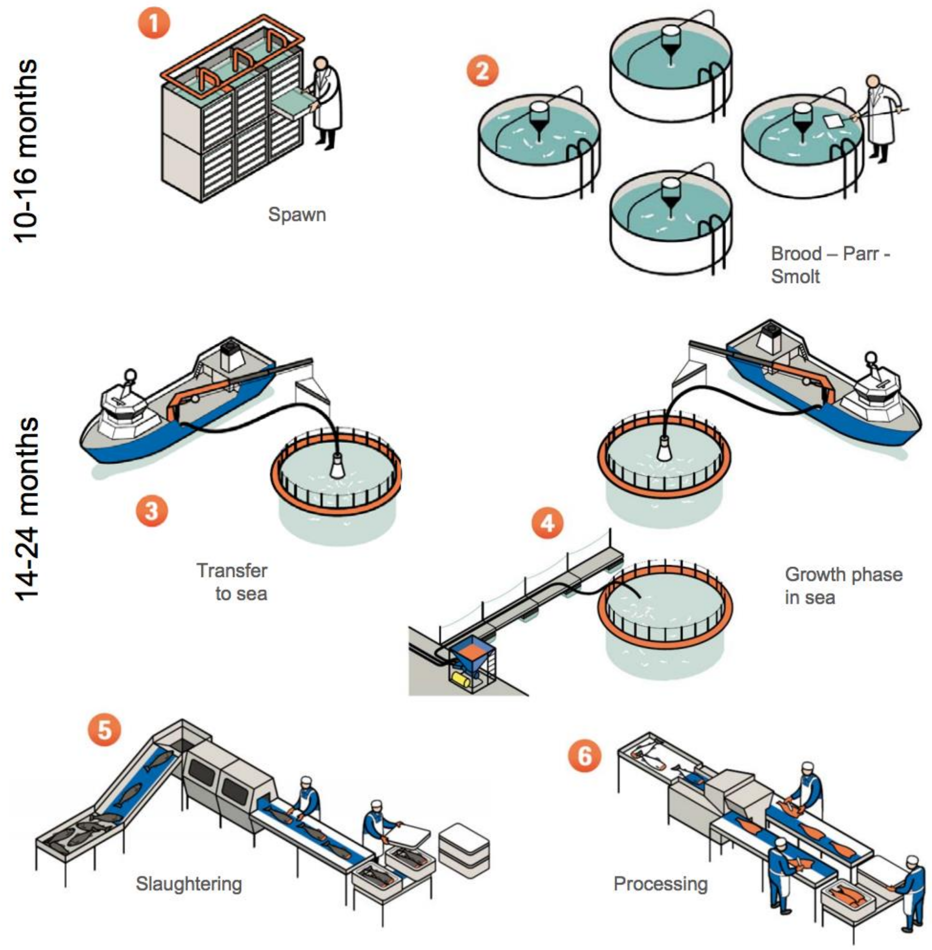


Figure 4 The value chain process of the salmon industry (MHG, 2014)

First, the brood fish are stripped for eggs, which then grows to smolt for about 10-16 months in fresh water. Afterwards, the smolt is transferred to the fish cages and seawater for further growth. After additional 14-24 months, the fish is ready for harvesting. In total, the production process varies from between 24-40 months, depending on sea temperature and desired weight of fish.

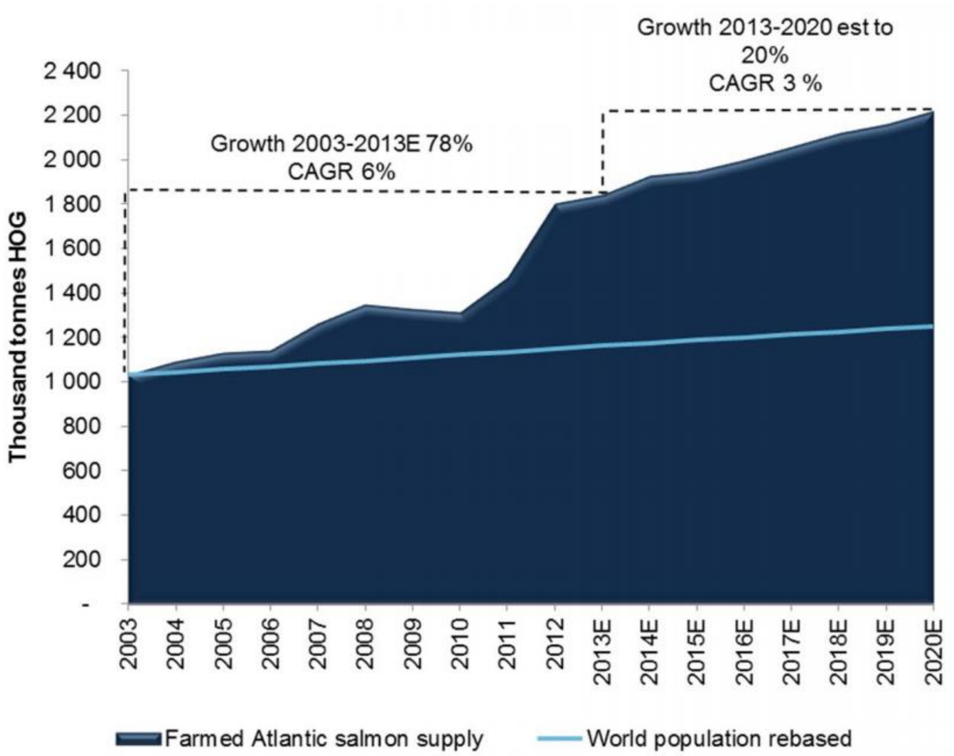


Figure 5 Global historic and forecasted production of Atlantic salmon (MHG, 2014)

The world harvest quantity of Atlantic salmon has increased steadily by 6% annually in the period from 2004 to the estimated volume of 2014 (Kontali, 2014). Analysts expect diminishing growth rate however, to 3% annually from 2013 to 2020. This is due to biological limits as production volume increase, the negative environmental impacts increase even more, which must be internalised by the industry (Kontali, 2014).

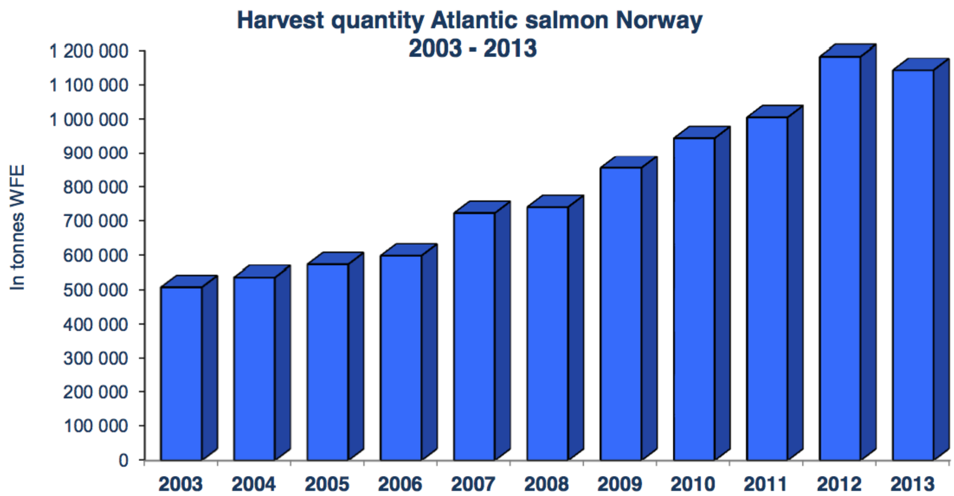


Figure 6 Harvest quantity of Norwegian Atlantic Salmon in wfe

In 2013, the harvest volume of Atlantic salmon was ca. 1 143 700 tonnes whole fish equivalents (wfe), which was a decrease of 39 500 tonnes (wfe) form the year before. Unfavourable growth conditions were blamed for this decrease. For trout, the figure was 73 900 tonnes (wfe) in 2013, which was almost the same as in 2012, giving a total harvest figure on salmonoids at 1 218 000 tonnes (wfe) in 2013, which was a decrease of around 39 400 tonnes (wfe) compared to 2012.

The Norwegian salmon is sold across the world (cf. figure 3). Approximately 66% of the salmon was exported to the EU market in 2013. Domestic consumption only accounted for about 3% of domestic production.

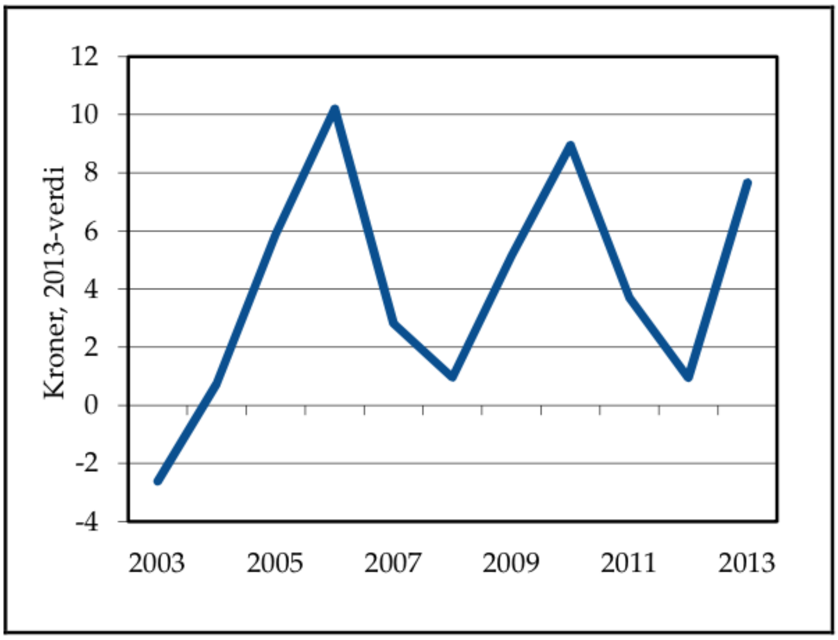


Figure 7 Average profit in NOK per kilo harvested (Norwegian Directorate of Fisheries, 2014)

Salmon is traded on the international market and the price has varied significantly the last years. Above table shows the average profit per kilo harvested for the Norwegian companies. In 2012, experts were predicting that the golden era of 2010 and 2011 had passed, and that we were going to see a market price below the ca. NOK 25/kg break-even price for Norwegian fish farming companies. This prediction was based on the fact that the Chilean fish farming companies were recovering themselves from the mass epidemic in 2007-2008, which almost wiped out the Chilean production (DN, 2011). However, the prediction was inaccurate, and in 2013, the weighted average price reached a new record of NOK 38.97, which was an increase of NOK 12.82 per kg compared to 2012.

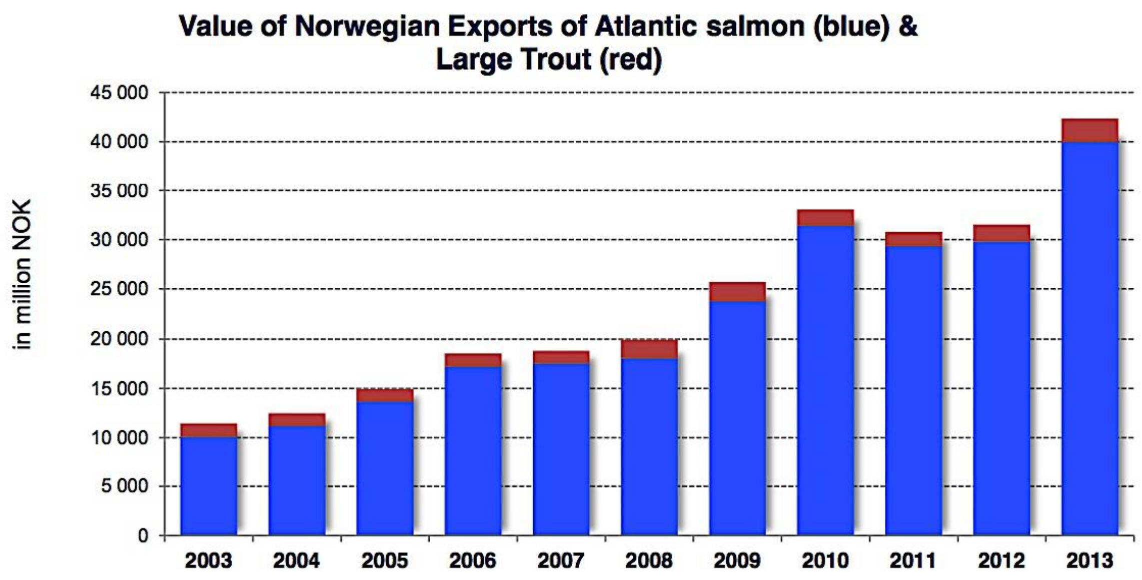
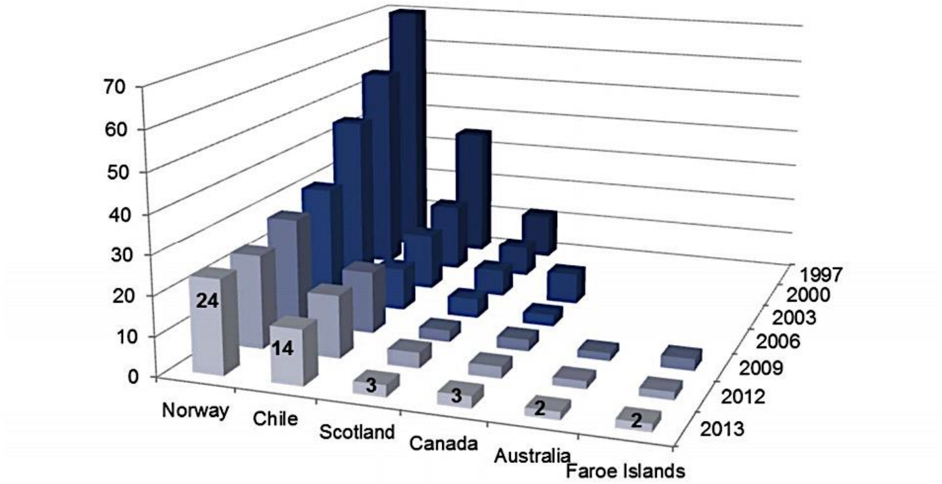


Figure 8 Value of Norwegian Exports of Atlantic salmon and large trout

The total export value of Atlantic salmon and trout from Norway was NOK 40 billion and 2.4 billion respectively in 2013. This was an increase of about 10.2 billion (+34%) and 0.7 billion (+38%) respectively, although the export volume fell by 4% for salmon and only increased by 1% for trout. Record high prices explain this increase in export value.

4.3 Definition of market

In this thesis, we cover the industry with data supplied by the Norwegian Directorate of Fisheries. There is an on-going trend of consolidation in this industry. In 2002, there were 114 companies running less than six concessions, while in 2013 this number had fallen to 63. (Kontali, 2014)



The graph shows number of players producing 80% of the farmed salmon and trout in each major producing country.

Figure 9 Global consolidation trend 1997-2013

The consolidation trend is not unique to Norway and we see the same trend in other large fish farming nations. (Kontali, 2014)

4.4 Industry Analysis

The Porter´s five forces industry analysis is useful for mapping out the important conditions for the profitability of an industry. In order to describe the profitability and intensity of competition in the Norwegian fish farming industry, we shall analyse the five competition forces in the fish farming industry. In addition, it outlines the current trends in the industry to comment on the future profitability.

4.4.1 Threat of entrants

Consistently delivering higher return than expected will attract newcomers to the industry. Historically, the fish farming industry has enjoyed high profits although the price has fluctuated significantly from time to time.

Potential entrants to the fish farming industry are companies, which wish to establish themselves in the Norwegian fish farming. They may be companies from other industries or foreign companies not yet established in Norway.

In Norway, fish farming companies are under strict regulations. The two most important laws regulating the industry are the "The Aquaculture Act" of 17 June 2005 and "The Food Safety Act" of 19 December 2003. There are two types of salmon farming licenses - one in fresh water for smolt/fingerling production and one in the seawater. In contrast to the fresh water licenses, seawater licenses are limited in number and only awarded by the Norwegian Ministry of Trade, Industry and Fisheries and administered by the Directorate of Fisheries in limited years. The licenses last in perpetuity unless the company does not uphold its responsibilities, in which the government has the right to withdraw the license (Lovdata, 2005).

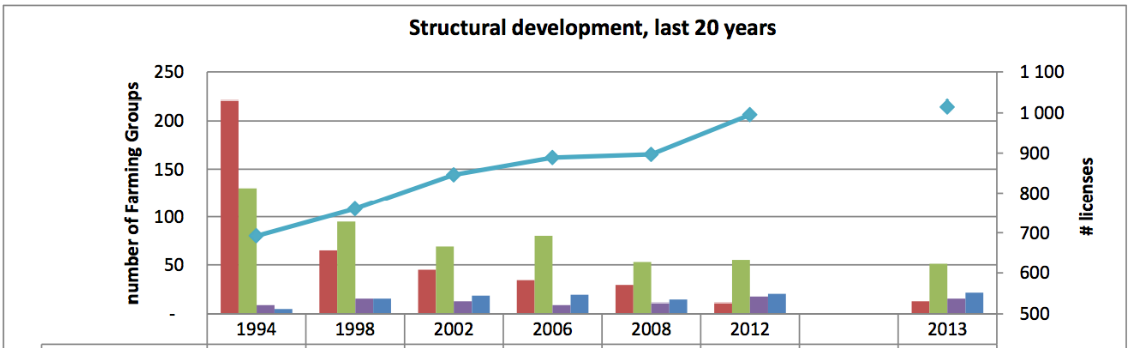
In order to be eligible to own and run a fish farming company, you must own one or more fishing licenses. One can either buy new licenses or second-hand licenses. For the latest batch of licenses, so-called "green licenses", it costed NOK 10 million per license for the fixed price licenses. 45 green licenses were announced in 2013 and required higher environmental standards in the production. For the closed auction green licenses, the price went up to NOK 55-66 million, which reflected more of the market price (DN, 2014). For the second-hand market, the price of the licenses is somewhere between NOK 40-60 million (MHG, 2014).

In addition, there are heavy capital expenditures in equipment. Marine Harvest´s industry book mentions NOK 30-35 million as an estimate for a production site consisting of four licenses to NOK 40-60 million each. It also mentions the existence of economies of scale and up to NOK 75 million in working capital assuming NOK 32 in sales price. The larger companies also have access to raw materials such as fish and smolt cheaper than the smaller players. There is, however, little product differentiation as the companies basically sell the same products. Large, fully vertical integrated companies also have an advantage in securing raw materials and capacity in slaughterhouses compared to newcomers.

Threat of entry from domestic companies is rather low due to high entry barriers, and the industry is heavily knowledge-based. However, this knowledge can be purchased given enough capital. One should not disregard future competition from large foreign players. As an example, Mitsubishi Corporation acquired Cermaq ASA in October 2014 (Bloomberg, 2014). One should also not disregard the competition from fish farming in other countries, notably Chile.

4.4.2 Internal rivalry

A strong threat against industry attractiveness is the companies themselves. A fierce competition among the players may slash the profitability for the whole industry. The seller concentration, diversity of competitors, product differentiation and exit barriers determines the threat from the internal rivalry.



	1994	1998	2002	2006	2008	2012		2013
1 license	221	65	45	34	29	11		12
2-5 licenses	130	95	69	80	53	55		51
6-10 licenses	9	15	12	9	11	17		15
>10 licenses	5	15	18	19	14	20		21
Total Licenses	692	760	846	889	897	996		1 015

Table 4 Structural development in licenses

The last two decades have seen a consolidation trend. Five companies were running ten or more licenses, in total ca. 75 licenses, 20 years ago. In 2013, this figure was 21, controlling 736 licenses in total (Kontali, 2014). The remaining 78 companies controlled 279 licenses, about 28% of the licenses. Although the industry is relatively consolidated, there still are enough companies to provide effective competition.

The diversity among competitors is rather low. The companies are similar to each other in terms of origin and costs, which does not encourage to more intense competition.

The degree of product differentiation is still low. They all sell a generic product and there is little focus on trying to differentiate and brand building. Some companies have tried to build brands to differentiate themselves, however. An example of this is Marine Harvest´s Mowi brand in Japan, whose advertisement video created some controversies in autumn 2014 (Aftenposten, 2014). Another example is Salma, which has focused on selling a high quality Atlantic salmon to higher prices. Most fish farming companies, however, try not to differentiate themselves, but rather hinges on the general "Norwegian salmon" brand which has a positive association in the foreign market. This brand, promoted by the Norwegian Seafood Council, is well-established and free to use. The companies that are not vertically integrated would sell their fish to a slaughterhouse, which is then labelled under the value-added processing or export company´s brand.

There should be few exit barriers of importance. The biggest assets in a fish farming company, mainly facility, fish and license, can be sold without difficulties and even the companies themselves are attractive targets.

In longer term, increased production and competition from other countries, notably Chile, may lead to reduced prices. High cost producers in Norway may suffer greatly and even go out of business.

At current circumstances, we assume low to moderate threat from internal rivalry, as high demand, high prices, little product differentiation and low exit barriers argues for low threat. However, this may be changed when other parts of the world increase their production, which would press the price down, hurting Norwegian companies. In order to survive, the companies would have to differentiate themselves and create brands. The large, vertically integrated companies would have an advantage in this compared to the small fish farming companies.

4.4.2 Threat of substitutes

The threat from substitutes derives from products that can cover the customer´s needs in the same way as the focal product to a reasonable price. The existence of close substitutes may pressure the profitability in the industry.

In order to identify the potential substitutes, we must define the focal products and market. The focal products are Norwegian, Atlantic salmon and rainbow trout sold in the global market. The closest substitutes will then be Atlantic salmon and rainbow trout produced in other countries, and other farmed salmonoids like the Coho and Chinook (MHG, 2014). Other substitutes include other fish species and other types of lean meat, such as chicken and pork. In the longer term, we might see salmonoids farmed in land-based or enclosed farms as substitutes to current sea-based cage farming.

Historically, Norwegian salmon has mainly exported to EU, Russia and Asia (MHG, 2014). In 2012 and 2013, fresh salmon fish and filet accounted for about 90% of the export quantity and value in Norway (Norwegian Directorate of Fisheries, 2014). In the European market for fresh fish and filet, Norway competes with Scotland and

Faroe Islands, since long distances and prohibitive transportation costs make it unprofitable for the larger salmon nations such as Chile to compete in the European market. However, Chile does export frozen fish globally, which is a substitute to fresh salmon, thereby pushing fresh salmon prices downward. The frozen salmon category, however, is generally declining in importance (MHG, 2014).

In other markets with transportation costs not particularly favouring one nation from another, Norwegian salmon is competing directly with other countries to a larger extent. For example in Asia, the market is generally shared by all major producers as the costs are similar (MHG, 2014). We disregard trout here, as the value is more or less negligible compared to Atlantic salmon.

The threat from other salmonoids is assumed to be low. Chinook is produced in small volumes and most of it is consumed locally. Other species are more suited for salted fish (MHG, 2014). We do not expect the production and fishing of other salmonoids to increase greatly. In short to medium term, increased production of Atlantic salmon in other countries is also not expected to increase greatly, apart from Chilean production. In addition, Norwegian fish farming companies, notably Marine Harvest, have acquired foreign companies, which means that they have some control of foreign production as well. Taking a longer perspective, improved technology that allows fish farming at open sea, may enable countries without fjords and calm seas to compete directly with Norwegian companies.

As for other types meat, such as chicken and pork, there are strong economic and environmental arguments for salmon. As mentioned in social factors in the PEST analysis, salmon farming is an efficient way of producing proteins while bringing other health benefits such as omega 3 fat acids.

The threat from substitutes is overall considered low.

4.4.4 Threat of suppliers

The bargaining power of the suppliers is mainly determined by the seller concentration, the differentiability of their products and their importance relative to the focal industry.

The fish farming industry mainly requires four products and services, namely smolt, feed, equipment and shipping services. We shall focus on the first two products, smolt and fish.

