THE NORWEGIAN SALMON TAX: AN EMPIRICAL STUDY OF THE NORWEGIAN SALMON INDUSTRY

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Dissertation written under the supervision of professor Isabel Horta Correia

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Abstract

Natural resources may play a crucial role in driving economic growth within a nation, capitalizing on inherent advantages as inputs in production processes. Norway's aquaculture sector has emerged as a notably lucrative industry in recent years. Rooted in the country's historical tradition of communal resource ownership, a special tax on sea usage was introduced for the Aquaculture sector in 2023.

This dissertation endeavors to delineate the primary drivers underpinning the industry's profitability, suggesting two principal factors: 1) technological advancements and 2) historical government interventions. Drawing upon empirical data from both firm- and industry-level, we aim to elucidate the impact of these factors. Additionally, we propose a hypothetical exercise of the forthcoming tax legislation to underscore its potential ramifications.

Our findings underscore the significant influence of historical government interventions in shaping the industry's landscape. These interventions have led to a scarcity of sea resources, consequently driving up profitability. While technological advancements undoubtedly bolster industry viability, the dominance of a few major firms can be attributed to historical governmental policies demanding licenses for operation.
Furthermore, our hypothetical taxation exercise highlights the complexity inherent in determining an appropriate tax rate, particularly given historical investment patterns among industry players.

Keywords: Natural Resources, Taxation on natural resources, Fiscal Policy, Norwegian Aquaculture

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Resumo

Os recursos naturais podem desempenhar um papel crucial no impulsionamento do crescimento económico de um país, capitalizando vantagens inerentes como entradas nos processos de produção. Ao longo dos últimos anos, o setor da aquacultura emergiu como uma indústria notavelmente lucrativa na Noruega. Enraizado na tradição histórica do país de propriedade recursos comuns, foi introduzido, em 2023, um imposto especial sobre a utilização do mar para o setor da aquacultura.

Esta dissertação procura delinear os principais impulsionadores que sustentam a rentabilidade da indústria, sugerindo dois fatores principais: 1) avanços tecnológicos e 2) intervenções históricas do governo. Com base em dados empíricos, tanto ao nível das empresas, como da indústria, pretende-se elucidar sobre o impacto destes fatores. Complementarmente, propõe-se um exercício hipotético da futura legislação fiscal para destacar as suas potenciais ramificações.

Os resultados sublinham a influência significativa das intervenções históricas do governo na moldagem do panorama da indústria. Estas intervenções conduziram à escassez de recursos marinhos, impulsionando, desta forma, a rentabilidade. Embora os avanços tecnológicos indiscutivelmente fortaleçam a viabilidade da indústria, a predominância de algumas grandes empresas pode ser atribuída a políticas governamentais históricas que exigem licenças para operação.

Além disso, o nosso exercício hipotético de tributação destaca a complexidade inerente na determinação de uma taxa de imposto apropriada, especialmente dadas as tendências de investimento históricas entre os intervenientes da indústria.

Palavras-chave: Recursos Naturais, Impostos sobre Recursos Naturais, Política Fiscal, Aquacultura Norueguesa

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1. Introduction

The Norwegian Aquaculture has in recent years proven to be a very profitable industry and is now the second largest export industry in Norway. The seas are characterized by benevolent sea currents of favorable temperature for fish farming, which has since the 1970s worked as the most important input in the production. The economic significance of natural resources in fostering a country's growth is well-established, and aquaculture is not the only industry fostering Norway's growth. Since the oil findings in 1969, the industry has been significant in terms of value creation, government revenue, investments, and export value. In 2023 the sector[1] could account for 74% of the total exports and had since 1971 had annual export growth of 26.9%[2]. In 1990 the Government created what is today, the world's biggest sovereign wealth fund, "The Norwegian Pension Fund Global", which is a result of all revenues[3] from the industry, the fund is today worth approximately 16 trillion NOK. The utilization of natural resources often creates a higher return because it lies naturally within the production, this return is defined as Resource Rent (RR), which has been discovered in both sectors over the past years.

Nevertheless, with the shift towards cleaner energy sources and constraints in oil explorations, Norway faces new economic challenges, and the government is therefore forced to think about different sustainable solutions for the future. The successful fiscal tradition in the oil sector has been discussed since 2017 as a proposal in the aquaculture sector as well, as a security for future generations. The fiscal framework targeting the RR is defined as a "Resource Rent Tax" (RRT). This, together with the paradox of resource-rich countries experiencing poverty underscores the need for effective resource management (Sach & Warner, 1995).

This thesis aims to dig deeper into the newly implemented RRT in aquaculture. First, the focus is on understanding the industry's characteristics, where we explored two primary topics: 1) the impact of technology, which shows the economies of scale associated with

[1] This includes natural gas, crude oil and condensate.