Historically, the smolt industry has not faced the same consolidation trend as the fish farming industry. It is still rather fragmented with many independent producers who depend on spot deliveries and short-term contracts. However, currently the trend is increased vertical integration and capacity expansion in order to secure supply (Kontali, 2014). In 2012, there were 148 smolt producers, with the largest ones producing over one thousand tonnes biomass, and the smallest ones producing less than ten tonnes (Norwegian Directorate of Fisheries, 2014). The supply of smolt depends on the available roes, which is fixed in the short term. Therefore, its bargaining power depends somewhat on the business cycles. When there are high salmon prices, the smolt producers wish to increase the supply, and may demand a higher price as the supply is inflexible in the short term.

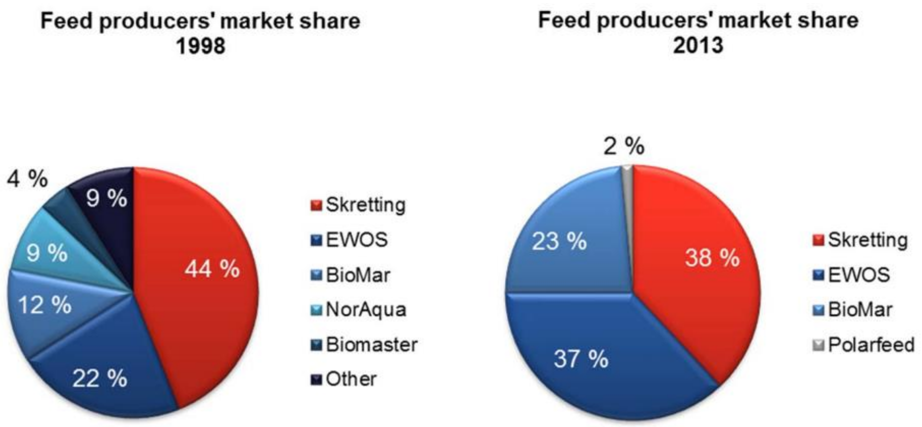


Figure 10 Consolidation of feed producers 1998-2013 (MHG, 2014)

While the smolt industry is fragmented, the salmon feed producers are not. Since 2008, there are essentially three producers of salmonid feed - Biomar, Skretting and EWOS, all of them having global presence. Historically, they have operated on cost-plus contracts, which leaves the risk of increased raw material prices to the fish farming companies (MHG, 2014). In terms of differentiability, fish feed is a relatively homogenous product with low switching costs for the fish farming companies. The relationship between the feed and fish farming industries are based on mutual dependency. Fish feed is important for the fish farming industry, yet the fish feed has no real alternative usage other than being sold to the fish farming companies.

The large fish farming companies enter into long-term contracts, which secure them years of supply to advantageous price and conditions. An example would be the close relationship between Marine Harvest and BioMar (Biomar, 2010). Both parties seem to be somewhat balanced in terms of bargaining power. The last decades, however, we have seen an increasing rate of integration, both horizontal and vertical. The fish farming companies´ rationale is to secure supply and to avoid too volatile price fluctuation, which can also be perceived as prevent the suppliers getting too much power.

Overall, we consider the suppliers having moderate bargaining power.

4.4.5 Threat of customers

The bargaining power of the customers is determined by factors analogous to the threat of suppliers.

This threat is marginal compared to the other forces. The buyers are hundreds or thousands of various customers of different sizes across the world. Apart from the possible exception of the largest retail chains in Europe, most of the customers possess little or no bargaining power. The large fish farming companies are vertically integrated and possess their own export companies, which means that they do not have to depend on external companies to sell to the global market and the thousands of buyers. The small independent fish farming companies and their buyers, i.e. slaughterhouses and the export companies, take the price as given. Hence, the customers cannot bargain the price to a large degree. Salmon is traded in the free market with market prices easily available from the salmon bourse *Fishpool* headquartered in Bergen, Norway.

Hence, we consider the bargaining power of the customers to be low.

4.4.5 Conclusion of industry analysis

We can now answer subquestion 1.2: *How is the intensity of competition affected by industry specific forces?*

The threats from entrants, substitutes and customers have been assessed as low, while the threats from internal rivalry is low to moderate and the threat from the suppliers is moderate. Overall, the intensity of competition is stretching from low to medium.

Since the intensity of competition is not fierce, the fish farming industry can expect a rather high potential profitability of the average firm in the industry. Regulated supply and trends in consumer demands argue for high potential profitability in short to medium term.

In reality, the fish farming industry has generally enjoyed high profitability the last decades. To illustrate, for the last twelve years, the large fish farming companies in Norway had 13.8 per cent in operating margin (Kontali Analyse, 2014). In the long term, we might see stronger threats to profitability due to foreign acquisition, new technology enabling other countries to produce, optimised production from Chile and suppliers demanding a better deal. Reduced profitability may then spur a differentiation and branding trend to a larger extent, which would especially affect the smaller players.

4.5 Conclusion competition analysis

We can now answer the research question 1: *How is the competition environment in the Norwegian fish farming industry characterised by?* In the competition analysis of the fish farming industry we covered the macro environment and the intensity of competition in the industry. The PEST analysis gave us arguments for continued low interest rates and a peaked currency value, both of which benefit the industry. Social factors tell us that the demand for salmon and environmental and product quality will increase. Improved technology, supported by both governmental and private enterprises, is a driving force for sustained competitive advantage for the Norwegian fish farming industry. It is necessary to keep the costs down while satisfying higher environmental and product requirements.

The intensity of competition in the fish farming industry is not fierce, as there are high entry barriers, high prices and low product differentiation among other factors. This indicates a good profitability. In the future, increased foreign competition, from participation in the Norway and from increased production in foreign countries, may push the profitability in the industry down.

Chapter 5 - the profitability of the fish farming companies

The competition analysis from the last chapter indicates that the industry is quite profitable. In this chapter, we will investigate the variation of profitability among our sample of over 90 fish farming companies. Using the financial reports of the companies, as given by the Norwegian Directorate of Fisheries, we shall describe the variation in profitability and the relative performance of the companies in the period 2009-2013.

In this chapter, we try to answer research question 2 with subquestions:

2. What profitability variations exist between Norwegian fish farming companies, and which areas of performance seem to be especially important for relative profitability?

2.1 Which elements in the income statements of the fish farming companies are of particular importance?
2.2 In the performance figures between 2009-2013, what trend and variation can be observed?
2.3 Which companies are the most profitable?

First, we will describe the general elements in the income statements and the balance sheets of the fish farming companies, while later how and why we choose to *normalise* the income statements. We then perform a *Common Size analysis* to show the income statement of the average fish farming company, before we present and analyse different key performance figures. Finally, we will look at the correlation between the key figures and which fish farming companies are the most profitable.

5.1 The main elements of the balance sheet and income statement

5.1.1 The balance sheets of the fish farming companies

	Median	Min	Max	Mean
Intangible fixed assets	11.23%	0.00%	54.38%	15.11%
Land, buildings and other real property	0.86%	0.00%	33.37%	3.96%
Fish farming equipment	12.54%	0.00%	31.58%	12.93%
Operating equipment	0.69%	0.00%	12.08%	1.64%

Total tangible fixed assets	17.55%	0.00%	39.31%	18.53%
Financial fixed assets	1.91%	0.00%	48.65%	7.35%
Total fixed assets	36.80%	2.41%	64.47%	41.00%
Stocks	39.25%	0.00%	93.07%	33.77%
Receivables	14.09%	1.77%	80.74%	21.32%
Bank deposits, cash at bank etc	2.00%	-4.81%	67.70%	3.92%
Current assets	63.20%	35.53%	97.59%	59.00%
Total assets	100.00%	100.00%	100.00%	100.00%
Equity	42.32%	4.82%	90.37%	37.04%
Provisions for liabilities and charges	10.05%	0.00%	20.34%	9.62%
Other long-term liabilities	15.75%	0.00%	60.25%	22.46%
Current liabilities	28.45%	6.76%	78.27%	30.89%
Total liabilities	57.68%	9.63%	95.18%	62.96%
Total equity and liabilities	100.00%	100.00%	100.00%	100.00%

Table 5 The composition of the balance sheet for the average salmon company

Drawing from a sample of 169 companies, we describe the balance composition of the average company in the industry. On the *financial side* of the balance sheet, the main elements are equity, provisions, other non-current liabilities and current liabilities.

The main elements of the *asset side* are *total fixed assets*, which consists of intangible fixed assets, total tangible fixed assets and financial fixed assets, and *total current assets*, which consists of inventories, receivables and investments, and cash and cash equivalents.

Intangible fixed assets consists of concessions, patents and licenses, deferred tax asset and goodwill. The value of intangible fixed assets is not negligible, and for some companies it is significant. For Marine Harvest ASA, intangible fixed assets accounted for almost 18 per cent of total assets (forvalt.no). Fishing licenses, patents and customers´ goodwill towards the company brand are included in this asset class.

Total tangible fixed assets consist of land, buildings and other real property, fish farming equipment and boats, fixtures and fittings, tools, office machinery and similar assets.

5.1.2 The income statements of the fish farming companies

The first elements in the income statement are the sales revenues from salmon, rainbow trout, insurance payment, other ordinary revenues, which gives the total operating income. The next are the operating expenses, which consists of the costs of smolt, fish feed, fish insurance, slaughter and freight cost, changes in stocks of growing fish and products, payroll expenses, depreciation of intangible fixed assets, depreciation of tangible assets, costs from other business units (e.g. costs incurred from slaughterhouse or smolt production) and other operating expenses. The difference between the total operating income and total operating expenses gives us the operating result, which is the same as earnings before interest, tax, depreciation and amortization (EBITDA) since non-operating income is not included in the operating result.

Financial income and financial expenses follow the operating income, in which the two former is aggregated to net financial expenses. Finally, the last element in the profit and loss account is the ordinary result before tax.

G.3.2. Profit and loss account

Sales revenues of salmon	NOK
Sales revenues of rainbow trout	NOK
Compensations	NOK
Other ordinary earnings	NOK
Operating revenues	NOK
Smolt costs	NOK
Feeding costs	NOK
Insurance costs (fish)	NOK
Slaughter costs and freight charges	NOK
Changes in stocks	NOK
Wages and salaries	NOK
Depreciation of intangible fixed assets	NOK
Depreciation of tangible fixed assets	NOK
Costs not related to production of fish	NOK
Other operating expenses	NOK
Operational expenditure	**NOK**
Operating profit	**NOK**
Financial revenues	NOK
Financial expenses	NOK
Result of financial items	**NOK**
Profit on ord. activities before taxation	**NOK**

Table 6 The main elements in the income statement (profit and loss account) for a typical salmon farming company (Norwegian Directorate of Fisheries, 2014)

5.2 To include or exclude certain elements in the income statement?

There are arguments both for and against why we should exclude some elements in the income statement. It is the long-lasting profitability related to the normal activities and the core operations we wish to study. Including some elements might then be misleading for our analysis. By *normalising* the income statement, we adjust it for random, single or irrelevant events that affect the results. Normalisation can help us to predict future results in a reliable way (Sverre & Pettersen, 2012).

Firstly, different companies may choose different valuation method. According to Norwegian accounting standards, a company should value its stock to the lowest value of historical cost or market value. Unlisted companies may choose to follow Norwegian or international standards. When different companies use different accounting standards, it may prompt us to exclude some elements in order to provide a better picture.

Secondly, the element may be affected by volatility and external circumstances. This might lead to extreme results for the company, which in reality has little to do with its core operations.

Thirdly, an argument against excluding some elements is that it would punish, in the pretext of giving a more correct picture, some companies in which the elements are relatively more important. It would thereby give a misleading picture.

An alternative to normalisation would be to extend the time horizon. We would then capture more of the differences over time.

5.2.1 Changes in stocks of growing fish and products

Listed companies in Norway are required to value its stock according to International Financial Reporting Standards (IFRS) in order to be comparable for international investors. According to IFRS and International Accounting Standards 41 (IAS41) regarding agriculture, the fish farming companies must value its biomass according to market value, not historic cost. However, there is an industry norm among the large, listed companies to exclude the fair value adjustment of the biomass when presenting the financial result to the public. This is to prevent salmon price fluctuations to confuse the real result of the operations for the period. Fair value adjustment of the biomass has no actual cash flow effect. It is volatile and influenced by external factors not controlled by the companies.

There are further arguments for excluding the element changes in stocks of growing fish and products. One, different companies may use different valuation principle. Listed companies must use IFRS standards, which require them to value the fish to spot prices, while unlisted companies may value the biomass to historical cost (BDO, 2015). However, changes in stocks of growing fish and products are not equal to the fair value adjustment of the biomass, although they are related. Since we have data for five years, which covers several production cycles, we do not need to exclude the fair value adjustment of the biomass. We therefore keep this element.

5.2.2 Exclude slaughter and freight charges?

The biggest salmon farming companies have integrated slaughterhouses and shipping and some of the companies report the slaughter and freight costs in the financial reports of the farming companies. Since most companies do not have in-house slaughter or shipping, should we exclude this element from the common size analysis for normalisation purposes? If we include the slaughter and freight costs only for some companies, it might give a distorted view of reality.

However, those companies that do not report slaughter charges, for example those that sell fish directly from the facilities pay for the slaughter charges indirectly by taking a lower price for the fish. Additionally, different companies are likely to have different degree of in-house slaughtering; some of them may partly outsource the slaughtering. These circumstances make it difficult to see the true situation clearly for the companies that do not report slaughter costs. We therefore choose to include the element slaughter and freight charges.

5.2.3 *Exclude the element* costs not related to production of fish?

The element *costs not related to production of fish* refers to the costs that cannot be traced to the Atlantic salmon and rainbow trout production, for example costs related to operating a slaughterhouse or a hatchery. Note that some companies will be classified as a hatchery company and not a salmon farming company if the income from the hatchery activity exceeds 30 per cent. The costs from the hatchery will then be reported under costs not related to production of fish.

These costs are related to other operating revenues. The Norwegian Directorate of Fisheries mentions that in some companies, other operating revenues not only consists of other fish species like halibut, but also the sale of hatched salmon. These revenues would then be related to these costs not related to production of fish. Later in our analysis, we want to analyse the impact of having a broader product scope on the company´s performance. This would be an argument against excluding these costs from the common size analysis.

The element *other operating expenses* may also include costs that cannot be traced to the production of Atlantic salmon and rainbow trout. The reason is the difficulty of distinguishing and separating all the related costs to the non-fish related activity.

Overall, we conclude that the exclusion of these costs would *not* give us a standard, normalised view of the fish farming companies in our sample. We need this information to compare the other operating revenues, and we therefore choose to keep these costs in the common size analysis.

5.2.4 Conclusion

We choose to include all three elements. The first one we choose to include, changes in stocks of growing fish and products, is mainly due lack of accurate data about the fair value adjustment of the biomass. Additionally, we do not need to exclude it since we have data for sufficiently long period.

We chose to keep the element slaughter and freight costs since for companies that do not slaughter or ship themselves have this cost incorporated in the selling price. There also seems to be varying proportion of in-house and outsourced slaughter and shipping. The decision whether to slaughter and ship yourself is not necessarily a question about whether to outsource completely or not, but in many cases to which degree. This is indicated by the large variance in relative slaughter and freight costs.

Lastly, we chose to include the costs not related to the production of fish since later we want to analyse the effect of other operating revenues.

5.3 Common size analysis

A common size analysis is useful in describing which elements in the financial report is especially important for the profitability of the fish farming companies. The importance of each element is shown as a percentage of the total assets less non-interest bearing liabilities, which is also known as return on capital employed.

Investors attach importance to the profitability relative to their investments, and we therefore use return on capital employed. Below is the average company´s profit and loss account as a percentage of the total capital employed in the period 2009-2013. The variation between the companies is represented by simple maximum and minimum observation during the corresponding period. Be aware that the goal of a common size analysis is to give an indication, not an exact picture on profitability. A high maximum value may very well be due to an old company that has depreciated much of its assets over the years, reducing the denominator and increasing the return of capital employed.

Common size analysis

	median	min	max	mean
Sales revenues of salmon	79,8 %	0,0 %	163,7 %	65,8 %
Sales revenues of rainbow trout	0,0 %	0,0 %	157,8 %	4,9 %
Compensations	0,0 %	0,0 %	3,3 %	0,1 %
Other ordinary earnings	0,5 %	0,0 %	26,3 %	3,7 %
Total operating revenues	85,5 %	28,3 %	164,5 %	74,5 %
Smolt costs	7,7 %	0,0 %	23,0 %	5,6 %
Feeding costs	33,4 %	9,1 %	60,8 %	27,3 %
Insurance costs (fish)	0,4 %	0,0 %	1,2 %	0,3 %
Slaughter cost and freight charges	7,8 %	0,0 %	18,2 %	6,7 %
Changes in stocks	3,2 %	-58,2 %	26,3 %	2,7 %
Wages and salaries	4,3 %	0,7 %	12,2 %	4,2 %
Depreciation of intangible fixed assets	0,0 %	-0,5 %	0,0 %	0,0 %
Depreciation of tangible fixed assets	3,0 %	0,0 %	5,7 %	2,9 %
Writedowns	0,0 %	0,0 %	1,2 %	0,0 %
Costs not related to production of fish	0,0 %	0,0 %	9,3 %	1,2 %
Other operating expenses	10,0 %	1,9 %	34,3 %	11,5 %
Total operational expenditure	65,8 %	22,6 %	136,7 %	57,1 %
Operating profit	18,4 %	-2,8 %	57,3 %	17,4 %

Financial revenues	0,5 %	0,0 %	12,0 %	0,9 %
Financial expenses	1,3 %	0,0 %	9,1 %	1,5 %
Result of financial items	-0,7 %	-9,1 %	11,8 %	-0,6 %
Profit on ordinary activities before taxation	18,2 %	-3,6 %	55,5 %	16,8 %
Total assets	100,0 %	100,0 %	100,0 %	100,0 %

Table 7 Common size analysis showing the elements as a share of total assets for the period 2009-2013

The table shows that the salmon, trout and other operating revenues account for the biggest elements for the average company. The maximum and minimum value vary greatly, because some companies only produce Atlantic salmon, while others only produce rainbow trout, rendering a minimum value of zero for the other product. Furthermore, the smolt, feed and slaughter cost account for a significant element in our analysis. Some companies seem to pay relatively more for their feed than others. Feed costs are not only important as a share of operating revenues. It accounted for more than half of the production costs per kilo harvested fish as well (Norwegian Directorate of Fisheries, 2014). As for the slaughter cost, not all companies have in-house slaughter, which explains the minimum value of zero. Lastly, other operating costs account for a somewhat surprisingly large share of the costs.

Research question 2.1 may now be answered: *Which elements in the income statements of the fish farming companies are of particular importance?* The common size analysis shows us that the sales revenue from salmon and trout, smolt, fish feed, slaughter and other operating expenses are the most significant elements in the financial report. Hence, we may define three possible main sources of profitability: the sale of salmon and trout, cost advantage in purchasing (economies of scale) and cost efficiency.

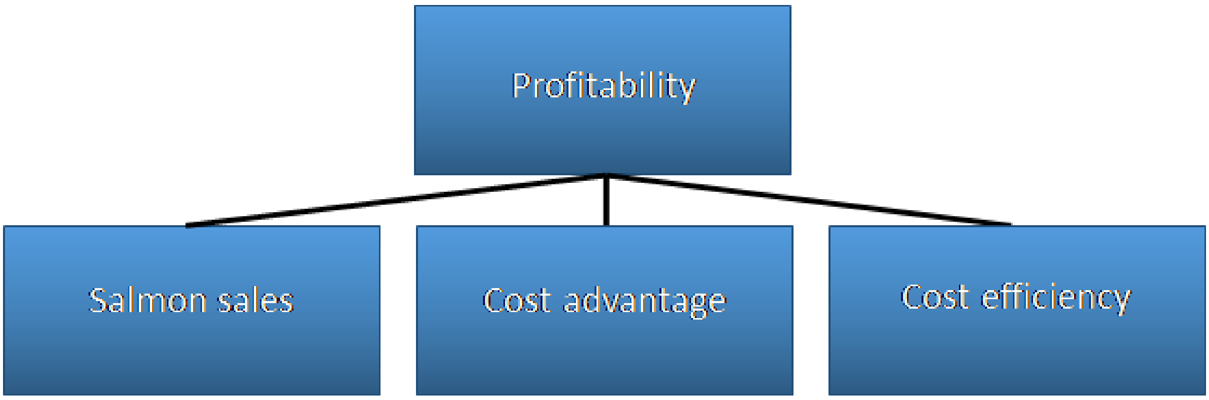


Figure 11 Three main sources of profitability on a general level

The figure shows how profitability may be achieved through salmon sales, cost advantage or economies of scale in purchasing and cost efficiency in running the fish farming facilities.

5.4 Relevant key profitability figures

One of the goals in this thesis is to analyse the variation in the profitability in the industry. In order to do so, we must take a closer look into relevant key profitability figures. First, we mention profitability measures on a general level, before taking a closer look into sources of profitability and their more specific profitability measures.

5.4.1 *Profitability measures on a general level*

We first analyse using profitability measures on a general level. *Return on equity (ROE), return on assets (ROA)* and EBIT/kg.

Key figure 1.1 - Return on equity

Return on equity is one the most common measures of economic performance for a company. It is calculated by dividing ordinary result before or after tax by opening balance equity. The measure shows the return that the company achieves using the shareholders´ capital.

One weakness with ROE is that the salmon farming companies may have different required rate of return on equity if they have different capital structure. The Modigliani-Miller theorem states how different capital structure in companies leads to different required rate of return on equity. They explain this by saying that the firm value is independent of the financing structure. Different sources of financing have different required rate of return due to varying risk, and under the assumption of a perfect capital market, a company will have the same WACC independent of its debt-equity share. According to Modigliani-Miller, it is the required rate of return on equity that will change as the leverage changes, keeping the required return on assets constant. As the share of each financing source adjust, their required rate of return also change since they reflect the risk. A company that is leveraged higher will not lower the total risk to the company even though debt is a cheaper form of financing. The firm risk has not changed, and the risk is simply passed to the equity holders. This means that different capital structure for the salmon companies imply a different required return on equity. By directly comparing the ROE, we do not take into account that the companies have different required return on equity. Still, many analysts do use ROE as a meaningful measure (Kontali).

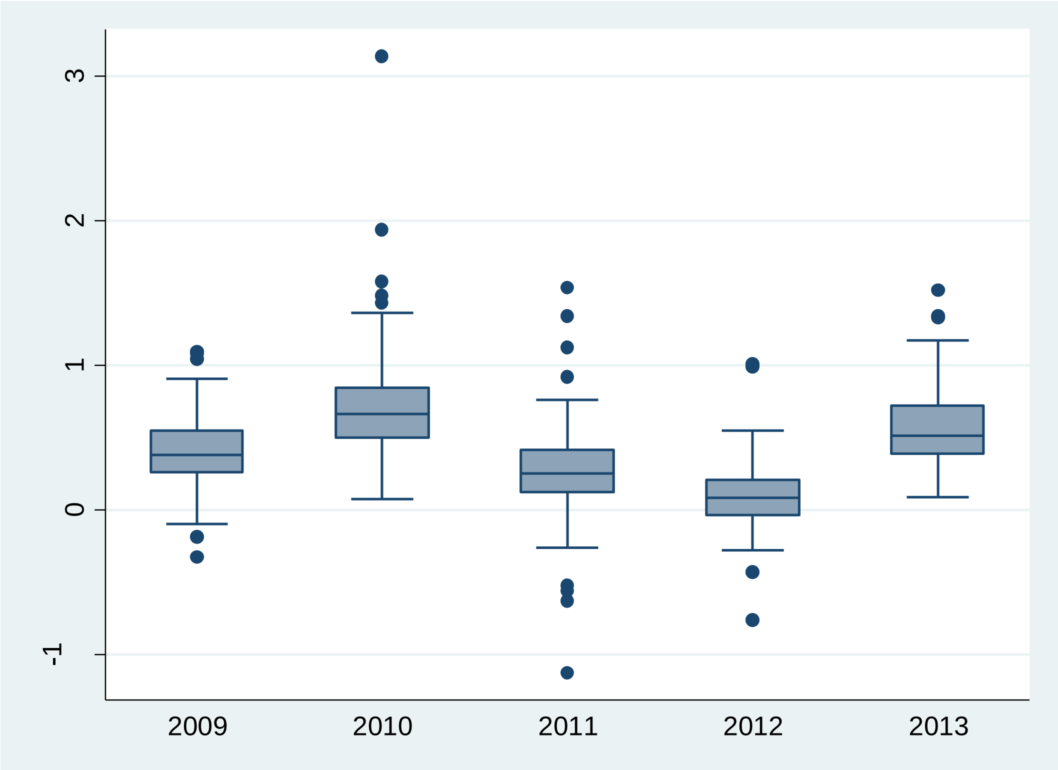


Figure 12 Box and whiskers plot, ROE 2009-2013

Graf 2: Overview of return on equity in the sample of salmon farming companies in the period 2009-2013

We use a box and whiskers plot to describe the variation and median of the return on equity before tax for the companies. Companies with negative equity have been removed from the sample. The line inside the box is the median. 50% of the data above this line is greater than this value, 50% of the data below this line is lower than this value. The upper line of the box is the upper quartile, which means that 25% of the companies have greater ROE than this. The lower line of the box is the lower quartile, which means that 25% of the companies have lower ROE than this. The *whisker,* the vertical line, is limited by the upper adjacent value, the horizontal line on top of the whisker. The upper adjacent value tells us the how high ROE the highest, normal companies have, excluding outliers, and vice versa for the lower adjacent value. The dots represent the outliers, which are more than 1.5 times greater than the upper quartile.

We see that the ROE seem to have a somewhat fluctuating development in the period 2009-2013, which corresponds to the salmon prices of the same period. The median was about 38.0% in 2009 and peaked the following year to 66.4%, fell to 8.7% in 2012 and reversed to 51.6% in 2013. The variation seems to be similar over the period, except for the year 2012. 2012 was a terrible year in which the salmon prices fell to a four-year low. The variation fell significantly that year, which may have several explanations. The number and variance of extreme observations (outliers) have decreased over the period. In 2009, the upper and lower outlier had a ROE of 109% and -32.7% respectively. In 2013, there were only two positive outliers, the biggest one having a ROE of 152%. In the booming years of 2010 and 2013, we note that no company had a negative ROE.

Key figure 1.2 - Return on assets

To compensate for varying required return on equity, we may include a Key figure that uses total assets in the denominator. By calculating operating profits plus financial income as a share of average total assets, we get a measure on how much money the companies earn per krone invested.

Optimally, we would use return on capital employed (ROCE), which would only use the capital available as the denominator. ROA is theoretically problematic as the reasoning is not coherent. In order to calculate ROCE, we would deduct all non-interest bearing liabilities from total assets. (Bragelien). However, our data does not list the balance sheet in such details for us to calculate it.

A problem with return on assets is that older companies, which have depreciated its assets over longer time, will appear more profitable since the denominator is of lower value. A newer company may have better performance and superior equipment and facilities, but due to the higher book value of their assets, the performance of the newer companies may look inferior.

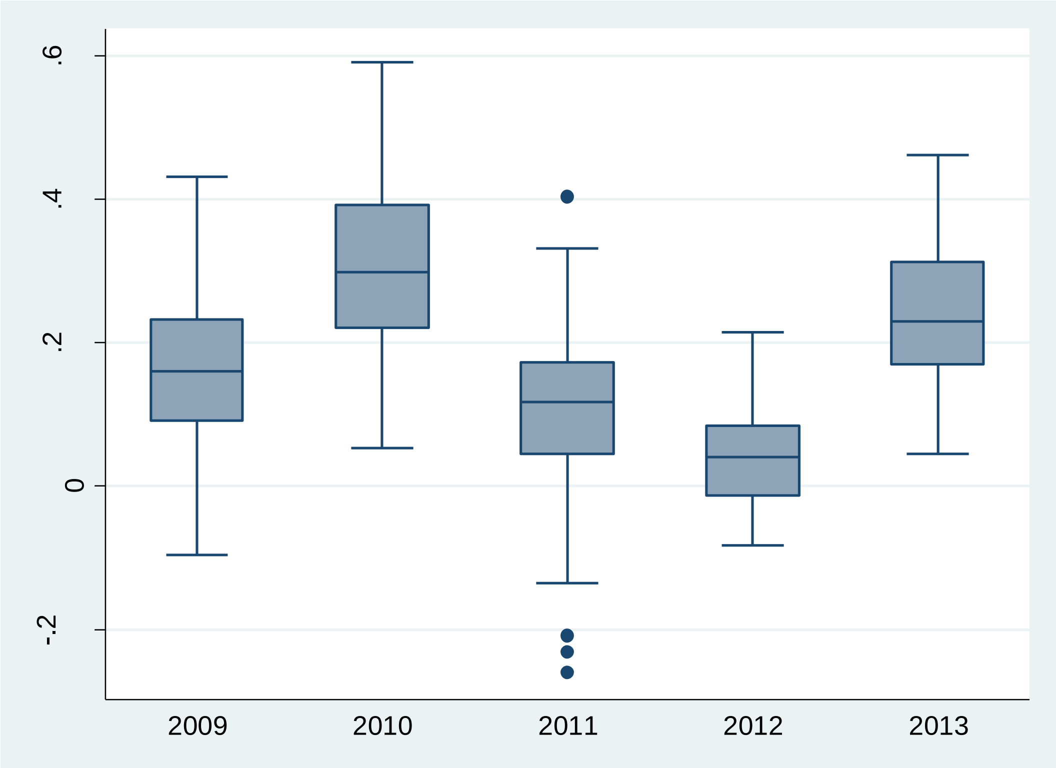


Figure 13 Box and whiskers plot, ROA

Similar with ROE, we see that return on assets is volatile over the period. The variation seems to be similar for all years except in 2012, which also corresponds with our findings in the ROE part. Note that the return on assets has a lot less variation compared to ROE, as it only varies between -26.1% to 59.1%. The median was 16.0% in 2009, increased to 29.8% next year, bottomed to 4.07% in 2012 and reversed to 23.0% in 2013.

Key figure 1.3 - Earnings before interest and tax per kilo fish harvested

As a third measure on profitability on a general level, we analyse the operational efficiency of the companies. We do this by looking at earnings before interest and tax per kilo fish harvested (EBIT/kg). This measure is widely used by analysts, and it is usually only available in the financial reports of the listed salmon farming companies. Earlier we saw that smolt, feed, slaughter costs and other operating expenses accounted for a significant amount of costs for the companies. To harvest one kilo fish as cheaply as possible, the above costs need to be minimised and EBIT/kg may be suitable method to measure this.

Note that according to IFRS, salmon farming companies must value their biomass according to market value. This would distort the real picture of the performance with external price volatility that the companies cannot control. Therefore, it is an industry norm to report the EBIT per kilo before biomass adjustments, also known as *operational EBIT* among the industry.

However, since data about the operational EBIT per kilo was not available for all companies, we will use the ordinary EBIT per kilo. As we look at data spanning over five years, the short-term effects on economic performance due to fluctuation in salmon prices should be evened out. Five years may be sufficient to cover several batches of salmon as the growth phase at sea takes between 14 to 24 months, cf. chapter 4.2.

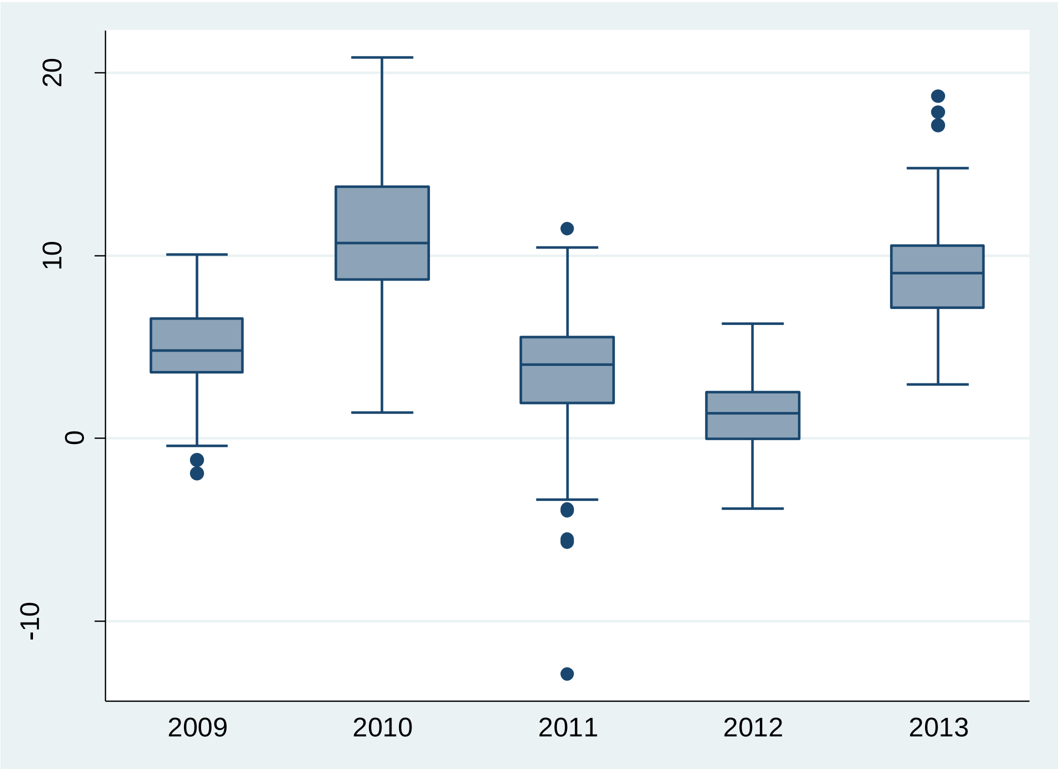


Figure 14 Median, maximum and minimum value for operating profits per kilo in 2009-2013

Again, this profitability measure correlates roughly with the other measures. The variation pattern is somewhat different. In 2013, the variation in EBIT/kg was relatively bigger than that for 2010, while for the other measures it was opposite. The median was NOK 4.79 in 2009, peaked following year to NOK 10.67, fell to 1.36 in 2012 and climbed up to 9.05 in 2013. The lowest value in the period was in 2011 with NOK -11.07 and the highest was NOK 20.84 in 2010.

Return on equity, return on assets and operational profits per kilo all give an indication on the profitability in a general level. For most part, they indicate the same - fluctuating and correlating with the salmon price, with higher volatility during good years.

5.4.2 Key *figures for the three sources of profitability*

The common size analysis showed that there were three main sources of profitability in the salmon farming industry: the sales of salmon and trout, economies of scale in purchasing, and cost efficiency.

Key figure 2.1 - Sales of salmon and trout as a share of total assets

The first of the three sources to profitability is the sales of salmon and trout. We use *sales of salmon and trout as a share of total assets* to investigate this source.

Selling salmon and trout is the core activity of the industry. It is what the companies earn the money from. As shown in the Common Size analysis, this element is the biggest revenue element in the industry´s income statement. It is reasonable to believe that how much a company manages to sell relative to its size has importance for its relative economic performance among the salmon farming industry.

Calculating the sales as a share of total assets is worth considering since the assets should indicate the total resources a company has available. The measure shows how much they can sell given a level of capital. Indirectly, it may show how well they utilise the maximum allowed biomass capacity, or in more abstract terms, how much they can produce given a constraint (total assets). Variation in this figure among the industry may show that some companies are able to maximise their efforts to ensure full production.

A limit with this measure is that it does not take into account that some companies in our sample are not full-fledged salmon farming companies. For example, some of them may have a substantial business in selling hatchlings or running slaughterhouses. As long as the share of other income from hatchery or slaughterhouse are below 30 per cent, they are considered salmon farming companies and are included in our sample.

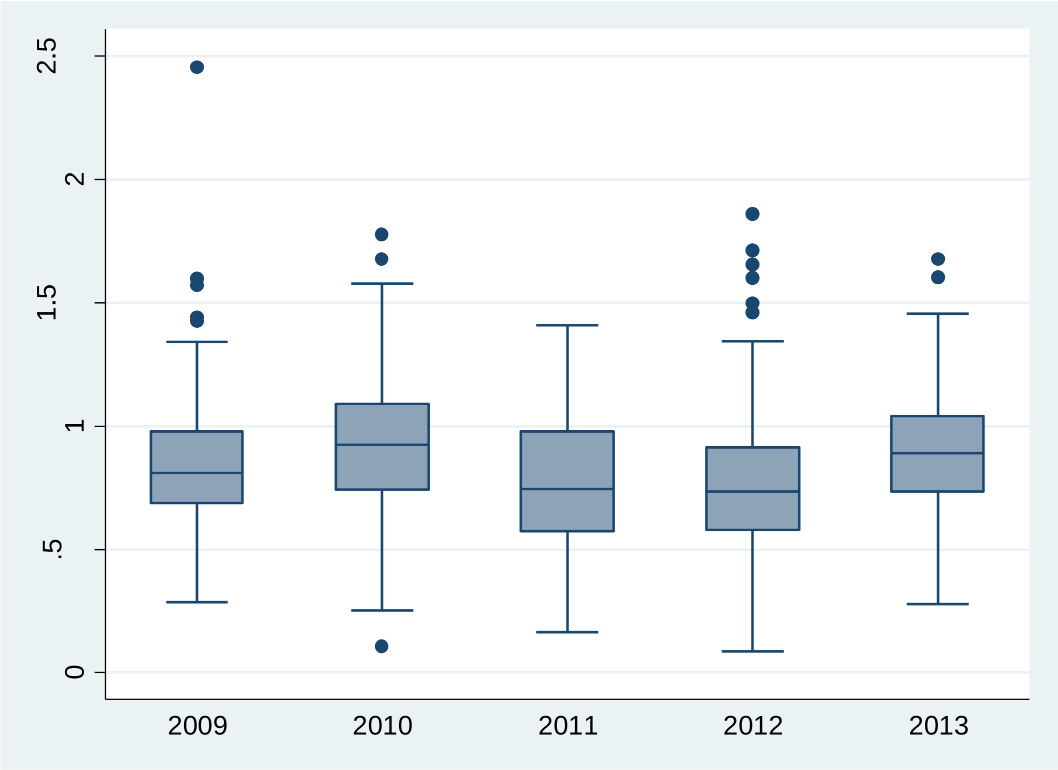


Figure 15 The median and variation for sales revenue as a share of total assets in the period 2009-2013

The sales revenue as a share of total assets seems to correlate with the other measures, but in a smoother pattern. The variation seems to be more homogenous across the period compared to other the other measures. The median value varies from a peak of 92.1% in 2010 to 73.5% in 2012. The minimum (non-outlier) value was 8.56% in 2012 and maximum value (outlier) was 177.7% in 2010.

Key figure 3.1 - Purchasing costs as a share of total income

The second of the three sources of profitability is cost advantage in purchasing. As a measure for cost advantage in purchasing or economies of scale in purchasing, we use purchasing costs as a share of total income.

It would be interesting to see how large the differences in cost advantage would be among the industry. The common size analysis showed us that the purchasing costs were only second in importance to the revenues of salmon and trout.

Unlike other measures, the lower the figure is, the lower it describes the company´s performance.

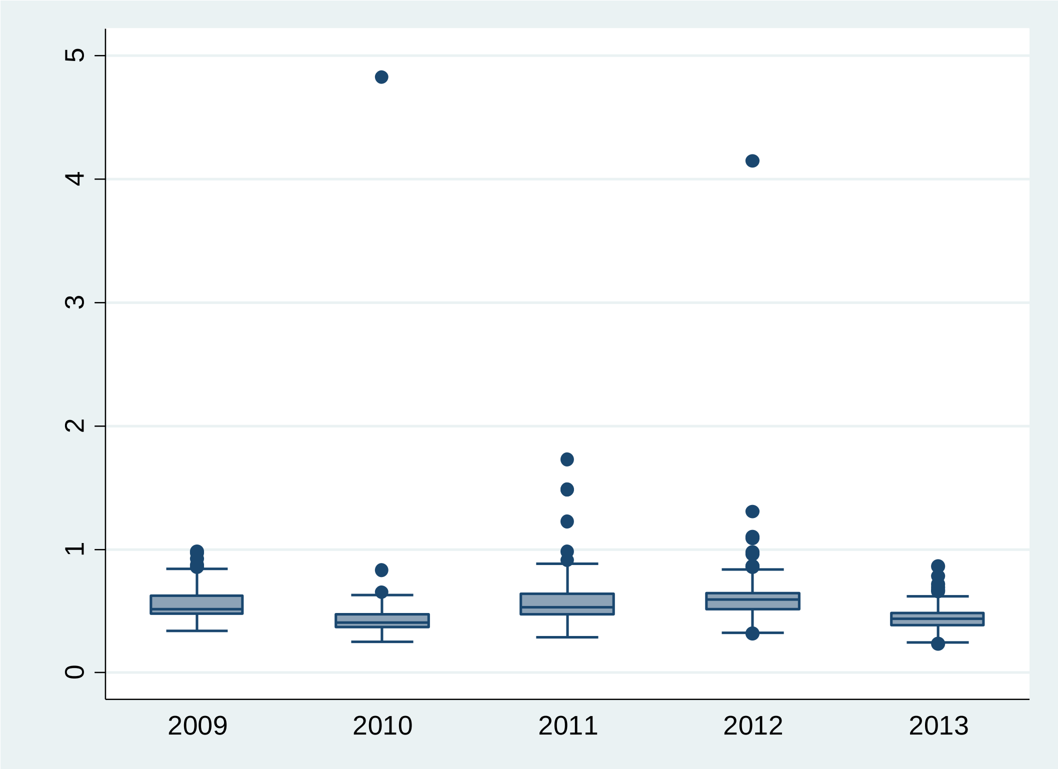


Figure 16 Overview of purchasing costs as a share of operating revenues in 2009-2013

The graph indicates that this measure correlates with the others. Lower value indicates higher cost advantage, and in the good years of 2010 and 2013, we see the levels being the lowest. Higher prices imply that the purchasing costs account for a lower degree. It is interesting to note that the variation (not including the outliers) is lower during the better years, while it was higher for the other measures in the same years. During the years of downturn, the variance is higher, which is interesting. This may imply that some salmon farming companies may be better than others in bargaining prices or reducing costs when the market turns sour. It could also mean that some companies rely more on long-term contracts or simply that the companies have different agreements regarding price.

Key figure 4.1 - Other operating costs as a share of total income

The last source of profitability is the cost efficiency in other operating expenses. The common size analysis showed this being a significant element in the income statement of the companies. It would be interesting to analyse the differences in the cost efficiency and management of the other operating costs. As a measure on cost efficiency, we use *other operating costs as a share of total income.*

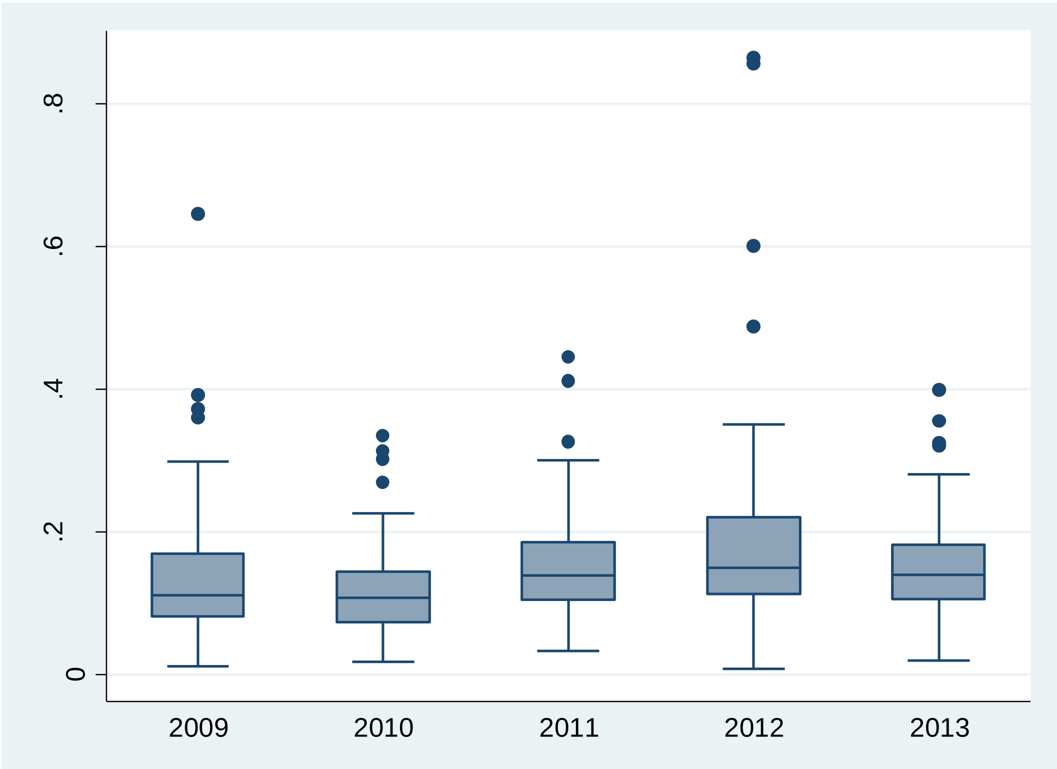


Figure 17 Other operating costs as a share of operating revenues in 2009-2013

Same as for the purchasing costs, we see that the variance is lower during the good years. Some companies may have better cost reduction actions when the market is in a downfall. The median varies from 10.8% in 2010 to 15.1% in 2012. The minimum value was 0.81% in 2012 while the maximum value was 86.4% in the same year.

5.4.3 Summary of key figures chosen for profitability analysis

This subchapter shall answer research question 2.2: *Which trend and variation is observed in our performance measures between 2009-2013?*

median	2009	2010	2011	2012	2013
Return on equity before tax	40,5 %	71,7 %	26,7 %	9,8 %	58,0 %
	38,0 %	66,4 %	25,5 %	8,7 %	51,6 %
Return on assets	15,9 %	30,5 %	10,8 %	4,3 %	23,9 %
	16,0 %	29,8 %	11,7 %	4,1 %	23,0 %
Operating profit per kg produced	4,73	11,07	3,54	1,29	8,99
	4,79	10,67	4,04	1,36	9,05
Sales revenue as share of total assets	84,3 %	92,1 %	77,1 %	76,8 %	90,1 %
	80,9 %	92,4 %	74,5 %	73,5 %	89,0 %
Purchasing costs as share of operating revenue	55,7 %	46,9 %	59,6 %	64,3 %	44,6 %
	51,7 %	40,5 %	53,1 %	59,5 %	43,9 %
Other operating costs as share of operating revenue	13,5 %	11,6 %	15,5 %	18,3 %	15,0 %
	11,2 %	10,8 %	14,0 %	15,1 %	14,0 %

Figure 18 The mean and median for the key figures 2009-2013

The mean and median for the key figures in the period roughly correlate according to the salmon prices. Unsurprisingly, when the price is low, the return on equity, assets and earnings before interest and tax per kilo are lower than compared to the boom years. During the boom years, the sales revenue as share of total assets goes up, while the purchasing costs as a share of total revenues go down.

Standard deviation	2009	2010	2011	2012	2013
Return on equity before tax	0.25	0.40	0.36	0.24	0.28
Return on assets	0.10	0.12	0.12	0.07	0.09
Operating profit per kg produced	2.34	3.72	3.80	1.82	2.86
Sales revenue as share of total assets	0.30	0.29	0.28	0.33	0.26
Purchasing costs as share of operating revenue	0.13	0.45	0.24	0.40	0.11
Other operating costs as share of operating revenue	0.09	0.06	0.07	0.14	0.07

Figure 19 The development in standard deviation for all key figures in 2009-2013

The variance is for the profitability measures on a general level (ROE, ROA and EBIT/kg) are rather similar throughout the period, with the exception of the bad year of 2012. In 2010, the variance seems to increase a bit, and held on to 2011. In 2012, the variation for all three key figures fall, which might imply that as prices fall, there is an increased price competition leading to a more similar profitability on a relative basis.