[2] $Average\ Annual\ Growth\ Rate = (\frac{1{,}968{,}966}{36})^{\frac{1}{52}} - 1 = 26.89\%$

[3] The fund is also financed through dividends from Equinor, which is the biggest petroleum company on the Norwegian socket, the government owns 67% of all stocks. Additionally, through the government's direct financial involvement (SDØE is the Norwegian short name) where the government owns shares in many oil and gas fields, pipelines and land facilities. However, most of the value of the funds comes from return on investments in shares, property, interest and infrastructure for renewable energy.

larger firms, and 2) the historical context of government interventions, potentially contributing to the scarcity of larger firms and the sea.
Then, in assessing the efficacy of the tax in capturing the rent, we have conducted a hypothetical exercise. This exercise involved applying the tax using 2022 figures and simulating its implementation in 2023.

Noteworthy, natural resources can be divided into two categories, renewable- and non-renewable natural resources. A *non-renewable* resource is something where the stock is limited, and there is only a fixed amount that is available to utilize. Industries that are characterized by this are usually the oil and petroleum sector or the mining sector. The opposite of this is a *renewable* resource~~,~~ this type of resource is characterized by being able to generate a non-stop flow of output for an indefinite time like the air and the sea.

The aquaculture industry has seen a steady increase in production, mainly driven by technological development since the breakthrough in 1970, however, it didn't become profitable at a high level before 1980 (NOU 2019:18, 2019). It all started in 1970, when The Grøntvedt brothers from Norway put 20,000 Atlantic salmon into large floating cages, to make it easier to feed the fish and prevent them from predators, resulting in the world's first successful salmon farm (Hunt & Isabella, 2020). Their innovation combined with government support and Norway's natural resources developed the industry fast. The industry has been transformed from a "sideline business" with small owners to supplying products to a global market (NOU 2019:19, 2019, p.9). This has led to the aquaculture industry having a positive RR over the last 10 years (Greaker & Lindholt, 2022). The sector has since its commercialized breakthrough faced several government interventions, through license use and limitations in their farming.

The concept of RR derives from the English term and was originally linked to David Ricardo in the 1800s, as income from ownership of agricultural land in England. RR is a result of the use or the extraction of natural resources and is the difference between the real generated revenue and all real costs that occur in obtaining these revenues. The extra profit lies naturally in the return of capital and labor invested, which would not be there if the resource was privately rented in a competitive market. Ricardo's illustration in 1917 drew parallels to the agricultural practice where farmers paid rent for the privilege of utilizing the soil. This concept found application in Norway, particularly in the extraction of non-renewable resources such as oil, resulting in the establishment of the world's largest sovereign wealth fund. This rationale is now extended to Norwegian salmon farmers in 2024, as they are obligated to pay rent for their use of the renewable resource, the sea, akin to the principle of compensating the landlord.

The dissertation is to be structured as follows:
After this literature segmenting setting the stage by presenting the topic, outlining the scope of analysis, and delving into prior literature. Section 2 delves into comprehending the technology employed within the industry. Moving forward, Section 3 explores and elucidates the structural nuances of the industry. Section 4 delves into the legal framework, and offers hypothetical numerical scenarios for both RR and an estimated RRT. Section 5 engages in a discussion of diverse findings, while the concluding insights are presented in Section 6.

1.1 Literature Review

In this section we provide a comprehensive exploration of relevant studies and frameworks, forming the basis for the questions raised in this thesis. Notably, prior research extensively investigates RR in the Norwegian aquaculture sector. NOU[4] 2018:19 draws on empirical papers, including the work of Greaker & Lindholt (2019)[5] and Flåten & Pham (2019), to quantify sectoral RR. Greaker & Lindholt, utilizing Statistics Norway (SSB) data, and Flåten & Pham, employing profitability survey data from the Directorate of Fisheries, contribute valuable insights into the aquaculture sector. In particular, Flåten & Pham's (2019) empirical paper utilizes the profitability survey from the Directorate of Fisheries to calculate RR in the sector, where they combine a Ricardo and market rent.
Dalen et al. (2023) uses the same model as Greaker & Lindholt for the year 2022, and extend these insights, revealing a peak in RR in 2016 and a subsequent record in 2022.
They calculate the RR using the definition made by the System of Environmental-Economic Accounting. Nonetheless, there are certain restrictions on the ability to differentiate between the various stages of production that are found on land and in the ocean. Additionally, Dalen et al. use two distinct returns on capital rates to demonstrate that aquaculture has a low capital intensity since the RR is largely steady.

[4] NOU is an abbreviation for Norway's public investigations. When the government or a ministry sets up a committee to investigate a question, or a specific policy area, the committee's final report is available as a NOU.
[5] Dalen et al. (2023) uses the same framework as Greaker and Lindholt (2019) to quantify the RR for 2022.