The variance of the sales revenue as a share of total assets are about the same throughout the period. As for the purchasing costs as a share of operating revenue, standard deviation increase in 2010 and 2012, which were good and bad years. When we exclude the outliers, the standard deviation is lower for the good years. The variance of the other operating costs as a share of operating revenue increase substantially in year 2012.

5.5 Correlation analysis of key figures

We shall analyse whether the key figures described above has any relationship with each other. First we examine whether the profitability measures or key figures on a general level correlate with each other. We then analyse whether some of the three key figures for the sources of profitability correlate with the performance measures on a general level. This may indicate which areas are of special importance to the relative economic performance

5.5.1 Correlation analysis between ROE, ROA and EBIT/kg

The correlation analysis shows that *return on equity* correlates strongly with *return on assets* and *operating profits per kilo*. We could already have guessed that judging from the box and whiskers plot in 5.4.1. The coefficient of correlation are respectively 77.2% and 66.3% for return on assets and operational profits per kilo respectively and both results are statistically significant on one per cent significance level. This strong correlation enables us to continue on with just return on equity as a profitability measure on a general level.

	roe_co~g	roa_co~g	opr_kg~g
roe_comp_avg	1.0000		
roa_comp_avg	0.7629	1.0000	
	0.0000		
opr_kg_sal~g	0.6526	0.8291	1.0000
	0.0000	0.0000	

Table 8 Correlation between the profitability measures on a general level

5.5.2 Correlation analysis between ROE and the three sources of profitability

To analyse whether the three potential sources of profitability may be of importance for the relative economic performance, we study the correlation between return on equity and the three sources, as shown in below table.

	roe_co~g	p_sale~g	p_purc~g	p_othe..
roe_comp_avg	1.0000			
p_sales_re~g	0.4495	1.0000		
	0.0000			
p_purchasi~g	-0.3379	-0.2252	1.0000	
	0.0000	0.0032		
p_other_op~g	-0.2728	-0.2862	0.2433	1.0000
	0.0003	0.0002	0.0014	

Table 9 Correlation analysis between ROE and the key figures for the three potential sources of profitability

Salmon sales as a share of total assets have the highest correlation with return on equity, with a coefficient of correlation of 0.4392. The correlation has a p-value of 0.00. This may imply that being able to produce and sell in high quantities relative to others has is most important for economic performance relative to other competitors.

Purchasing costs as a share of total revenues, which indicated cost advantage or economies of scale in purchasing, has a rather weak negative coefficient and the correlation with return on equity is not significant. Thus, lower purchasing costs cannot be proven to improve a company´s relative economic performance.

Cost efficiency, as measured by *other operating costs as a share of total revenues,* has a stronger negative correlation with return on equity, with a coefficient of -0.263. The correlation is significant on a 1% significance level. It indicates that low operating costs in a company are something that may explain relative economic performance.

In the scatter plot with return on equity on y-axis and salmon sales as a share of total assets, there is a weak relationship positive relationship. For the operating costs as a share of operating revenue, we have a weak negative relationship with profitability.

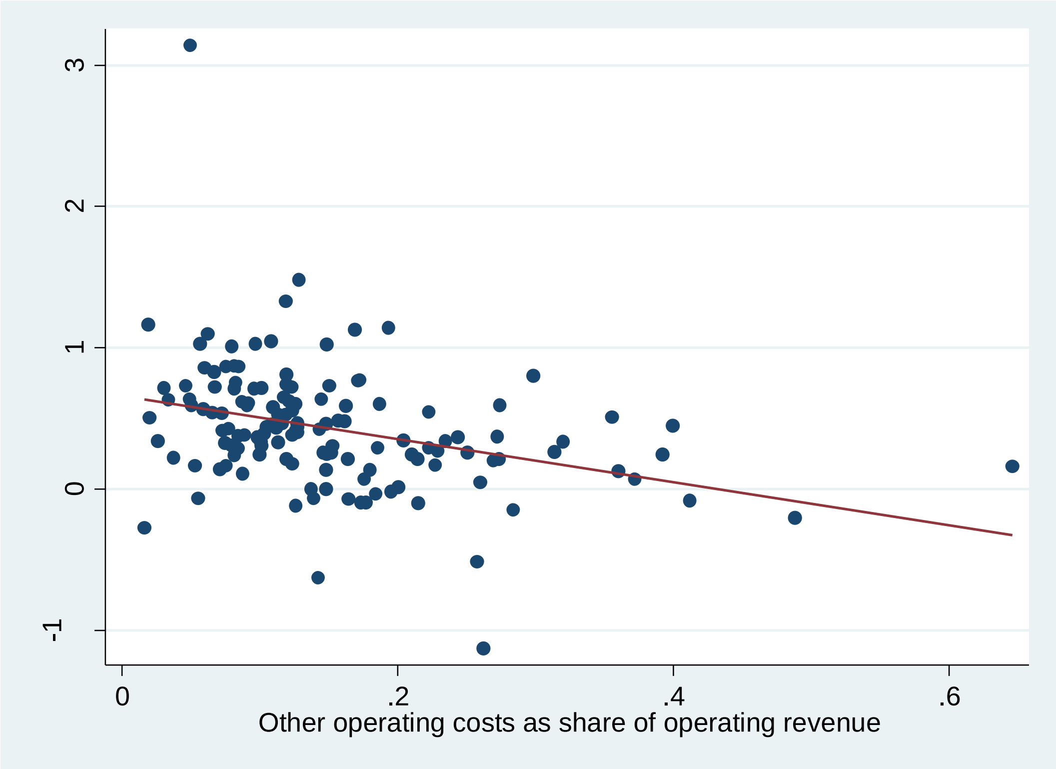


Figure 20 Scatterplot showing the relationship between ROE and other operating costs as a share of operating revenue

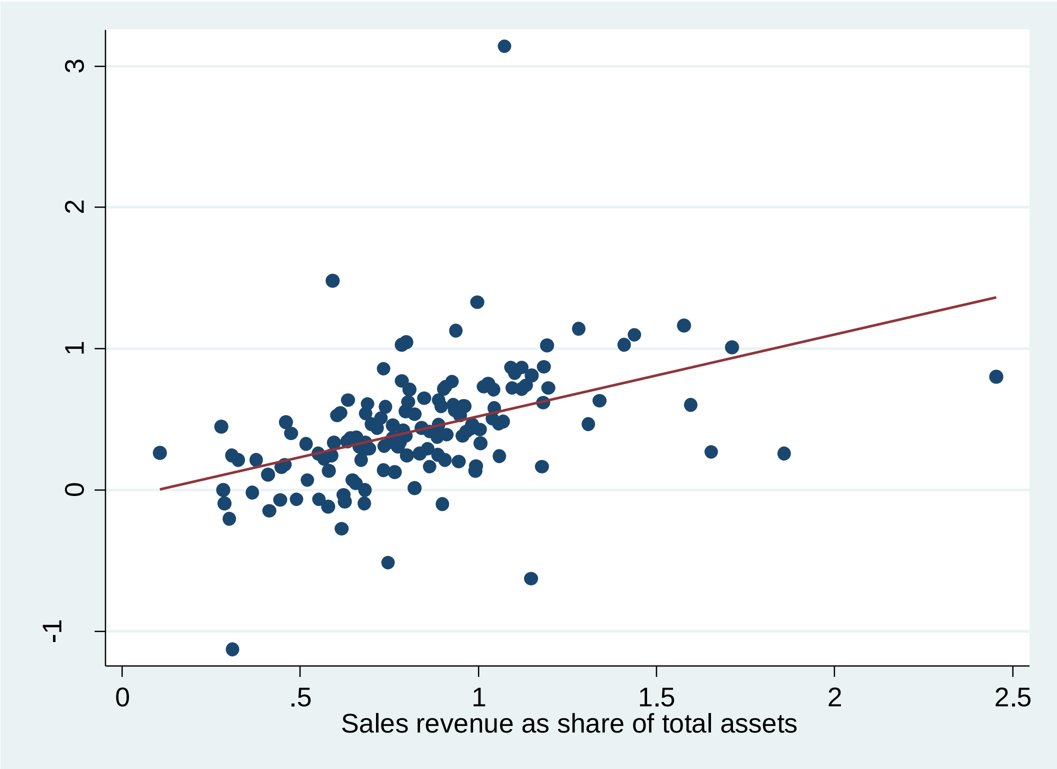


Figure 21 Scatterplot showing the relationship between ROE and salmon sales as a share of total assets

5.6 The most profitable companies

We can now answer the subquestion 2.3: *Which salmon farming companies are the most profitable ones in the industry?* The table below shows us the ranking of the companies for each performance measure. This helps us to see a pattern for the companies´ relative performance using different measures.

Return on equity before tax, company average	Sales revenue as share of total assets, company average	Purchasing costs as share of operating revenue, company average	Other operating costs as share of operating revenue, company average
Company 4	Company 34	Company 34	Company 35
Company 13	Company 30	Company 57	Company 68
Company 135	Company 67	Company 135	Company 70
Company 68	Company 135	Company 67	Company 5
Company 67	Company 70	Company 61	Company 91
Company 7	Company 4	Company 76	Company 89
Company 90	Company 61	Company 70	Company 120
Company 91	Company 21	Company 59	Company 34
Company 16	Company 35	Company 90	Company 76
Company 61	Company 9	Company 33	Company 30
Company 87	Company 118	Company 31	Company 110
Company 35	Company 103	Company 24	Company 4
Company 75	Company 16	Company 129	Company 48
Company 136	Company 137	Company 133	Company 57
Company 24	Company 43	Company 5	Company 7
Company 31	Company 13	Company 83	Company 129
Company 45	Company 136	Company 7	Company 46
Company 118	Company 7	Company 137	Company 32
Company 49	Company 120	Company 112	Company 115
Company 48	Company 119	Company 45	Company 85

Table 10 Ranking the performance of the salmon farming companies for different key figures. the colour marked for a company follows the company for the other key figures

Note that for the columns *purchasing costs as a share of total assets* and *other operating costs as a share of operating revenues,* lower value is better. Hence the top twenty companies in these columns are ranked from lowest to highest.

On the first column, the twenty companies with highest return on equity are listed. To illustrate the pattern, the top ten companies in terms of ROE have been coloured green. The following ten are coloured yellow. As the table shows, the top twenty companies in terms of ROE are heavily represented in the column showing the top twenty in terms of salmon sales as a share of total assets. This indicates that high salmon sales as a share of total assets may partially explain high relative economic performance. As for the *purchasing costs as a share of operating revenues,* we see a weaker relationship - eight of the top twenty best performing companies in terms of ROE are represented in this performance measure.

Regarding the *other operating costs as a share of operating revenues*, six of the top twenty ROE companies are represented. In the correlation analysis, this key figure had a significant correlation with ROE, yet it represents the fewest of the top twenty ROE company in its category. Overall, salmon sales as a share of total assets seem to explain relative economic performance the most, as shown from the correlation analysis.

5.7 Summary

We shall now answer research question 2: *What profitability variations exist between Norwegian fish farming companies, and which areas of performance seem to be especially important for relative profitability?* In order to answer this, we analysed the economic performance of the salmon companies in the period from 2009 to 2013. The Common Size analysis showed that there are three possible sources to profitability in the salmon farming industry; *salmon sales, cost advantage in purchasing and cost efficiency in other operating costs.*

A closer inspection showed that the profitability unsurprisingly varies according to the salmon prices. The variation in profitability was relatively similar the period, with the exception of the year 2012 in which it fell.

Furthermore, an analysis of the correlation between return on equity and the three possible sources of profitability unsurprisingly showed that salmon sales has a strong correlation with profitability and that purchasing costs as a share of total revenues had a weak, insignificant relationship with return on equity. On the other hand, other operating costs as a share of operating revenues had a medium negative relationship with return on equity.

In the last part of this chapter, we looked closer into the relative economic performance in terms of return on equity for the companies, and the three potential sources of profitability. The pattern in relative performance indicated that high salmon sales as a share of total assets characterise the most profitable salmon companies, while purchasing costs as a share of operating income and other operating costs as a share of operating revenues had a weaker relationship.

Chapter 6 - Factors

In the previous chapter, we analysed the variation in profitability among the companies with regards to different key profitability figures. In this chapter, we shall look into whether there are *factors* or *traits* that may explain the variation in profitability among the Norwegian fish farming companies.

We do this by answering research question number 3 with subquestions:

3. Which factors may be of significant importance for the profitability of the Norwegian fish farming companies?
    a. 3.1 Which factors may influence profitability and how do the fish farming companies differ in regards to these factors?
    b. 3.2 What relationships exist between the factors?
    c. 3.3 What characterises the different companies?

Initially we look at factors that seem to be relevant for the profitability in the industry, based on the earlier presented cost driver theories of Porter and Riley. The factors that we regard as relevant, is the basis of the framework utilised in the further analysis. We also explore whether there are differences between the companies with regards to the factors we deem relevant. Next, we look into the correlation between the factors and lastly, we try to give an overview of the level of each factor for each company.

6.1 Factors which are likely profitability drivers in the fish farming industry

Based upon Porter´s ten cost drivers theory and Riley´s cost driver theory, we shall discuss factors that may explain differences in profitability in the industry. Contributing to the discussion of relevant factors, are the macro environment and industry analysis, as it requires in-depth inside industry knowledge.

We have identified ten factors which we regard as highly relevant for the industry profitability. Those are: 1) Scale, 2) Scope, 3) Experience, 4) Technology, 5) Cooperation, 6) Employees commitment to continuous improvements, 7) Capacity utilisation, 8) Timing, 9) Location, and 10) Productivity.

6.1.1 Scale

The last decades have seen an on-going trend of consolidation of this industry, as mentioned earlier in the introduction of the industry. In 2002, there were 114 companies running less than six concessions, while in 2013 this number had fallen to 63. (Kontali, 2014). The companies are getting fewer, but bigger.

Scale (or size) is a significant cost driver mentioned in both Porter and Riley´s cost and profit driver theories. When there are economies of scale existent, a high output result in low average unit cost. Size may, however, be a disadvantage as complexity and coordination increase the costs as more technically advanced equipment and more units must interact and communicate.

Each fish farming company has licenses, which restricts them from producing more than a certain volume, known as the maximum allowed biomass (MAB). This represents a legal boundary for how much farmed fish the companies may produce. The higher total MAB a company possess, the more economies of scale can be achieved on prior and latter activities. Activities such as purchasing of raw materials and slaying costs. Other potential benefits are being able to cover the demand of several large customers, which small companies would not be able to supply to. Large customers might be more profitable to serve since they require less effort per order. Operating costs may also be underproportionate with size. Examples of these expenses are the costs of labour, insurance, vaccination and other operating costs. Additionally, there might be economies of scale related to investments in new production technology. New technology often brings greater benefits to companies of bigger size.

Another size measure is the total actual biomass produced. Often, there is significant discrepancy between those MAB and total actual biomass produced due to operational circumstances.

We see that size can be beneficial for a company in terms of reduced limits and cost savings. Strong arguments for economies of scale aside, size, as mentioned can inflict more complexity and coordination costs than benefits. Smaller fish farming companies which sell their fish directly to the open market are leaner, have fewer costs, but are more prone to more supply/demand and price fluctuations risks. The complicated nature of company size makes it interesting to analyse its impact on profitability.

We shall analyse the factor *size* using two indicator, namely maximum allowed biomass and total actually produced biomass.

Category	Factor	Indicator
Size	Maximum allowed biomass Actual production	Volume Volume

Indicator: Maximum allowed biomass (MAB)

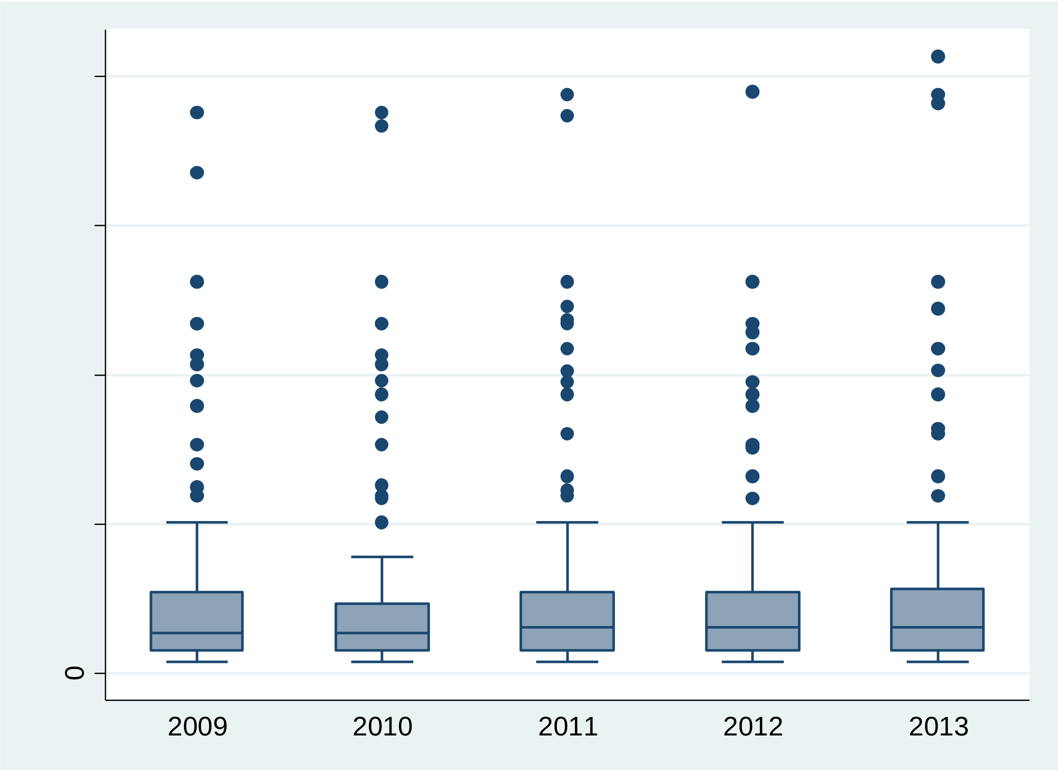


Figure 22 Box and whiskers plot, MAB

In general, the maximum allowed biomass are stable as the authorities restrict the MAB for each company unless it is given a new license. The median is 2700 tonnes in 2009 and 2010, but increases to 3120 tonnes in 2011-2013. The minimum is 780 tonnes for all years, which is the minimum size of one license MAB. The maximum increases steadily for the largest company as it gains more licenses. In 2009, it had a MAB of 37560 tonnes, while in 2013 it had increased to 41340 tonnes. The mean also steadily increase as the authorities allocates more licenses. In 2009, the mean was 5219.806 tonnes, while in 2013 this had climbed up to 6280.605 tonnes.

The standard deviation increase as some companies keep only one license, while other companies acquire more licenses, thereby increasing their MAB.

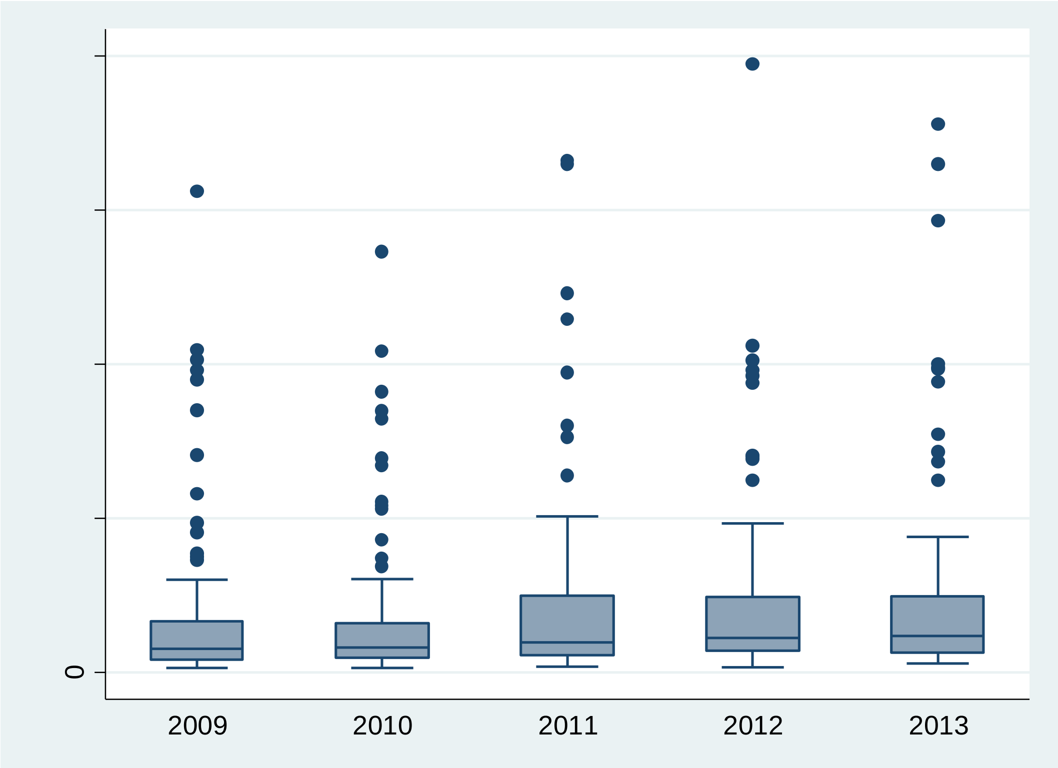


Figure 23 Actual production

Indicator: Actual production

Between 2009 and 2013, both the mean and median of actual production increased. The mean increased from 6866.144 tonnes to 10029.311 tonnes. The median increased less impressively, from 3142.737 tonnes to 4763.261 tonnes. This indicates that the larger companies increased their output more relative to their smaller peers. The maximum value was 62421.868 tonnes in 2009, which fell to 54594.696 the next year. In 2011, the actual production quickly exceeded the 2009 levels and increased to 78908.648 tonnes in 2012. In 2013, the production fell to 71089.712 tonnes. The minimum value also shared the same trend.

The actual production fell in 2010 and 2013, while increasing for the other years, and the end result was higher actual production than in the past. This corresponds to the increasing production as described in chapter 4.

6.1.2 Scope

By scope we mean the product range or the range of services that a company offers. Porter mentions scope as an important strategic choice, and scope is also included in Riley´s structural cost drivers. In Cooper and Kaplan´s Activity-based costing, indirect and difficult to observe opportunity costs are caused by complex product and customer mix.

In the fish farming industry, large companies such as Marine Harvest has bigger scope than smaller companies. They offer different fish species and within each fish species there are different products. As an example, Marine Harvest offers salmon, rainbow trout, halibut, salmon feed and salmon oil.

Another way of looking at scope is to see in terms of the company´s vertical integration, which was Riley´s main view of scope. Some of the companies in our sample also control the activities before and after the focal activity, like producing fish feed and value added processing of the fish. Vertical integration reduces the hold-up problem and supply risks, but increases complexities. Vertical integration as a strategy has therefore often been viewed as a difficult and costly strategy in many industries. In the fish farming industry however, big companies are implementing this strategy to secure supply and reduce price fluctuations due to external factors. Due to the difficulties in quantifying this "vertical scope effect", we choose to measure scope as mentioned in the previous paragraph.

The sales of products and services beyond salmon, rainbow trout and insurance compensation gives the fish farming companies *other ordinary earnings* (cf dataset). Having a broad product range can be important decision factor for some customers to choose a supplier. Instead of having to purchase from several companies, they instead acquire it from one company. On the other hand, having a broad product range can also be costly for the company to offer. The direct costs of having these additional products are usually easy to quantify, but the indirect costs are harder to measure. As mentioned by Zimmerman (1979), hard-to-observe opportunity costs may be present when offering a broader product range. An example could be offering a third or fourth type of fish species doesn´t require hiring of more people in production, logistics or marketing, it merely uses free capacity, but the same people could have spent more time and efforts on the existing portfolio. Hence, the quality on the existing portfolio may go down. Broader product range incurs higher coordination costs between departments and complexity costs for the management.

To measure product and service *scope,* we use *total other ordinary earnings as a share of total operating revenues*. It may be questionable whether this indicator actually measure scope or product range since a relatively high share of "other ordinary earnings" can come from a small number of other products. *The number of other products and services* could alternatively have been used as an indicator, however we think it is more enlightening to see the relative differences in revenues form other products. By using the first measure, we have an indication of the *significance* of other products and services. It is reasonable to assume that fish farming companies with broader scope are likely to have a higher relative share of other ordinary earnings.

We note that this indicator is identical to the key figure used in the source of profitability "other earnings". Chapter 5 showed that "other earnings" did not seem to explain higher relative profitability. However, a high share other earnings may be different in the sample and be a key feature for some of the fish farming companies, which deserves further investigation.

In addition, we want to see whether including rainbow trout has an effect on profitability. Many companies do not produce rainbow trout.

Category	Factor	Indicator
Scope	Product and Service Range	Other ordinary earnings as a share of total revenues. Product distribution of salmon, trout and both.

Below is the description of the sample´s average value, variation and development for *other earnings as a share of total operating revenues* in the period 2009-2013.

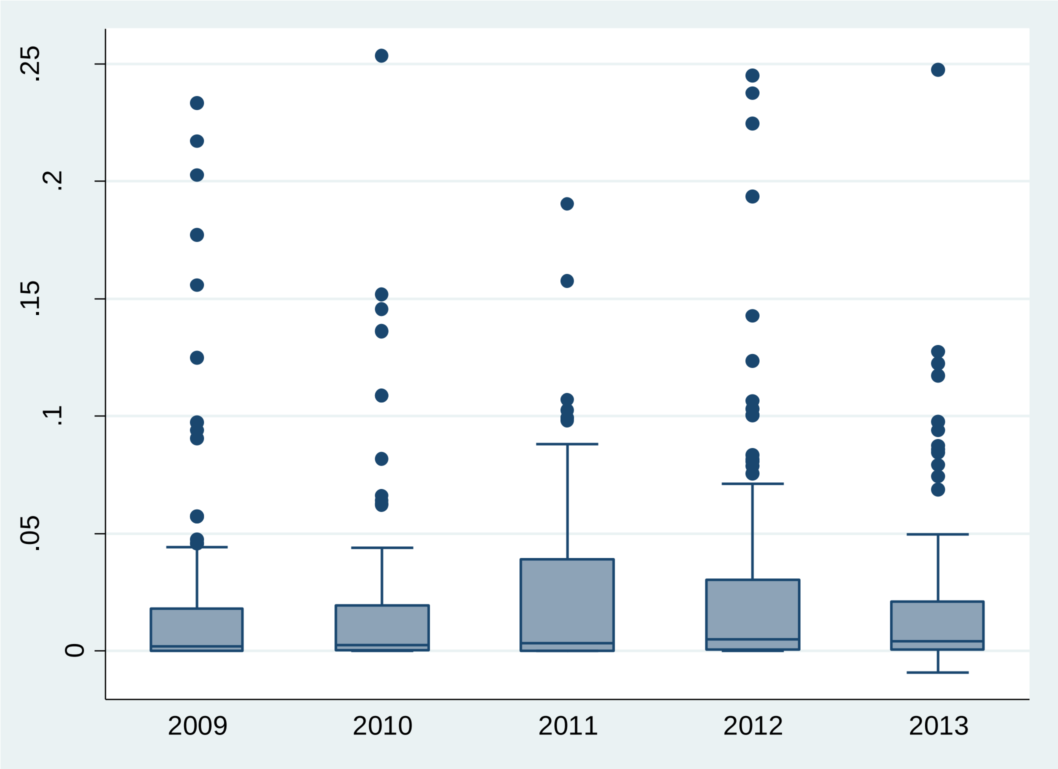


Figure 24 Box and whiskers plot for the factor *scope*

The median varies from a low of 0.2% in 2009 to a high of 0.5% in 2012. The mean varied from 0.2% in 2009 to 0.3% in 2012. The figures show that most companies had very little other ordinary earnings. The maximum value varied from 20 to 25% and the standard deviation fluctuated from 4.64% in 2009 to 5.33% in 2012.

Number of companies	2009	2010	2011	2012	2013
Only salmon	84	87	78	76	77
Only trout	3	4	3	2	2
Both salmon and trout	16	9	10	15	12
Total	103	100	91	93	91

Table 11 Product distribution between the companies

Not all companies produce rainbow trout. About 84% of the companies do not produce trout, while 13% produces both Atlantic salmon and trout. Only 3% of the companies produce trout exclusively.

6.1.2 Technology

Technology is mentioned by Riley (1987) as one of the important structural cost drivers. Porter, on the other hand, does not include technology among his ten categories, but his category timing is related to technology as a profitability factor.

The fish farming industry are among the most technologically advanced food industries in the world. From the fish eggs spawn, the smolt placed into the fish cages and until the fish grows big enough to be sent for slaying. In some companies today, the whole process can be automatized, but others still do it manually.

In some smaller fish farming companies, feeding the fish is a manual process, done by people from boats, while the feeding process is automatic in larger companies. Feeding manually saves the small companies the heavy investment required, but they may incur higher operating costs. If some key personnel are injured or sick, the company may have to call in expensive temporary staff.

Larger companies also have automatic monitoring systems, which enable them to observe the fish and cages using surveillance cameras. This way, they can respond more rapidly to sudden breaches to the cage, which allows the fish to escape, or to observe abnormal behaviour among the fish, which possibly means an individual disease, an epidemic or fish lice.

When smaller companies do not choose to invest in automation, while larger companies do, it may indicate an economies of scale. On the other hand, while some companies may afford automation, but still choose not to, it may be due to increased complexity costs, like training costs related to using the system and maintenance.

It is reasonable to believe that among larger companies, most of them have similar technology level. Technology as an explanation for higher relative profitability may not mainly be between larger companies, but between smaller and larger companies, the former not being able to afford the technology. If so, then technology is not so much of a the higher technology, the more profitable you become, but a hygienic factor in order to become big, meaning economies of scale is present. Further complicating this analysis, is the fact that technology not always reduces costs, but improves quality, which does not always result in higher revenues.

It would be interesting to see, whether there are technological differences among the large companies, whether it has any effects on economic performance, or if the differences are merely among the small versus large companies. Naturally, it is hard to measure "technology", not only in terms of quantifying it, but also getting access by the companies for this information. A proxy to this category could be value of research and development and patents as a share of total assets.

Category	Factor	Indicator
Technology	Research and development and patents	Value of research and development and patents as a share of total assets

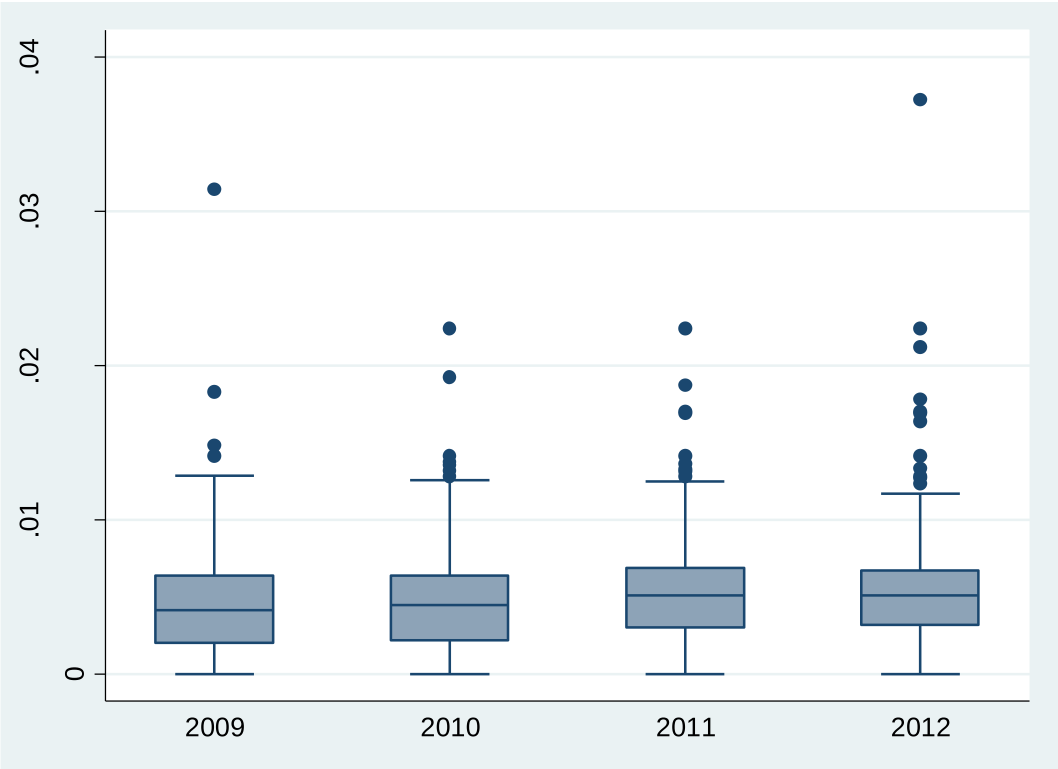


Table 12 Value of research and development and patents as a share of total assets 2009-2012

Note: We only have data for research and development and patents for the period 2009-2012.

Some companies do not possess any research and development or patents in their balance. The average company had about 0.5% of assets in research and development or patents, which gradually increased to 0.6% in 2012. The standard deviation also rose, which means that some companies continue to have no value in research and development and patents, while other companies increase their share.

6.1.3 Employees´ commitment to continuous improvements

Employees´ commitment to continuous improvement is mentioned as Riley´s first executional (operational) cost drivers. All companies consist of people, and how motivated and committed they are to perform their task to the full, detect and solve problems, negotiate with their suppliers and customers and how they continuously improve their infrastructure and routines, plays an important role, not only in the fish farming industry, but every industry.

Sometimes there are agent and principle problems present, in which the parties sometimes have conflicting goals. While employees´ commitment to improve is hard to measure precisely, we can choose to use a proxy.

Category	Factor	Indicator
Employees´ commitment to continuous improvements	Type of ownership	Closeness of personal ownership

Companies that are owned by an individual are more likely to be owned by the manager or by someone in his family. On a general basis, an individual owner usually has closer relationship with the manager, thereby reducing the agent problems.

year	Companies not owned by person	Company or parent company owned by person	Companies directly owned by person	Companies 2 steps from person	Companies 3 steps from person	Companies 4 steps from person	Companies 5 steps from person	Companies 6 steps from person
2009	41	62	22	24	8	2	6	0
2010	42	58	19	20	9	2	7	1
2011	44	47	12	17	6	2	10	0
2012	47	46	10	19	7	2	8	0

Table 13 Number of companies owned by persons or companies

Separate from this data material, in a sample of large companies (running six or more licenses) we studied from a Kontali Analyse report, about half of them were family run.

6.1.4 Location

The location of a fish-farming site may affect the quantity and quality of the fish produced. Some would argue that differences in license fee between different regions are caused by different biological factors such as sea temperature, weather conditions and infrastructure in the region. As an example, fish farming sites in Finnmark County are priced lower than the rest of the countries. Long shipping distances should also affect the license fee. Other factors could be that the relevant fish-farming site has good water flow, little pollution and high oxygen levels in the water. The sites may be located far from places where the wild salmon habitat, therefore reducing the risk of interbreeding. Favourable weather conditions that reduce the risk of salmon escaping or the facilities breaking down are also valuable for the companies owning the sites.

It would be interesting to analyse whether this added value from the location reflects on the economic performance in our sample. We analyse all fish farming companies with respect to the location in Norway (Northern, Central or Southern Norway) and economic performance. In our sample, there were 195 observations (not companies, as this figure varies from year to year) in the North, 54 in Central, 237 in the West and 1 in Southern Norway.

Companies in region	2009	2010	2011	2012	2013
North	41	41	35	39	39
South	1	0	0	0	0
West	52	50	48	45	42
Central	11	11	10	11	11
Total	105	102	93	95	92

Table 14 Geographical distribution of the companies

6.1.5 Capacity utilisation

Porter and Riley mention capacity utilisation as especially important when there are high fixed costs. In order for a company to be profitable in the long term, the price should cover all costs, including the fixed costs. At low capacity, the company will allocate the fixed cost on fewer products, raising the product´s unit costs. We define capacity utilisation as actual production as a share of total MAB.

Category	Factor	Indicator
Capacity utilisation	Capacity costs	Actual production as a share of maximum allowed biomass

The salmon farming industry is capital intensive, and requires heavy initial investment in equipment, license, biomass and working capital. The cycle from laying eggs to harvest can take up to 36 months, including 24 months of growing the fish inside the cages. For a normal facility in Norway, NOK 25-30 million is invested only in equipment such as cages, nets, boats and cameras. For a second-hand license, companies may have to pay up to NOK 200 million for a typical facility consisting of four licenses. Payback time for a typical investment in Norway varies from five to thirty years, depending on the salmon price and the license costs.

Maximum allowed biomass refers to how many kilos of biomass are allowed to present at any time for one license. While each company naturally strives to produce fish at full capacity, producing more batches in the same license yet keep the MAB restriction, very few actually does it. Historically, smaller companies outperformed their larger peers in capacity utilisation. The last few years, however, the larger companies have reduced the gap. In 2013, the best capacity (MAB) utilisation among large companies (running six or more licenses) was more than 1625 tonnes per license (45% better than average), while the lowest achievement was approx. 700 tonnes per license. Companies in the northern part of Norway achieved the weakest MAB utilisation, but had a positive trend. The companies in the West were improving and approaching the average levels while the farmers in the central part of Norway were improving more than the average (Kontali Analyse, 2014).

In management accounting, we often separate between practical maximum capacity and theoretical maximum capacity. The theoretical maximum capacity is the volume a facility could produce if there were no sample-taking, fish lice, diseases and mortality and escaping fish. In addition there are external factors that will affect the production, such as sea temperature, bad weather and equipment malfunctioning. As an example, Christoffer Marøy in his master thesis calculated a theoretical capacity of 1950 tonnes per license (Marøy, 2011). The practical capacity will always be a bit lower due to the impeding factors above.

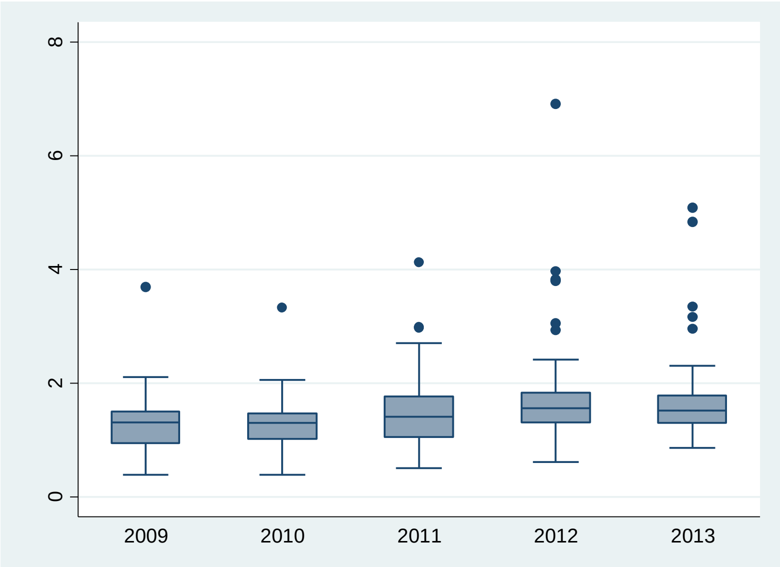


Figure 25 Capacity utilisation measured as actual production as a share of MAB

The mean of actual production as a share of MAB grows steadily from 126.3% in 2009 to 171.62% in 2012, with a slight decline in 2013 to 164.8%. The minimum share was 39.1% in 2009, which climbed to 86.3% in 2013, while the maximum increased from 369.3% to 691.1% in 2012. Overall, we see an industry-wide increase in MAB utilisation.

6.1.5 Debt ratio

As mentioned earlier, the salmon farming industry is capital intensive and some companies are heavily debt-laden. Those companies with high debt ratio have to pay more of their profits as interest and principle. It could also be argued that there are indirect and direct effects of increased leverage to the company´s performance.

The capital structure of a company is irrelevant for its economic performance in a world with an efficient market and without taxes, transaction costs, and information asymmetry. This was stated by the economists Merton Miller and Franco Modigliani and is known as the Miller-Modigliani theorem. In reality, the above assumptions are not met, and therefore there are advantages and disadvantages of leverage present.

While the direct and indirect effects of leverage consist of different costs and benefits, it is not possible for us to quantify each benefit and cost. We can only give a net indication of benefit or cost of increased leverage.

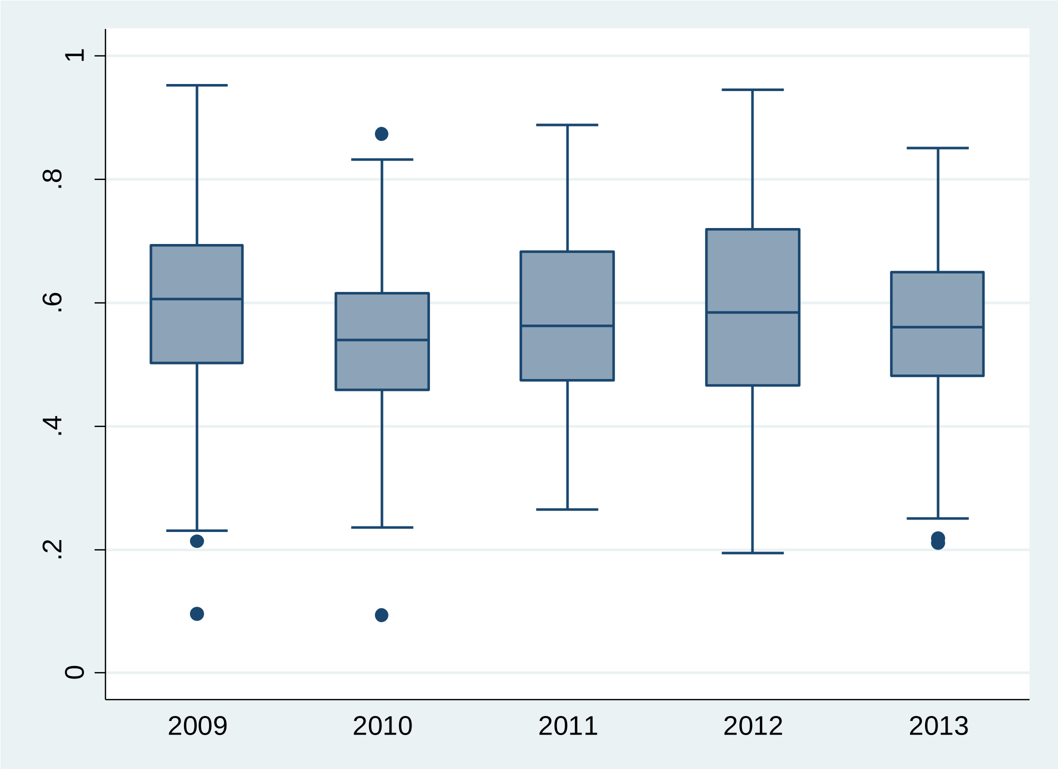


Figure 26 Box and whiskers plot of debt ratio

The debt ratio of the average salmon farming companies varies from a low of 53.5% in 2010 to a high of 58.9% in 2012. 2010 and 2013 were well performing years for the industry, and the debt ratio were lower in these years. The standard deviation in the good years is also lower, at 13.9 and 13.2 per cent respectively for 2010 and 2013. For 2009, 2011 and 2012, the standard deviation was 15.5, 14.9 and 17.0 per cent. The difference between maximum and minimum observation is quite big. The minimum outlier value was 9.4% in 2010 while lower adjacent value is about 20 per cent or above. The upper adjacent value varies from 85.1% in 2013 to 95.2% in 2009.

6.1.6 Experience, Cooperation, Timing and Productivity

Experience is mentioned by Riley as one of the cost drivers. Costs fall as experience is gained. A proxy to experience could be the age of a company.

Category	Factor	Indicator
Experience	Age	The age distribution of the companies

Experience could in some cases be a disadvantage as it may lead to structural inertia. The biggest obstacle to measure experience by the age of a company, however, is that experience, especially tacit knowledge, may be lost in a company as employees leave. A counter-argument is that most companies have written down standard operating procedures to institutionalise the knowledge. It is reasonable to believe that due to regulations from the government and food safety agency, the companies operate quite similarly in the first place.

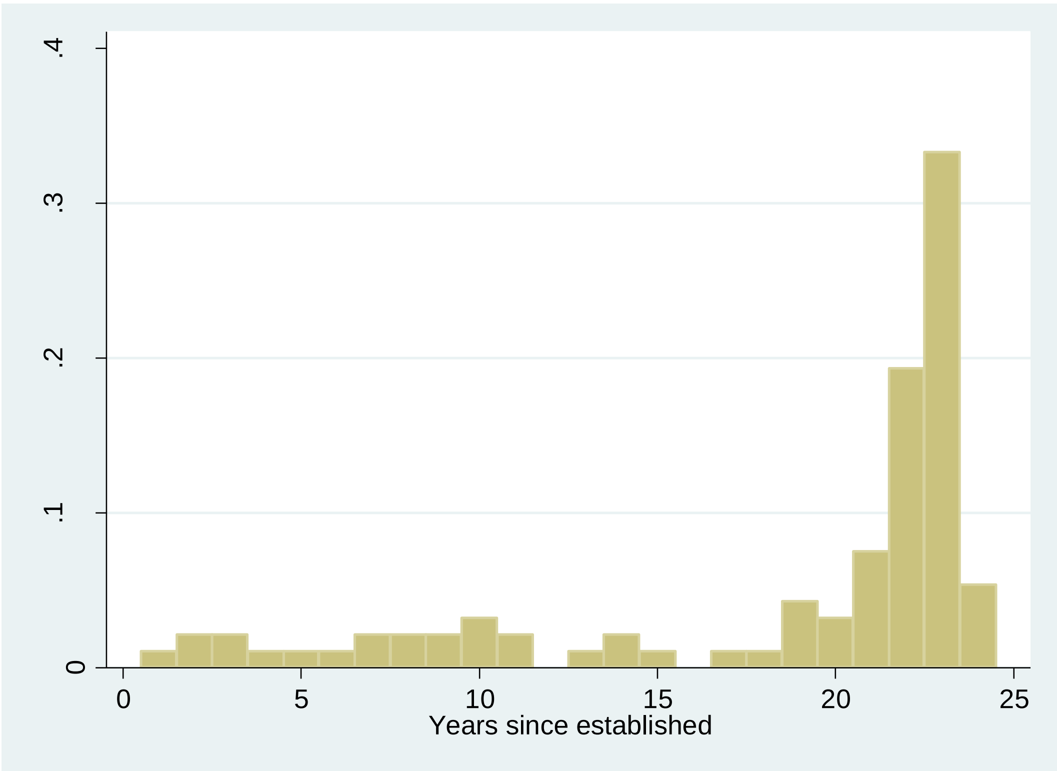


Figure 27 The age distribution of the companies, representing the factor *experience*

The table above shows the distribution of the companies´ age in 2012. The oldest company at that time was 24 years old. Most companies were 23 years old in 2012, accounting for over 30 per cent of the sample.

Cooperation or *interrelationship* between different business units in an organisation may increase the cost efficiency if the activities can be coordinated between the units. Some salmon farming companies participate in alliances and cooperation. The biggest ones, like Marine Harvest, cooperate with research organisation to improve the operations. It also has cooperation with WWF on developing sustainable aquaculture. Another example is that smaller companies have common purchasing cooperation in order to save costs. However, finding an authoritative source on the different cooperations and alliances has been difficult, so we choose not to analyse this factor.

Right *timing* can make or break for a company. According to Bill Gross, a successful entrepreneur and CEO of Idealab, a business incubator which has more than 100 companies in its list, the biggest factor in determining the success of a business start-up was not the business idea, team, funding or business model, but the timing. Some companies may be founded in the beginning of an economy slowdown, which makes it hard for them to survive. This factor looks more into whether a company survives than the cost and profit drivers over a long term, which we are more interested in. We therefore choose not to analyse this factor.

Labour productivity is important in many industries. However in the Norwegian salmon farming industry, labour costs account for a small share of total costs. The companies are already highly capital intensive and its workforce is among the most productive in the world. Due to these reasons, we believe labour productivity is not a main factor explaining the variation in relative profitability between the Norwegian companies.

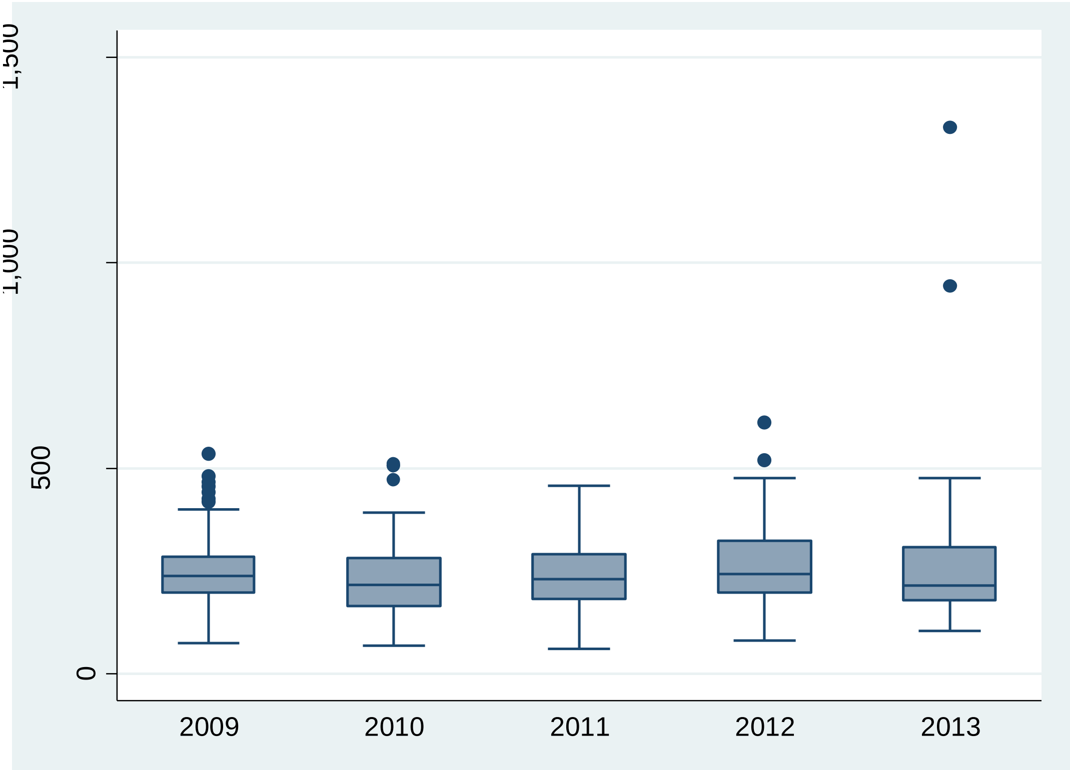


Figure 28 Labour productivity - Production in kilo per work hour

The above figure shows the production in kilo per work hour. The mean and variance have remained relatively stable in this period.

Note that there were other factors that would have been interesting for our analysis to explore, most notably the majority of the operational cost drivers. However, due to lack of data, we cannot include them.

6.1.7 The factors summed up

We can now answer subquestion 3.1: *Which factors may influence profitability and how do the fish farming companies differ in regards to these factors?* By applying the cost driver theories of Porter and Riley, we have discovered eight factors that we have data on and seem to be relevant for profitability in the salmon farming industry. The companies are relatively different in one or several factors.

The mean value of actual production and maximum allowed biomass has increased in the period. The actual production fell in some years, but ended up at a higher level and the standard deviation also showed a rising trend. As for the factor scope, we see that most companies have little other ordinary earnings, and that most companies produces salmon exclusively. The standard deviation fluctuates. The value of research and development, as well as patents as a share of total assets, bigger than the mean, some companies have almost 4 per cent of total assets in their research and development and patents. Most of the companies were located in the west, followed by the north. The capacity utilisation has increased steadily industry-wide while the mean value of the debt ratio varies, possibly correlating with salmon prices. The variation in debt levels are quite high, meaning some companies are significantly more leveraged that others.

Category	Factor	Indicator	Description
Size	MAB Actual production	Volume Volume	MAB stable. Actual production fluctuates, but end up on higher level
Scope	Product range	Other ordinary earnings as a share of total revenues. Product distribution of salmon, trout or both	Most companies had very little other earnings. Little fluctuation in variation. About 84% produces salmon exclusively. 3% trout exclusively
Technology	Research and development and patents	Value of research and development and patents as a share of total assets	Average share: 0.5%. Slight increase in variation in the end of period.
Employees´ commitment to continuous improvements	Type of ownership	Closeness of personal ownership. Family ownership.	About 50% of companies owned directly by an individual or its parent company. About 50% family-managed and owned directly.
Location	Geographic region	Geographic region	Most companies located in the west, followed by the North.
Capacity utilisation	Capacity costs	Actual production as a share of maximum allowed biomass	Industry-wide increase in MAB utilisation.
Experience	Age	The age distribution of the companies	Most companies were 23 or 22 years old in 2012, accounting for over 50% of sample.
Productivity	Labour productivity	Production in kilos per work hours	Stable mean and variation throughout period.
Timing	-	Hard to measure	
Co-operation	-	Hard to measure	

Table 15 Overview of the factors and their description

6.2 The relationship between the factors

6.2.1 Analysing the relationship between the factors

We analyse whether some of the factors seem to correlate with each other. Correlation may indicate whether one factors drives another, or whether two factors are being driven by a third external factor. When we know more about the correlation, we can more clearly see how the factors work. The table below shows us all the factors correlating against each other.

	produc~g	mab_co~g	p_othe..	techno~g	p_prod~g	debt_r~g	age_co~g
production~g	1.0000						
mab_comp_avg	0.9698	1.0000					
	0.0000						
p_other_re~g	0.3237	0.3156	1.0000				
	0.0000	0.0000					
technology~g	0.3701	0.3519	0.0177	1.0000			
	0.0000	0.0000	0.8265				
p_producti~g	0.1575	0.0334	0.0025	0.0865	1.0000		
	0.0408	0.6661	0.9741	0.2827			
debt_ratio~g	0.2041	0.1781	0.0191	0.2719	0.1631	1.0000	
	0.0078	0.0205	0.8050	0.0006	0.0341		
age_comp_avg	-0.1504	-0.1950	-0.0051	0.0632	0.0587	-0.1976	1.0000
	0.0610	0.0147	0.9494	0.4332	0.4669	0.0134	

Figure 29 Correlation analysis between the factors

The correlation analysis indicates two relationships. The first relationship is size and this factor consisting of actual production and MAB, is correlated with most of the other factors. Actual production is significantly correlated with MAB (0.970), scope (0.324), technology (0.370), capacity utilisation (0.158) and debt ratio (0.204), but not experience. MAB is significantly and positively correlated with actual production (0.970), scope (0.316) and debt ratio (0.178). It is negatively correlated with our proxy for experience (-0.195).

The second relationship is financial. In addition to size, the debt ratio was positively correlated with the factors of technology, capacity utilisation and experience. The coefficients of correlation varied from 0.163 to 0.272, with a significance level of 5%.

We can now answer the subquestion 3.2: *What relationships exist between the factors?* There seems to be two visible groups of related factors.

The *size factors* correlate with each other and with scope, technology, capacity utilisation (for actual production only), debt ratio and experience (for MAB only). The *financial factors,* consisting of *debt ratio, technology, capacity utilisation* and *experience*, correlate with the *size* factors. Debt ratio correlates negatively with *experience*.

6.3 Summing up the characteristics of the salmon farming companies

We can now answer the research question 3: *Which factors may be of significant importance for the profitability of the Norwegian fish farming companies?* In this chapter, based on theory about cost and profit drivers, we have developed a framework with factors that are potential profit and cost drivers in the Norwegian salmon farming industry. We have seen that there are two major relationships - one being related to *size,* the other one *financial.*

The companies are described using indicators for each factors and the variation in the factor levels shows that the companies have different characteristics. The table below sums up the top twenty companies in terms of actual production, thereby answering subquestion 3.3: *What characterises the different companies?* See appendix for a complete list.

Production, calculated according to fdir definition, company average	Maximum allowed biomass, in kg, company average	Other ordinary earnings as share of total operating revenue, company average	Value of patents and r&d as share of licence volume, company average	Production as share of Maximum Allowed Biomass, company average	Debt ratio, company average	Years since established, company average
Company 81	Company 90	Company 27	Company 25	Company 27	Company 81	Company 70
Company 71	Company 31	Company 153	Company 49	Company 69	Company 29	Company 104
Company 96	Company 65	Company 36	Company 68	Company 96	Company 167	Company 146
Company 90	Company 71	Company 126	Company 143	Company 127	Company 115	Company 85
Company 6	Company 81	Company 31	Company 84	Company 126	Company 40	Company 126
Company 126	Company 153	Company 53	Company 23	Company 138	Company 13	Company 60
Company 138	Company 23	Company 49	Company 90	Company 168	Company 8	Company 127
Company 31	Company 49	Company 38	Company 167	Company 13	Company 90	Company 92
Company 3	Company 3	Company 33	Company 92	Company 92	Company 140	Company 108
Company 65	Company 6	Company 112	Company 40	Company 80	Company 78	Company 84
Company 132	Company 132	Company 9	Company 94	Company 68	Company 75	Company 106
Company 49	Company 94	Company 99	Company 81	Company 11	Company 50	Company 113
Company 92	Company 25	Company 26	Company 3	Company 44	Company 38	Company 96
Company 80	Company 141	Company 96	Company 100	Company 50	Company 65	Company 30
Company 68	Company 109	Company 95	Company 132	Company 118	Company 1	Company 162
Company 153	Company 147	Company 80	Company 101	Company 56	Company 158	Company 21
Company 23	Company 167	Company 32	Company 109	Company 60	Company 98	Company 22
Company 11	Company 161	Company 14	Company 7	Company 98	Company 114	Company 9
Company 100	Company 12	Company 34	Company 71	Company 100	Company 155	Company 122
Company 54	Company 58	Company 65	Company 4	Company 57	Company 116	Company 56

Table 16 The companies ranked in terms of actual production and the ranking for the other factors

In the next chapter, we use regression analysis to see the relationship between the factor characteristics and the economic performance measures of chapter 5.

Chapter 7 The relationship between the factors and the profitability measures

In chapter five, we saw that there is variation in profitability among the fish farming industry. Chapter six showed the variation and the pattern in the factors that characterise the companies and may influence economic performance. In this chapter we connect the results from the prior two chapters together and investigate the relationship between the relative economic performance and the characteristics of the companies. We try to describe which factors characterises the companies with best economic performance. Therefore, we answer research question 4:

- 4: Which relationships are between the characteristics of the company and their economic performances?

The figure below shows how factors may influence profitability.

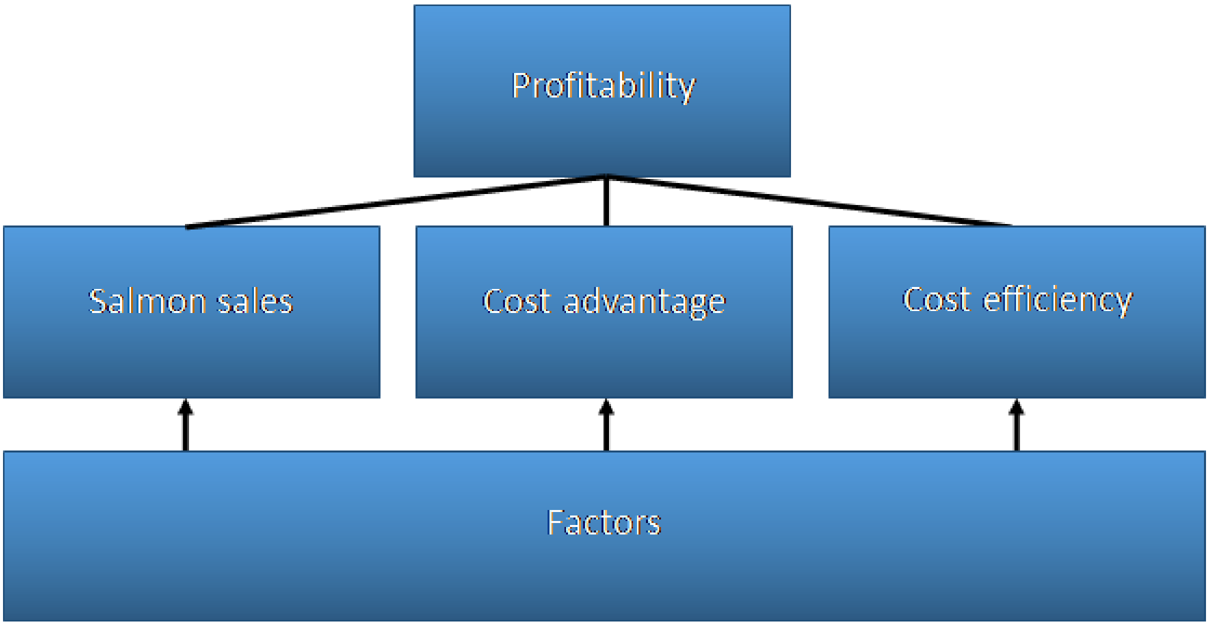


Figure 30 The relationship between the factors and profitability

7.1 Profitability measure comparison

In the first part of our regression analysis, where we develop the most basic version of our model, we will therefore run the regression with each of them. If results are still similar, we can move on as planned, using Return to Equity as our main profitability measure and dependent variable in the later models. As we develop our models, we discuss the results.

7.1.1 The basic model

Our data set is a panel, with more than 90 companies over 4 years. We expect there to be unobserved effects within the groups. That is, the observations for a company or a year can have things in common, which are not picked up by the independent variables. For the basic version of our model, we use Ordinary Least Square regression with dummies, also called Least squares dummy variable regression (LSDV), in which we add dummies for all companies and years (subtracting one to prevent multicollinearity).

Profitability, measured as ROE, ROA and operating profit per kg respectively, was regressed against the potential explanatory variables discussed in chapters 4 and 5. For now, we have made no particular specifications or changes, with the exception of discrete and nonnumeric variables, which had to be converted into binary (dummy) variables A summary of the results is shown below. Company dummies are not shown in the summary.

VARIABLES	(1) roe	(2) roa	(3) opr_kg_production
p_other_revenue	0.233	0.220	8.733*
	(0.502)	(0.172)	(5.178)
p_purchasing_costs	-0.123**	-0.0652***	-2.632***
	(0.0501)	(0.0172)	(0.517)
p_other_op_costs	-1.027***	-0.254***	-7.696***
	(0.218)	(0.0747)	(2.248)
mab	3.00e-08	7.62e-09	1.93e-07
	(2.11e-08)	(7.24e-09)	(2.18e-07)
production	9.42e-09	4.43e-09	-2.51e-08
	(8.02e-09)	(2.75e-09)	(8.28e-08)
productivity	0.000335	0.000193*	0.00230
	(0.000297)	(0.000102)	(0.00306)
feed_factor	-0.0756	-0.0614**	-0.678
	(0.0846)	(0.0290)	(0.873)
patents	-2.05e-06**	-3.86e-07	-5.85e-06
	(9.42e-07)	(3.23e-07)	(9.72e-06)
rd	-1.50e-06	-2.95e-07	-3.43e-06
	(1.30e-06)	(4.44e-07)	(1.34e-05)
owner_is_person	-0.000179	-0.0169	-0.269
	(0.0695)	(0.0238)	(0.717)
p_production	0.0298	0.00449	0.0694
	(0.0580)	(0.0199)	(0.599)
debt_ratio	0.520***	-0.0748	-0.742
	(0.181)	(0.0619)	(1.864)
age	-0.0274***	-0.00615**	-0.129
	(0.00905)	(0.00310)	(0.0934)
spot	0.0481***	0.0219***	0.778***
	(0.00503)	(0.00173)	(0.0519)
north	-1.206	-0.408	-2.339
	(0.806)	(0.276)	(8.315)
west	-0.641	-0.350	-0.415
	(0.704)	(0.241)	(7.263)
central	-0.674	-0.328	-1.995
	(0.722)	(0.248)	(7.452)
south	-0.579	-0.325	-0.0754
	(0.827)	(0.284)	(8.537)
only_trout	0.165	0.0889	0.532
	(0.192)	(0.0658)	(1.980)
salmon_and_trout	-0.250***	-0.0567*	-1.865**
	(0.0885)	(0.0304)	(0.914)
y2009	-0.000173	0.0145	-0.563
	(0.0389)	(0.0134)	(0.402)
o.y2010	-	-	-

y2011	-0.143***	-0.0618***	-2.420***
	(0.0331)	(0.0113)	(0.341)
o.y2012	-	-	-
Observations	385	385	385
R-squared	0.806	0.826	0.859

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17 Summary output of the basic model

7.1.2 Interpretation of the basic model

Until the model is more thoroughly specified, the information it can provide is limited. Still, we can make some observations about the three profitability measures. Right now, the size of the coefficients is difficult to interpret, but we see that the signs for a coefficient tend to be the same for the three regressions. In addition, whenever a coefficient is strongly statistically significant, with a p-value smaller than 1%, it tends to be significant at least on a 5% level, in the other regressions.

The cases where the profitability measures are very different, can to some degree be explained. As a proxy of technology, we expected patents to be connected to cost savings, and have a positive coefficient. On the other hand, if owning patents holds no major benefits, a bigger balance would mean a larger denominator in ROE and ROA. As the ROA denominator, including both equity and debt, is larger than the ROE denominator equity, an increase in the balance would affect ROE more than ROA. This could explain why the coefficient is only statistically significant for ROE.

The coefficient for debt_ratio is positive and strongly significant for ROE. For the others it is negative, and not even significant at a 10% level. This is not unexpected, and can probably be explained by the gearing effect. The amount paid to debt holders is fixed. This means that, as long as the total return is higher than the interest rate, higher debt means higher return to equity.

While age is strongly significant for ROE, it is not significant at all for opr_kg_production. We expected this variable to be different from the others, as it does not take balance values into account. More surprisingly, the significant coefficient for feed factor in the ROA regression has no obvious explanation.

7.1.3 Takeaways from the first regression

Our main purpose with the basic model, was to make sure that ROE is a suitable profitability measure. We found that the coefficients in each regression mostly have very similar relationships with the independent variables. In the cases where they differed, a direct relationship usually provided a plausible explanation.

Being as close as they are, either profitability measure would work, as long as we are aware of the differences when interpreting results. Although a similar measure is used in the fish farming industry to compare operating efficiency, operating profit per kg is not optimal for our use. To look at profitability, we prefer a measure that includes more. In conclusion, we choose to use ROE as our profitability measure, although ROA would probably work well, too.

As well as comparing profitability measures, working with the basic model helped us identify a few issues that need to be addressed, and gave us ideas for improvements. Most importantly, we need to specify the model so that the coefficients have clear interpretations.

7.2 Improving our LSDV model

Building on the results and experiences from the first model, we will now properly specify our model, and make other improvements. From now on, we will use ROE as the dependent variable.

6.2.1 Getting meaningful coefficients

First, we will change the variables that are difficult to interpret in the original model.

First, our “company size variables”, mab and production, have very small coefficients. This is because their underlying variables, the licence volume and production, are counted in kg, while even the smallest companies produce tens of tonnes. To make these easier to read, we replace these with variables measured in 1000 tons, that is, in millions of kg. The new variables are denoted, respectively, mab_mill and production_mill. Similarly, we make new variables for patents and rd (research and development) denoted in millions of NOK.

6.2.2 FE and RE

The model has a relatively high explanatory power, for all three profitability measures. Still, this does not have to mean much. Because of the way R squared is calculated, it will always increase when you add variables. With 157 dummy variables just for the companies, a high explanatory power is therefore no surprise.

A high number of variables comes with a cost, in the form of degrees of freedom. This reduces the chances of finding strong relationships, and we would like to avoid it if possible.

As explained in the methodology chapters, the Fixed Effect Transformation method removes the fixed effects without creating dummy variables, saving degrees of freedom compared to LSVD. If we believe the unobserved effect to be uncorrelated with the independent variables, we need to use a Random Effect model. To choose, we use the Hausman test, which consists of running a regression on each model, and testing for a significant difference. The results are shown in table 18.

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
p_other_re~e	.3647448	.1253869	.2393579	.2666154
p_purchasi~s	-.1259721	-.1473054	.0213333	.019553
p_other_op~s	-1.041519	-1.085112	.0435927	.1242156
mab_mill	.0225796	-.0068072	.0293867	.0185694
production~l	.0070528	.0087072	-.0016544	.0046959
productivi~r	.1570724	.3460612	-.1889888	.100758
feed_factor	-.1172054	-.1469505	.0297451	.0396882
patents_mill	-1.68723	-.9013087	-.7859217	.7511544
rd_mill	-.7983109	-.0332018	-.7651091	.6301064
owner_is_p~n	-.0477382	.0155814	-.0633196	.0539878
p_production	-.0100088	-.03284	.0228312	.040058
debt_ratio	.565784	.6776543	-.1118703	.1268558
age	-.0436877	-.0016103	-.0420774	.0157037
spot	.046556	.0544049	-.0078488	.002112

```
                         b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                           =       32.08
                Prob>chi2 =      0.0039
```

Table 18 The Haussman specification test

With a p value below 0.4 percent, the null hypothesis is rejected. Our choice is now between the LSVD model, and the FE model. While the FE model saves degrees of freedom, the LSVD model allows us to see the coefficients of the dummy variables. We there run both regressions, using the new variables. A summary of the results is shown below, in table 19.

VARIABLES	(1) roe	(2) roe
p_other_revenue	0.233	0.365
	(0.502)	(0.435)
p_purchasing_costs	-0.123**	-0.126**
	(0.0501)	(0.0492)
p_other_op_costs	-1.027***	-1.042***
	(0.218)	(0.214)
mab_mill	0.0301	0.0226
	(0.0211)	(0.0207)
production_mill	0.00942	0.00705
	(0.00802)	(0.00745)
productivity_year	0.181	0.157
	(0.161)	(0.149)
feed_factor	-0.0757	-0.117
	(0.0846)	(0.0814)
patents_mill	-2.051**	-1.687*
	(0.942)	(0.902)

rd_mill	-1.496	-0.798
	(1.296)	(1.282)
owner_is_person	-0.000215	-0.0477
	(0.0695)	(0.0670)
p_production	0.0299	-0.0100
	(0.0580)	(0.0538)
debt_ratio	0.520***	0.566***
	(0.181)	(0.174)
age	-0.0274***	-0.0437***
	(0.00905)	(0.0162)
spot	0.0481***	0.0466***
	(0.00503)	(0.00423)
north	-0.627	
	(0.402)	
west	0.257	
	(0.366)	
central	-1.048*	
	(0.587)	
o.south	-	
y2009	-0.000164	
	(0.0389)	
o.y2010	-	
y2011	-0.143***	
	(0.0331)	
o.y2012	-	
only_trout	0.165	
	(0.192)	
salmon_and_trout	-0.250***	
	(0.0885)	
	(0.335)	
Constant	-0.696	-0.427
	(0.434)	(0.408)
Observations	385	385
R-squared	0.806	0.594
Number of id		121

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 19 LSDV and fixed effect regressions

6.3 Results

Costs

Thanks to the extra degrees of freedom, the Fixed Effects model has lower standard errors for most of the coefficients. The two models yield fairly similar results. This was not unexpected, but still strengthens our belief in the results. Purchasing costs turns out to be quite an important determinant of profitability. An increase of 100 percentage points in purchasing costs/operating revenue, leads to a predicted 11.9% increase in ROE. Other operating costs as share of total operating costs is also strongly significant, though with a lower coefficient.

Size and location

The only size variable with any kind of statistical significance was mab_mill, which predicts an ROE increase of 3.3% for each million kg in allowed biomass, at a significance level of 10%. This is too low for such a large data set, but still interesting. When doing preliminary OLS regressions without dummy variables, production and mab tended to have large effects. Apparently this was just size being correlated with unobserved effects.

Location also had large, significant coefficients in OLS, before we added company variables. Thus, the apparent effect of location was just picking up differences between companies.

Patents

Surprisingly, patents turned out to have a large negative effect. As discussed when first seeing indications of this, it could be that patents are overvalued in the books, blowing up the equity number while providing little extra cash flow.

We only have balance values for r&d and patents. Assuming that r&d activities, and therefore their affiliated costs, are relatively stable, the balance values for r&d and patents need to be highly correlated with the spending on such activities.

In either case, the negative coefficient comes from doing unprofitable activities, or possibly because it takes time for these to translate into cash flow. A new, expensive treatment against samon lice, for instance, might not pay off until it becomes an even bigger problem than now. With a dataset spanning more years, it would be interesting to whether patents and r&d assets stay unprofitable.

Age

This is a strange finding. The model predicts ROE to fall by 3.2%, for each year since the company was started. This surely is not a linear relationship, or the fish farming companies would be gone. More likely, it was caused by a few large, but unprofitable companies, or some small, very profitable ones.

Spot prices

The spot prices on Fish pool have a large effect on predictions from the model. Not surprising, as they decide the company's revenue. If the price increases by 1 NOK, ROE is predicted to increase by 4.9%. Because the rest of our data were limited, we only downloaded yearly averages of the spot price. Still, it varied by 10 NOK in the four years of our regression. As prices will vary even more on a daily basis, fish farming is a volatile business.

Salmon or trout

With strong statistical significance, our model indicates that companies farming both salmon and trout, do worse than companies farming just one of them. This could be due to lack of focus, as we have already controlled for location, company size and year, which could all be correlated with the type of fish, and might have led to similar results if omitted.

Chapter 8 Future profitability

Chapter 7 showed us the relationship between the factors and the economic performances in the period 2009-2013. In this chapter we discuss what might become important for future profitability.

The guiding research question of this chapter is:

5. What will be important for future profitability in the salmon farming industry?

We can only make educated guesses based upon the development in the industry and its surroundings. Initially we discuss the future importance of the sources of profitability and the factors. Later we take a closer look at other conditions that may be important for the future profitability in the industry.

8.1 Sources of profitability and the factors in the future

Salmon sales and other operating costs as a share of operating revenues (cost efficiency) were the sources that showed significant correlation in chapter 5. Purchasing costs as a share of operating revenues (cost advantage) did not. We will look at all three sources though, as in the future, changes in the industry and the environment might render some sources more or less relevant. In the following we discuss the future importance of the sources of profitability and the factors.

8.1.1 The importance of salmon sales in the future

The salmon sales is the biggest element in the common size analysis and is most important for the profitability of the salmon farming companies. Explained by supply growth lagging behind the huge demand growth, the companies have had a phenomenal growth over the last decades.

There are several factors that might affect the top line. It is expected that the world demand for Atlantic salmon and rainbow trout continues to grow thanks to the rising consumption of fish in developing countries. The oil price has fallen dramatically recently, which had a big impact on the Norwegian economy. As a result, the Norwegian currency has depreciated significantly, which would make Norwegian salmon more competitive in the world markets and increase its sales. The main arguments against rising sales for Norwegian companies is increased competition from cheaper countries like Chile or disruptive technological breakthroughs.

Currently, land based salmon farming is not economical feasible, but that might change in the future. Norway´s competitive advantage is the long coast with cold and relatively still waters. If land based salmon farming becomes more profitable, Norwegian companies would lose this advantage, which would result in surrendering market share to companies in other countries. The Norwegian Directorate of Fisheries has acknowledged this threat, and has called for further development of land-based facilities and license exemptions on land. Only by having a technological advantage in land-based facilities can Norwegian companies achieve sustainable competitive advantage over their foreign peers. According to an official in the directorate, it is better that this technology is pioneered and controlled by Norwegian companies than foreign companies, which are already undertaking research and development in this (NRK, 2015).

Political factors also affect the top line. Increased sanctions or trade wars between countries, as evident between Norway and China after the Nobel Peace Prize and Russia after the Ukrainian civil war, will hurt the sales. The sales of Norwegian salmon to the European Union is subject to tariffs according to the agreement between the EU and the European Economic Area (EEA). Norway is part of the latter organisation and EEA and EU have agreements regarding tariffs and quotas for Norwegian seafood export renewed every five years (DN, 2015).

Political factors can also hurt Norwegian salmon companies indirectly. A free trade agreement *(TTIP - transatlantic trade and investment partnership)* between the U.S. and the European Union under negotiation, the latter being Norwegian salmon´s biggest export market, could result in all Norwegian competitors having tariff free access to the EU market (DN, 2015). This would affect Norwegian companies greatly, some more than others since the biggest companies have geographically diversified salmon farming into countries such as Chile, Scotland and Canada, which all have or are negotiating free-trade agreements with the EU. Producers from the EU may be granted toll free import, processing and export of salmon and white fish to the U.S. and Asia, which might affect the sales of Norwegian salmon to the EU and export of salmon to South Korea and Japan (DN, 2015).

8.1.2 Purchasing costs

Purchasing costs might become more important in the future. Having a stable access to raw materials such as smolt and feed to competitive prices is not given in the future. Sudden shocks to supply might increase the costs dramatically for those companies that buy it to spot prices, a cost that already accounts for the largest share of operating costs in the industry. For example, Peru decided to ban anchoveta fishing in 2014, the main ingredient in fishmeal and fish oil which many feed companies rely on, propelling the price upwards (iLaks, 2014). The big salmon farming companies, like Marine Harvest are partially protected from price and supply fluctuations since they have vertically integration with the feed production plants.

8.1.3 Other operating costs

This was one of the sources of profitability that had a significant impact on relative economic performances. Being cost efficient in running the facilities may be more important and possible to manage compared to the former two sources of profitability. As competition increase, the more important cost efficiency will be. In the future if more domestic and international companies compete, perhaps spurred by disruptive technology, cost efficiency may be a precondition for profitability, not a source of it.

8.2 Other important factors for future profitability

Salmon is becoming an increasingly differentiated product. Earlier, salmon was a generic product that was sold as whole fish in the retail stores. The Norwegian salmon farming company adopted a volume strategy to create value by efficient operations, low production costs and high volumes (Samuelsen, 2009). Little was done to differentiate the salmon, and the companies largely competed on price.

Nowadays, we see more efforts by the companies to focus more on quality, value-added products and differentiation, for both Atlantic salmon and rainbow trout. As an example, Marine Harvest launched a high-end salmon, promoting its origin from a famous river in Western Norway, the strong and healthy features of the salmon giving it superior taste compared to other salmon. We also see companies promoting organic salmon, which are being fed with more environmental friendly feed. In addition, the animal welfare is supposedly better since the maximum allowed salmon density in each marine cage is lower while the marine cages themselves are copper free. Cages made of copper is an inherent risk to the environment. As some salmon farming companies also control the slaughterhouses, they may capture the extra value from value added services like cutting the fish. In Japan, Marine Harvest is adding a processing line to cut the salmon into sushi slices as the older people that did the cutting are retiring and the younger generation is more unwilling to do the cutting (UCN, 2014). In the future, a relentless focus on quality may be the key to achieve higher relative profitability.

The last decades we have seen an increasing trend of backwards and forwards vertical integration from the salmon farming companies, i.e. they acquire smolt and feed producers and slaughterhouses and secondary processing plants. We have also seen this trend for the retailers that buy their own food and beverage factories, which result in own private labels for sale to the customers. We also see this for seafood. Norwegian retailers carry their own private labels for Atlantic salmon and rainbow trout. Currently the bargaining power of the customers are low, as the salmon farming companies have thousands of different customers. In the future though, the vertical integration of the retailers and the processing plants could go further up to the salmon farms themselves. This could pose a risk to the profitability of the salmon farming companies as the retailers have their own ensured supply option. If there is a disagreement over price, the retailers could have higher bargaining power as they have alternatives. As Norwegian consumption only accounts for a tiny fraction, only the biggest retailers in the world pose a risk from the customer side.

The interest rate is currently record low, and we have seen how differently leveraged the companies are in chapter 6. Depending on when and how high the interest rates increase, this could put some salmon farming companies out of business.

The Norwegian authorities could impose stricter standards when they award licenses in the future. In 2013, the authorities released 45 new and special *green licenses* which required the prospective companies to prove that they used new technology that reduced the risk of escaping salmon or the prevalence of lice without using medicaments more than three times per production cycle. This policy could be expanded in the future to include all future licenses, which would increase the entry barriers for the companies (Norwegian Directorate of Fisheries, 2014).

8.3 Conclusion

The goal of this chapter was to answer the research question 5: *What will be important for future profitability in the salmon farming industry?* We have taken a look at the future importance of the three sources of profitability, and other important factors in the future.

Falling oil price and the devaluation of the Norwegian currency makes Norwegian salmon more competitive, but disruptive innovation in land-based facilities looms large and may threaten the sales of salmon and trout in the future. Trade wars and trade agreements on transcontinental scale which Norway is not part of, is also threatening the sales.

Purchasing costs account for more than half of the production costs. Securing a reliable and competitive source can make or break it for certain companies that are not vertically integrated.

Having relatively low other operating costs may increasingly be the aspect that separates the best from the rest. Price of salmon and raw materials may be more or less fixed, while the company has ability to control these costs in a greater degree.

Higher quality and increased differentiation seems to be the trend and may become more important for future relative profitability. Although the risk from vertical integration by the retailers in general is low, it is a risk factor that the companies should be aware of. Lastly, the companies must prepare themselves for higher interest rates which could threaten highly leveraged companies. They also must expect to pay higher for the licenses, both directly through the license fee and indirectly through higher environmental standards.

Chapter 9 - Conclusion

9.1 The results of the problem statement and the research question

The goal of the thesis has been to explore and describe factors that are important for the profitability of Norwegian salmon farming companies. We have in total studied 169 companies for at least one year in the period of 2009-2012. By analysing the competition arena of the salmon farming companies and their relative economic performances, we have tried to answer our problem solution, which was:

What may explain variations in profitability in the current Norwegian salmon farming industry, and what will be important for the future profitability?

To answer this problem statement, five research questions have been formulated.

1. How is the competition environment in the Norwegian fish farming industry characterised by?
2. What profitability variations exist between Norwegian fish farming companies, and which areas of performance seem to be especially important for relative profitability?
3. Which factors may be of significant importance for the profitability of the Norwegian fish farming companies?
4. Which relationships exist between the characteristics of the salmon farming companies and their economic performances?
5. What will be important for future profitability in the salmon farming industry

We introduced the analysis of profitability variation by looking at *what characterises the competition environment of the Norwegian salmon farming industry.* The Norwegian authorities has a high degree of influence by regulating the industry while the relatively weak Norwegian currency makes it more competitive. The low interest rate benefits the financing of the companies and consumer behaviour are favourable for the industry. On industry level, the intensity of competition is not fierce at the moment, helped by the high demand growth and lagging supply. Hence, the potential profitability is high for the average firm. In the future, the internal rivalry may increase due to foreign acquisition and disruptive technology.

In chapter 5 we analysed w*hat profitability variations exist between Norwegian fish farming companies, and which areas of performance seem to be especially important for relative profitability.* We saw a large variation in profitability between the companies in the period 2009-2013. Salmon sales and cost efficiency in other operating costs had significant correlation with the relative economic performances of the companies. Purchasing costs did not seem to correlate with relative profitability in our sample.

Based upon the theoretical frameworks and the competition environment analysis, we found factors that may be important for profitability in Norwegian salmon farming companies. We expected the following factors to be of importance; size, scope, experience, technology, cooperation, employees´ commitment to continuous improvements, capacity utilisation, timing, location and productivity. The companies were very different with regard to these factors. We divided these factors into two groups - regarding *size* and *financial.*

Our regression analysis from chapter 7 revealed that purchasing costs and cost efficiency in terms of other operating costs seems to explain variation in relative profitability, with the latter one having the strongest correlation. Further on, there is also a significant relationship correlation between debt ratio and relative profitability, likely due to the gearing effect. Our measure for technology had a somewhat surprising negative and significant correlation with relative profitability. Also surprising is the apparent negative correlation between profitability and producing both salmon and trout.

Using the two analyses of competition environment and profitability variation, we tried to make educated guesses about w*hat will be important for future profitability in the salmon farming industry.* Sales of salmon will continue to be most important. Large companies may have more advantages in securing export markets and raw materials compared to their smaller peers. Purchasing costs was not a significance now, but may become more important in the future due to future supply risk, where the integrated companies may benefit more. Cost efficiency is still the one factor that the companies can control the most. In the future, differentiation, vertical integration and the interest rate are likely to play a more important role.

9.2 Limitations and suggestion to future studies

An explanatory motive behind this thesis would be ideal since the intention of the problem statement is to *explain* profitability in Norwegian salmon farming companies. Due to the difficulties in proving causal relationships, this study aims to explore and describe instead. Hence, we only can make indications on what causes profitability.

Our sample covered five years and about 65-75 per cent of all Norwegian salmon farming companies. Optimally, we would have covered all the companies for an even longer period. For example, Marine Harvest, the world´s largest salmon farming company was not covered in our sample.

Another limitation with our study is that we could not include all factors we wanted due to lack of data. Some of the factor indicators could also be questioned for their validity. The employees´ commitment to continuous improvements, experience and technology had the most questionable proxies.

It would be interesting to see this study repeated later for a different country´s salmon farming industry. Comparisons with the Norwegian industry could then me made.

Appendix 1: Do files

File name: Main.do

*This is the main do file. To reproduce our results, save each do file, indicated in red, as its own file. Open all do files in the same stata window, replace the folder paths under “settings” below, and run this file.

```
clear all

capture log close


*SETTINGS

global only_positive_equity=1 // Set to 1 to ignore observations with negative equity, in all calculations

global logfiles="Z:\Masteroppgave\Analyse\Logs"

global workfiles="Z:\Masteroppgave\Analyse\Workfiles"

global output="Z:\Masteroppgave\Analyse\Output"

global fdirdata="Z:\Masteroppgave\Analyse\Data\Fra fiskeridirektoratet\Klargjort for Stata" //folder containing the fdir data, in 5 decrypted excel files

global otherdata="Z:\Masteroppgave\Analyse\Data" //folder containing average spot prices

global snffiles="C:\Users\Bendik\Database NHH mellomlagring" //folder containing the entire SNF database, merged and appended into one Stata file

log using "$logfiles\log.txt", replace text


***********************************

*Import and prepare fdir data

do "fdir merge.do"


*Import and prepare SNF data

do "SNF fish farming.do" //Takes a long time to run


*Merge datasets

use "$workfiles\SNFfish.dta", clear

merge 1:1 year id using "$workfiles\fdir.dta"

*Drop observations missing from fdir data

drop if _merge==1

*Save merged dataset

save "$workfiles\fdir+SNF.dta", replace


*Generate new variables
```

```
do "New variables.do"

***************************
*COMMON SIZE ANALYSIS
*Common size: Profit and loss account
global variables $profit_loss_variables total_assets
global denominator total_assets
global xlfilename cs_profits
do "Common size.do"

*Common size: Assets
global variables $asset_variables
global denominator total_assets
global xlfilename cs_assets
do "Common size.do"

*Common size: Liabilities
global variables $liability_variables
global denominator equity_and_liabilities
global xlfilename cs_liabilities
do "Common size.do"

****************************
*Profitability measure summary
use "$workfiles\fdir+SNF.dta", clear
global variables roe roa opr_kg_production p_sales_revenue p_purchasing_costs p_other_op_costs
global xlfilename profitability_summary
do "profitability measures.do"

*Factor summary
use "$workfiles\fdir+SNF.dta", clear
global variables production p_other_revenue p_production technology_proxy debt_ratio mab
global xlfilename factor_summary
do "profitability measures.do"
```

```
*******************************

*ILLUSTRATION GRAPHS


use "$workfiles\fdir+SNF.dta", clear


*Make box plots from fdir data

foreach v in opr_kg_production roe roa p_sales_revenue p_purchasing_costs p_other_op_costs productivity
production mab p_other_revenue p_production {

        graph box `v', over(year)

        graph export "$output\\`v'_boxplot.png", as(png) replace

}


*Histogram of company age

use "$workfiles\fdir+SNF.dta", clear

keep if year==2012 //the last year for which we have this data

histogram age, discrete

graph export "$output\age histogram.png", as(png) replace


*Box plots based on SNF data

use "$workfiles\fdir+SNF.dta", clear

drop if year==2013

foreach v in technology_proxy debt_ratio{


graph box technology_proxy, over(year)

graph box debt_ratio, over(year)

        graph box `v', over(year)

        graph export "$output\\`v'_boxplot.png", as(png) replace

}



*****************************

*Correlation analysis

use "$workfiles\fdir+SNF.dta", clear
```

```
*Keep only one observation per company, as we are using company averages

sort company

by company: gen n=_n

keep if n==1


pwcorr roe_comp_avg roa_comp_avg opr_kg_sales_comp_avg, sig

pwcorr roe_comp_avg p_sales_revenue_comp_avg p_purchasing_costs_comp_avg
p_other_op_costs_comp_avg, sig

pwcorr production_comp_avg p_other_revenue_comp_avg technology_proxy_comp_avg
debt_ratio_comp_avg mab_comp_avg, sig

pwcorr  production_comp_avg mab_comp_avg p_other_revenue_comp_avg technology_proxy_comp_avg
p_production_comp_avg debt_ratio_comp_avg age_comp_avg, sig


*************************************

*Scatter plots (of company averages)

use "$workfiles\fdir+SNF.dta", clear


*Keep one observation per company

sort company

by company: gen n=_n

keep if n==1


twoway(scatter roe_comp_avg p_other_op_costs_comp_avg) (lfit roe_comp_avg
p_other_op_costs_comp_avg)

graph export "$output\scatter_p_other_op.png", as(png) replace

twoway(scatter roe_comp_avg p_sales_revenue_comp_avg) (lfit roe_comp_avg p_sales_revenue_comp_avg)

graph export "$output\scatter_p_sales_revenue.dta", as(png) replace


*************************************

*PROFITABILITY ORDER TABLES


*Profitability measures

use "$workfiles\fdir+SNF.dta", clear

global first_variable roe_comp_avg

global pos_variables p_sales_revenue_comp_avg

global neg_variables p_purchasing_costs_comp_avg p_other_op_costs_comp_avg
```

```
global xlfilename profitability_measure_order
do "Profitability order table.do"

*Factors
use "$workfiles\fdir+SNF.dta", clear
global first_variable production_comp_avg
global pos_variables mab_comp_avg p_other_revenue_comp_avg technology_proxy_comp_avg /*
*/ p_production_comp_avg debt_ratio_comp_avg age_comp_avg
global neg_variables
global xlfilename factor_order
do "Profitability order table.do"

******************************************
*EXAMINE OWNERSHIP STRUCTURE
Merge with the entire SNF database

use "$snffiles\Hele datasettet.dta", clear
rename orgnr id
rename aar year
rename navn company
merge 1:1 id year using "$workfiles\fdir.dta"
keep if year>2008
keep company id year mors_navn mors_orgnr mors_eandel eierstruktur _merge
save "$workfiles\ownerstructure.dta", replace

capture noisily export excel using "$workfiles\ownerstr.xlsx", replace firstrow(variables)
*The exported data is analysed in vba, to find out whether the owner is a person

*Import file with owner information
import excel "$otherdata\ownerstr.xlsx", sheet("Sheet1") firstrow case(lower) clear
rename orgnr id
rename regnskapsr year
rename samlenavnforvirksomheten company
save "$workfiles\ownership_types.dta", replace
```

```
use "$workfiles\ownership_types.dta", clear
merge 1:1 id year using "$workfiles\fdir.dta"
keep if _merge==3
keep id year layers
save "$workfiles\owners.dta", replace
use "$workfiles\fdir+SNF.dta", clear
merge 1:1 id year using "$workfiles\owners.dta", nogenerate
save "$workfiles\fdir+SNF+owners.dta", replace
use "$workfiles\fdir+SNF+owners.dta", clear
*Prepare data
rename layers steps
label variable steps "Steps away from personal owner"
drop if year==2013
*Generate dummy for
gen owner_is_person=0
replace owner_is_person=1 if steps>0
tab steps,gen(steps)

*label the dummies
label variable owner_is_person "Company or parent company owned by person"
label variable steps1 "Companies not owned by person"
label variable steps2 "Companies directly owned by person"
forvalues x=3/7 {
		local y=`x'-1
		label variable steps`x' "Companies `y' steps from person"
}
save "$workfiles\regression_data.dta", replace



*Make summary in excel
*Define variables to be used
```

```
global variables owner_is_person steps1 steps2 steps3 steps4 steps5 steps6 steps7
*Preserve labels before summary calculation
foreach v in $variables {
	local l`v': variable label `v'
}

*Define data to be used
global data="$workfiles\regression_data.dta"
*Define "last year". We do not have 2013 data for ownership
global lastyear=2012
global collapse_by="sum"
do "Dummy summaries.do"
use "$workfiles\dummy_summaries.dta", clear

*Copy back labels
foreach x in $variables {
	label variable `x' "`l`x''"
}

capture noisily export excel using "$output\owner summary.xlsx", replace firstrow(varlabels)


********************************************
*DUMMY VARIABLE SUMMARIES

*Salmon or trout
use "$workfiles\fdir+SNF.dta", clear
global variables only_salmon only_trout salmon_and_trout
global data= "$workfiles\fdir+SNF.dta"
global lastyear=2013
global collapse_by="mean"
do "Dummy summaries.do"
use "$workfiles\dummy_summaries.dta", clear
capture noisily export excel using "$output\salmon_or_trout.xlsx", replace firstrow(varlabels)
```

```
*Regions
use "$workfiles\fdir+SNF.dta", clear
global variables north south west central
global data= "$workfiles\fdir+SNF.dta"
global lastyear=2013
global collapse_by="mean"
do "Dummy summaries.do"
use "$workfiles\dummy_summaries.dta", clear
capture noisily export excel using "$output\regions.xlsx", replace firstrow(varlabels)



*****************************************************
*REGRESSIONS
ssc install outreg2  //install outreg2



use "$workfiles\regression_data.dta", clear


*Data preparations


*generate year dummies
forvalues v=2009/2012 {
	gen y`v'=(year==`v')
}


*Group similar variables in global macros, to improve readability and simplify working with the data
global year_dummies y2009 y2010 y2011 y2012
global steps_dummies steps2 steps3 steps4 steps5 steps6 steps7	//omitting steps1
global region_dummies north west central south	//not omitting any regions, as some companies are in more than one region
global fish_types only_trout salmon_and_trout //omitting companies producing only salmon



*Generate log variables
```

```
foreach v in roe roa opr_kg_production opr_kg_sales mab {
	gen ln`v'=ln(`v')
}



*6.1: LSDV (Least squares dummy variable regression)
****************************
*generate company dummies
tab company, gen(com)


reg roe p_other_revenue p_purchasing_costs p_other_op_costs mab production productivity feed_factor patents rd owner_is_person p_production debt_ratio age spot $region_dummies  $fish_types $year_dummies com1-com157
outreg2 using "$output\basic.doc", replace
reg roa p_other_revenue p_purchasing_costs p_other_op_costs mab production productivity feed_factor patents rd owner_is_person p_production debt_ratio age spot $region_dummies  $fish_types $year_dummies com1-com157
outreg2 using "$output\basic.doc"
reg opr_kg_production p_other_revenue p_purchasing_costs p_other_op_costs mab production productivity feed_factor patents rd owner_is_person p_production debt_ratio age spot $region_dummies  $fish_types $year_dummies com1-com157
outreg2 using "$output\basic.doc"


*Regression with improved variables
reg roe p_other_revenue p_purchasing_costs p_other_op_costs mab_mill production_mill productivity_year feed_factor patents_mill rd_mill owner_is_person p_production debt_ratio age /*
*/ spot $region_dummies $year_dummies $fish_types com1-com157
outreg2 using "$output\6.2.doc", replace


*Hausman test
xtset id year
quietly xtreg roe p_other_revenue p_purchasing_costs p_other_op_costs mab_mill production_mill productivity_year feed_factor patents_mill rd_mill owner_is_person p_production debt_ratio age spot, re
quietly estimates store random
quietly xtreg roe p_other_revenue p_purchasing_costs p_other_op_costs mab_mill production_mill productivity_year feed_factor patents_mill rd_mill owner_is_person p_production debt_ratio age spot, fe
quietly estimates store fixed
hausman fixed random //Significant --> use FE
```

```
*Fixed effect regression

xtset id year //Declare as panel data

xtreg roe p_other_revenue p_purchasing_costs p_other_op_costs mab_mill production_mill productivity_year
feed_factor patents_mill rd_mill owner_is_person p_production debt_ratio age spot /*

*/ $region_dummies $year_dummies $fish_types , fe

outreg2 using "$output\6.2.doc"
```

File name: SNF fish farming.do

```
*This file extracts the relevant data from the SNF database


/*Open main SNF dataset

use "snffiles\Hele datasettet.dta", clear


*Keep observations for industry categories in any way related to fish or aquaculture.

keep if bransjek_07==3111 | bransjek_07==3211 | bransjek_07==3222 | bransjek_07==10202 |
bransjek_07==10209 /*

*/  | bransjek_07==70100 | bransjek_07==03213 | bransjek_07==03221 | bransjek_07==03222 |
bransjek_07==3223


*Drop old observations, without corresponding data in the fdir dataset

rename aar year

keep if year>2008


save "$workfiles\SNFfish_before_translation.dta", replace

*/

use "$workfiles\SNFfish_before_translation.dta", clear


*Translate variables

rename orgnr id

rename navn company

rename fou rd

rename patent patents

rename eiend properties

rename maskanl machinery_plant

rename skiprigfl ships_rigs
```

```
rename drlosore oper_equipment
rename regdato date_established
label variable rd "Research and development"
label variable patent "Patents"
label variable properties "Real properties"
label variable machinery_plant "Machinery and plant"
label variable ships_rigs "Ships, rigs, planes etc"
label variable oper_equipment "Operating equipment, fixtures and fittings"
label variable date_established "Date established"

save "$workfiles\SNFfish.dta", replace
```

File name: Profitability order table.do

```
*Keep only one observation per company, as we are using company averages
by company: gen n=_n
keep if n==1
drop n

*Copy labels (they disappear later due to the collapse command)
foreach v in $first_variable $pos_variables $neg_variables {
	local l`v': variable label `v'
}

*Generate random company id, to preserve anonymity
gen rnd=runiform()
sort rnd
gen r_id=_n
gen company_id="Company " + string(r_id)
drop r_id rnd
label variable company_id "Random company id"
save "$workfiles\rnd.dta", replace

*Create files of variables ordered by themselves
```

```
foreach v in $first_variable $pos_variables {
	use "$workfiles\rnd.dta", clear
	sort `v'
	local l : variable label `v'
	label variable company_id "`l'"
	keep company_id
	rename company_id `v'
	save "$workfiles\\`v'.dta", replace
}

foreach v in $neg_variables {
	use "$workfiles\rnd.dta", clear
	gsort -`v'
	local l : variable label `v'
	label variable company_id "`l'"
	keep company_id
	rename company_id `v'
	save "$workfiles\\`v'.dta", replace
}

use "$workfiles\\$first_variable.dta", clear
foreach v in $pos_variables $neg_variables {
	merge 1:1 _n using "$workfiles\\`v'.dta", nogenerate
}

*Copy back labels
foreach x in $first_variable $pos_variables $neg_variables {
	label variable `x' "`l`x''"
}


capture noisily export excel using "$output\\$xlfilename.xlsx", replace firstrow(varlabels)
```

File name: Common size.do

```
*Makes common size analysis, with inputs from Common size input.do
use "$workfiles\fdir+SNF.dta", clear

*Copy labels (they disappear later due to the collapse command)
foreach v in $variables {
	local l`v': variable label `v'
}



*Generate variables for each company, for the mean over the years of data
sort company
foreach x in $variables {
	by company: egen mean_`x'=mean(`x')
	drop `x'
	rename mean_`x' `x'
}



*Remove extra years(all years are now the average)
by company: gen year_number=_n
keep if year_number==1

save "$workfiles\company means.dta", replace



*Generate variables for percentages
use "$workfiles\company means.dta", clear
foreach x in $variables{
	replace `x'=`x'/$denominator
}
save "$workfiles\asset percentages.dta", replace

*Calculate minimum percentages
```

```
use "$workfiles\asset percentages.dta", clear
collapse (min) $variables
gen statistic="min"
save "$workfiles\min.dta", replace

*Calculate maximum percentages
use "$workfiles\asset percentages.dta", clear
collapse (max) $variables
gen statistic="max"
save "$workfiles\max.dta", replace

*Calculate mean percentage
use "$workfiles\company means.dta", clear

collapse(sum)$variables
foreach x in $variables{
	replace `x'=`x'/$denominator
}
gen statistic="mean"
save "$workfiles\mean.dta", replace

*Calculate median percentage
use "$workfiles\asset percentages.dta", clear
collapse(median) $variables
gen statistic="median"
save "$workfiles\median.dta", replace

append using "$workfiles\min.dta"
append using "$workfiles\max.dta"
append using "$workfiles\mean.dta"

display "`lprovisions'"

*Copy back labels
```

```
foreach x in $variables {
	label variable `x' "`l`x''"
}

capture noisily export excel using "$output\\$xlfilename.xls", replace firstrow(varlabels)
```

File name: New variables.do

```
*This do file generates and labels variables, to be used by other do files later

use "$workfiles\fdir+SNF.dta", clear
*Generate Profit and loss variables, and label them
gen sum_operating_revenue=salmon_revenue+trout_revenue+insurance_payout+other_ordinary_earnings
gen sum_operating_costs=smolt_cost+feed_cost+insurance_cost+slaughter_cost-
change_in_stock+wage_cost+depr_intangible_assets+depr_operating_assets+
cost_other_activities+other_op_costs
gen operating_profit=sum_operating_revenue-sum_operating_costs
gen net_finance=financial_revenues- financial_expenses
gen profit_before_tax=operating_profit+net_finance
label variable salmon_revenue "Sales revenues of salmon"
label variable trout_revenue "Sales revenues of rainbow trout"
label variable insurance_payout "Compensations"
label variable other_ordinary_earnings "Other ordinary earnings"
label variable sum_operating_revenue "Total operating revenues"
label variable smolt_cost "Smolt costs"
label variable feed_cost "Feeding costs"
label variable insurance_cost "Insurance costs (fish)"
label variable slaughter_cost "Slaughter cost and freight charges"
label variable change_in_stock "Changes in stocks"
label variable wage_cost "Wages and salaries"
label variable depr_intangible_assets "Depreciation of intangible fixed assets"
label variable depr_operating_assets "Depreciation of tangible fixed assets"
label variable writedowns "Writedowns"
label variable cost_other_activities "Costs not related to production of fish"
label variable other_op_costs "Other operating expenses"
```

```
label variable sum_operating_costs "Total operational expenditure"
label variable operating_profit "Operating profit"
label variable financial_revenues "Financial revenues"
label variable financial_expenses "Financial expenses"
label variable net_finance "Result of financial items"
label variable profit_before_tax "Profit on ordinary activities before taxation"
label variable feed_factor "Feed use/production"

*Generate asset variables and label them
gen total_tangible=buildings+fish_farming_equipment+operating_equipment
gen total_fixed=total_tangible+financial_fixed_assets+intangible_fixed_assets
gen current_assets=goods+receivables+cash_deposits
gen total_assets=total_fixed+current_assets
label variable total_tangible "Total tangible fixed assets"
label variable total_fixed "Total fixed assets"
label variable current_assets "Current assets"
label variable total_assets "Total assets"

*Generate liability variables
gen total_liabilities=provisions+long_term_liabilities+current_liabilities
gen equity_and_liabilities=equity+total_liabilities
label variable equity_and_liabilities "Total equity and liabilities"
label variable total_liabilities "Total liabilities"

*Calculate salmon sales percent
gen sales=trout_revenue+salmon_revenue
gen salmonpercent=salmon_revenue/sales
label variable salmonpercent "Salmon as percent of sales"

*Calculate production (based on 2010 fdir definition)
gen biomass_0101=(ib_laks_fjor_stk* ib_laks_fjor_kg)+( ib_laks_aar_stk* ib_laks_aar_kg)+ (ib_orret_fjor_stk* ib_orret_fjor_kg)+( ib_orret_aar_stk* ib_orret_aar_kg)
gen biomass_3112_kg=(ub_laks_fjor_stk*ub_laks_fjor_kg) + (ub_laks_aar_stk * ub_laks_aar_kg)+ (ub_orret_fjor_stk* ub_orret_fjor_kg)+( ub_orret_aar_stk* ub_orret_aar_kg)
gen production=(sales_salmon_kg+sales_trout_kg+ub_frossenfisk_kg/*-ib_frossenfisk_kg*/)+((biomass_3112-ub_utsatt_kg-biomass_0101)/1.067)
```

```
label variable production "Production, calculated according to fdir definition"

*Generate profitability measures
gen roe=profit_before_tax/equity
gen roa=profit_before_tax/equity_and_liabilities
gen opr_kg_sales=operating_profit/(sales_salmon_kg+sales_trout_kg)
gen opr_kg_production=operating_profit/production
label variable roe "Return on equity before tax"
label variable roa "Return on assets"
label variable opr_kg_sales "operating profit per kg sold"
label variable opr_kg_production "Operating profit per kg produced"

*Generate percentage variables
gen sales_revenue=salmon_revenue+trout_revenue
gen p_sales_revenue=sales_revenue/total_assets
gen purchasing_costs=smolt_cost+feed_cost
gen p_purchasing_costs=purchasing_cost/sum_operating_revenue
gen p_other_op_costs=other_op_costs/sum_operating_revenue
gen p_other_revenue=other_ordinary_earnings/sum_operating_revenue
gen p_production=production/mab
gen technology_proxy=(rd+patents)/mab
label variable sales_revenue "Revenue from sales of salmon and trout"
label variable p_sales_revenue "Sales revenue as share of total assets"
label variable purchasing_costs "Purchasing costs"
label variable p_purchasing_costs "Purchasing costs as share of operating revenue"
label variable p_other_op_costs "Other operating costs as share of operating revenue"
label variable p_production "Production as share of Maximum Allowed Biomass"
label variable technology_proxy "Value of patents and r&d as share of licence volume"
label variable p_other_revenue "Other ordinary earnings as share of total operating revenue"
label variable year "Year"

*Generate factors
gen debt_ratio=total_liabilities/equity_and_liabilities
label variable debt_ratio "Debt ratio"
```

```
gen productivity=production/paid_work_hours

label variable productivity "Production per work hour"


*Generate salmon and trout dummies

gen only_salmon=0

replace only_salmon=1 if sales_salmon>0 & sales_trout==0

gen only_trout=0

replace only_trout=1 if sales_trout>0 & sales_salmon==0

gen salmon_and_trout=0

replace salmon_and_trout=1 if sales_salmon>0 & sales_trout>0


*Gen age variable

gen s_date=string(date_established, "%10.0g")

gen year_established=substr(s_date,1,4)

destring year_established, replace

gen age=year-year_established

tab year age

label variable age "Years since established"


*Choose variables for company means calculation

local comp_mean_variables roe roa opr_kg_sales p_sales_revenue p_purchasing_costs p_other_op_costs /*

*/ sales_revenue other_op_costs production p_other_revenue technology_proxy debt_ratio mab age
p_production


*Generate company means for the variables listed above

sort company

foreach v in `comp_mean_variables' {

	by company: egen `v'_comp_avg=mean(`v')

}


*Label company means

foreach v in `comp_mean_variables'  {

	local l : variable label `v'

	label variable `v'_comp_avg "`l', company average"

}
```

```
*For regression

*Generate larger size variables

gen mab_mill=mab/1000000

gen production_mill=production/1000000

gen productivity_year=production_mill/work_years

gen patents_mill=patents/1000000

gen rd_mill=rd/1000000

label variable mab_mill "Licences in 1000 tonnes"

label variable production_mill "Production in 1000 tonnes"

label variable productivity_year "1000 tonnes produced per work year"

label variable patents_mill "Value of patents in millions"

label variable rd_mill "Value of rd in millions"



*Group variables

global profit_loss_variables salmon_revenue trout_revenue insurance_payout other_ordinary_earnings /*

*/ sum_operating_revenue smolt_cost feed_cost insurance_cost slaughter_cost change_in_stock wage_cost
/*

*/ depr_intangible_assets depr_operating_assets writedowns cost_other_activities other_op_costs /*

*/ sum_operating_costs operating_profit financial_revenues financial_expenses net_finance profit_before_tax


global asset_variables intangible_fixed_assets buildings fish_farming_equipment operating_equipment
total_tangible /*

*/ financial_fixed_assets total_fixed goods receivables cash_deposits current_assets total_assets


global liability_variables equity provisions long_term_liabilities current_liabilities total_liabilities
equity_and_liabilities


save "$workfiles\fdir+SNF.dta", replace
```

File name: fdir merge.do

```
*This do file imports data from the 5 excel files from FDIR. It then cleans up the data, and saves it as a stata file.
```

```
*Import fdir data, save in Stata format
import excel "$fdirdata\2009.xlsx", sheet("Grunnlag") firstrow case(lower) clear
save "$workfiles\2009.dta", replace

import excel "$fdirdata\2010.xlsx", sheet("Grunnlag") firstrow case(lower) clear
save "$workfiles\2010.dta", replace

import excel "$fdirdata\2011.xlsx", sheet("Grunnlag") firstrow case(lower) clear
save "$workfiles\2011.dta", replace

import excel "$fdirdata\2012.xlsx", sheet("Grunnlag") firstrow case(lower) clear
save "$workfiles\2012.dta", replace

import excel "$fdirdata\2013.xlsx", sheet("Grunnlag") firstrow case(lower) clear
save "$workfiles\2013.dta", replace

append using "$workfiles\2012.dta" "$workfiles\2011.dta" "$workfiles\2010.dta" "$workfiles\2009.dta"



*Translate variables, add labels
rename uaar year
rename selskapsnavn company
rename ant_tillatelser licnbr
rename tillatelses_storrelse licsize
rename fylke county
rename forlager_ib feedst_in
rename forlager_ub feedst_out
rename forkjop feedpurchased
rename enhets_id id
rename salgsinnt_laks salmon_revenue
rename salgsinnt_orret trout_revenue
rename betalte_arbeidstimer paid_work_hours
```

```
rename antall_arsverk work_years
rename forsikr_utbet insurance_payout
rename annen_driftsinnt other_ordinary_earnings
rename smoltkost smolt_cost
rename forkost feed_cost
rename forsikringskost insurance_cost
rename slaktekost slaughter_cost
rename beholdningsendring change_in_stock
rename lonnskost wage_cost
rename avskr_immat depr_intangible_assets
rename avskr_driftsm depr_operating_assets
rename nedskrivninger writedowns
rename kost_annen_virksomhet cost_other_activities
rename annen_driftskost other_op_costs
rename finansinnt financial_revenues
rename finanskost financial_expenses
rename annen_virksomhet other_activities
rename egenkapital equity
rename immat_eiendeler intangible_fixed_assets
rename bygninger buildings
rename oppdrettsutstyr fish_farming_equipment
rename driftslosore operating_equipment
rename finansielle_anl_midler financial_fixed_assets
rename varer goods
rename korts_fordringer receivables
rename kontanter_bankinnskudd cash_deposits
rename avsetning_forpliktelse provisions
rename langsiktig_gjeld long_term_liabilities
rename kortsiktig_gjeld current_liabilities
rename salg_laks_kg sales_salmon_kg
rename salg_orret_kg sales_trout_kg
rename forfaktor feed_factor

label variable intangible_fixed_assets "Intangible fixed assets"
```

```
label variable buildings "Land, buildings and other real property"
label variable fish_farming_equipment "Fish farming equipment"
label variable operating_equipment "Operating equipment"
label variable financial_fixed_assets "Financial fixed assets"
label variable goods "Stocks"
label variable receivables "Receivables"
label variable cash_deposits "Bank deposits, cash at bank etc"
label variable equity "Equity"
label variable provisions "Provisions for liabilities and charges"
label variable long_term_liabilities "Other long-term liabilities"
label variable current_liabilities "Current liabilities"
label variable licnbr "Number of licences"
label variable licsize "Total size of licences"
label variable county county
label variable feedst_in "Feed storage 1.1"
label variable feedst_out "Feed storage 31.12"
label variable feedpurchase "Purhcased feed"

*Remove companies with negative equity, if activated in main do file
drop if $only_positive_equity==1 & equity<0



*Convert dummy variable to numbers
replace other_activities="0" if other_activities=="N"
replace other_activities="1" if other_activities=="J"
label variable other_activities "=1 if company has other business besides fish farming"

*generate region dummies
gen north=0
replace north=1 if county=="N" | county=="T" | county=="F"

gen central=0
replace central=1 if county=="NT" | county=="ST"
```

```
gen west=0

replace west=1 if county=="H" | county=="M" | county=="R" | county=="SF"


gen south=0

replace south=1 if county=="AA" | county=="VA"


gen multiple_counties=0

replace multiple_counties=1 if county=="FL"


save "$workfiles\fdir.dta", replace



*Some companies are registred as "FL", meaning that they have activities in multiple counties. For these, we find the regions using the county numbers of their licences, acquired from Akvakulturregisteret.

keep if county=="FL"

*Import county numbers

merge m:m id using "$workfiles\countynbr.dta"

drop if _merge==2

drop if _merge==1


*Generate region, based on county numbers from Akvakulturregisteret

gen region="east" if countynbr=="01" | countynbr=="02"  | countynbr=="03"

replace region="." if region!="east"

replace region="west" if countynbr=="12" | countynbr=="15" | countynbr=="11" | countynbr=="14"

replace region="central" if countynbr=="16" | countynbr=="17"

replace region="north" if countynbr=="18" | countynbr=="19" | countynbr=="20"

replace region="south" if countynbr=="10" | countynbr=="09"


*Finding the missing regions

sort company

by company: tab region


*Reopening the file, without saving changes.

use "$workfiles\fdir.dta", replace
```

```
*Manually entering regions found to be missing

replace west=1 if company=="BOLSTAD FJORDBRUK AS" | company=="BREMNES SEASHORE AS" | company=="ERKO SEAFOOD AS"

replace west=1 if company=="LERØY MIDNOR AS" | company=="NRS FEØY AS" | company=="SALMAR FARMING AS" | company=="STEINVIK FISKEFARM AS"

replace north=1 if company=="CERMAQ NORWAY AS" | company=="EIDSFJORD SJØFARM AS" | company=="MAINSTREAM NORWAY AS" | company=="NORDLAKS OPPDRETT AS" | company=="SALMAR NORD AS"

replace central=1 if company=="LERØY MIDNOR AS" | company=="LERØY MIDT AS" | company=="MÅSØVAL FISKEOPPDRETT AS" | company=="SALMAR FARMING AS"


save "$workfiles\fdir.dta", replace


*Import average spot prices, and save as stata file

import excel "$otherdata\Average spot.xlsx", sheet("Sheet1") firstrow case(lower) clear

save "$workfiles\avgspot.dta", replace


*Merge spot prices with main data set

use "$workfiles\fdir.dta", replace

merge m:1 year using "$workfiles\avgspot.dta", nogen

drop if id==.

label variable spot "Fish Pool yearly average spot price"

label variable lspot "Spot price one year ago"

label variable l2spot "spot price two years ago"

label variable accspot "spot price next year"

label variable acc2spot "spot price in two years"


*Correct error in data, convert to kg

gen mab=licsize

replace mab= licsize/1000 if company=="ROGALAND FJORDBRUK AS" & year==2010 //In 2010, this company had licences exactly equal to 1000 times the previous and the following year. We assume this to be an error

drop licsize

replace mab=mab*1000

label variable mab "Maximum allowed biomass, in kg"
```

```
save "$workfiles\fdir.dta", replace
```

File name: profitability measures.do

```
use "$workfiles\fdir+SNF.dta", clear

*Copy labels
foreach v in $variables {
	local l`v': variable label `v'
}

forvalues y=2009/2013 {
	use "$workfiles\fdir+SNF.dta", clear

	keep if year==`y'
	save "$workfiles\fdir+SNF`y'.dta", replace

	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(max) $variables
	gen statistic="max"
	save "$workfiles\max.dta", replace

	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(min)$variables
	gen statistic="min"
	save "$workfiles\min.dta", replace

	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(mean)$variables
	gen statistic="mean"
	save "$workfiles\mean.dta", replace

	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(median) $variables
	gen statistic="median"
```

```
	save "$workfiles\median.dta", replace


	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(sd) $variables
	gen statistic="sd"
	save "$workfiles\sd.dta", replace


	append using "$workfiles\min.dta" "$workfiles\max.dta" "$workfiles\mean.dta"
"$workfiles\median.dta"
	gen year=`y'
	save "$workfiles\profitability_measures_`y'.dta", replace
}


use "$workfiles\profitability_measures_2009.dta", clear


forvalues y=2010/2013 {
	append using "$workfiles\profitability_measures_`y'.dta"
}


*Copy back labels
foreach x in $variables {
	label variable `x' "`l`x''"
}


sort statistic year
*Export entire table
capture noisily export excel using "$output\\$xlfilename.xls", replace firstrow(varlabels)
save "$workfiles\profitability_measures.dta", replace


*Export separate variable groups
foreach f in "min" "max" "mean" "median" "sd" {
	use "$workfiles\profitability_measures.dta", clear
	keep if statistic=="`f'"
	drop statistic
	order year, first //To make year the upper row after transpose
```

```
        rename  year `f' //To get the statistic in upper left corner
        save "$workfiles\\`f'.dta", replace
        capture noisily export excel using "$output\\`f'.xls", replace firstrow(varlabels)
}
```

File name: dummy summaries.do

```
use "$workfiles\fdir+SNF.dta", clear

*Copy labels
foreach v in $variables {
        local l`v': variable label `v'
}

forvalues y=2009/2013 {
use "$workfiles\fdir+SNF.dta", clear

        keep if year==`y'
        save "$workfiles\fdir+SNF`y'.dta", replace

        use "$workfiles\fdir+SNF`y'.dta", clear
        collapse(max) $variables
        gen statistic="max"
        save "$workfiles\max.dta", replace

        use "$workfiles\fdir+SNF`y'.dta", clear
        collapse(min)$variables
        gen statistic="min"
        save "$workfiles\min.dta", replace

        use "$workfiles\fdir+SNF`y'.dta", clear
        collapse(mean)$variables
        gen statistic="mean"
        save "$workfiles\mean.dta", replace
```

```
	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(median) $variables
	gen statistic="median"
	save "$workfiles\median.dta", replace

	use "$workfiles\fdir+SNF`y'.dta", clear
	collapse(sd) $variables
	gen statistic="sd"
	save "$workfiles\sd.dta", replace

	append using "$workfiles\min.dta" "$workfiles\max.dta" "$workfiles\mean.dta"
"$workfiles\median.dta"
	gen year=`y'
	save "$workfiles\profitability_measures_`y'.dta", replace
}

use "$workfiles\profitability_measures_2009.dta", clear

forvalues y=2010/2013 {
	append using "$workfiles\profitability_measures_`y'.dta"
}

*Copy back labels
foreach x in $variables {
	label variable `x' "`l`x''"
}

sort statistic year
*Export entire table
capture noisily export excel using "$output\\$xlfilename.xls", replace firstrow(varlabels)
save "$workfiles\profitability_measures.dta", replace

*Export separate variable groups
foreach f in "min" "max" "mean" "median" "sd" {
	use "$workfiles\profitability_measures.dta", clear
```

```
	keep if statistic=="`f'"
	drop statistic
	order year, first //To make year the upper row after transpose
	rename  year `f' //To get the statistic in upper left corner
	save "$workfiles\\`f'.dta", replace
	capture noisily export excel using "$output\\`f'.xls", replace firstrow(varlabels)
}
```

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