Dalen et al. Estimating the RR to be 26 billion NOK, while Flåten & Pham estimate 17 billion NOK in 2016. The latter calculates the value of RR as a percentage of revenue, the result being 34.7% in the same year. Flåten & Pham also mention that the RR being this high, may be due to constraints on production and export, partly due to both government intervention and fish diseases which limited the production.

Furthermore, Gunnlaugsson et al. (2018) contribute valuable insights by examining the fishing industry in Iceland and the implementation of a fishing fee as part of a RRT framework. Their work underscores the challenges in establishing a sustainable RRT framework for renewable resources, providing a crucial perspective within the broader context of natural resource taxation.

In addition to these studies, the literature review delves into broader perspectives on natural resource taxation. Broadway and Flatters (1985) assert that the primary rationale behind taxing natural resources is for the government to claim its share of the rent. This non-distorting tax, assumed to be efficient, ensures that decisions made by the tax-subject remain unaffected. According to the same authors, the RR represents the net value of the resource and does not signify the return to any variable factor of production. Consequently, firms, driven by the goal to maximize their present profits (the rent), are not swayed by the tax. This assertion is corroborated by Lund's (2011) findings, indicating that the RRT does not distort the exercise of actual alternatives, when referring to a suggested RRT on non-renewable natural resources in Australia. Moreover, Broadway and Flatters propose an interesting perspective on taxing natural resource users, suggesting that the government becomes a silent partner in firms. This collaboration, viewed from a risk perspective, can strengthen firms, and encourage socially beneficial risk-taking. Tax policies, particularly production taxes, can influence resource utilization for societal purposes and address concerns related to fairness for future generations or environmental expenses.

In contrast, Jacoby and Smith (1985) contend that despite the predetermined time of initial investment, decisions are aimed at maximizing expected profit. Decisions about natural gas production and development would indeed be distorted by an oil windfall profit tax.
They employed a constructed simulation model, which determines the production and development program that maximizes profit for a given field, while also accounting for the physical, regulatory, and economic constraints that the producer must overcome. This model

is made by reservoir, cost, and regulatory modules, which makes it possible to give an overall economic and financial evaluation of the field.
Additionally, Hausman (2011) suggests that failure to recognize the value of embedded options in transfers according to accounting standards may lead to distortions in the timing and size of investments during asset movements.

Eyrad et al. (2023) contribute to the debate on the fiscal framework in resource-rich countries, considering the country's characteristics. They observe an increasing trend in resource-rich countries adopting numerical rules for fiscal policy, with the majority implementing balanced budget rules, followed by debt and expenditure rules. Revenue rules are less commonly used, indicating less control over yearly revenues. Despite this, their empirical findings from 1960-2011 suggest that fiscal rules have not been effective in stabilizing economies. Many countries utilize fiscal resource revenues to create sovereign wealth funds, ensuring economic security for future generations. Suguwara (2014) notes that countries with high-quality institutions experience less volatile public spending, while Davis (2001) finds that sovereign wealth funds based on natural resources do not significantly impact certain countries. The Norwegian oil fund, however, serves as an example of success and efficiency in this regard.

Smith (2012) evaluates models to identify taxpayer behavioral responses, often focusing on aspects like timing or extraction rates. It is crucial to acknowledge that a taxpayer's response to a tax instrument involves modifications across all relevant margins. For instance, an excessive royalty rate in the oil industry may lead to early field abandonment, influence the investor's initial development plan, and even affect choices for improved recuperation techniques. Understanding the comprehensive impact on resource recovery, investor return, and government income requires dissecting interconnected investment challenges.

In summary, the literature review critically examines studies on RR in the aquaculture sector and broader natural resource taxation frameworks. While providing valuable insights, it also highlights gaps in the existing literature, particularly regarding fiscal policies for renewable resources. This sets the stage for the current study's exploration and contribution to the field. In this dissertation, we will follow the same approach and use the same dataset as Flåten & Pham to calculate the sectoral RR. This approach allows us to distinguish between the different stages in production. We will also dig deeper into the understanding of the historical government interventions, as well as consider the technology.

1.2 Data

The dataset used to calculate sector rent is the profitability survey from the Directorate of Fisheries (2023). This is published annually, and it is mandatory for all companies that operate to answer the survey. The representation of the industry is statistically significant, where from 2017-2022 was 62%, 88%, 68%, 91% 85%, and 85%, respectively. The reason for the volatility is according to The Directorate of Fisheries – complex, and not the same from year to year. Reasons can be mergers or acquisitions, and a high proportion of income comes from other activities[6].

The sectoral data from The Directorate of Fisheries provides detailed numbers about the input and output over the years. However, the production flow is not possible to follow in one year, so to understand the technology used in production, additionally to the sea, we will only use data from 2022, even though the input in production, will be the output in another year.

Additionally, to understand the importance of the two industries for the Norwegian economy, we have used export and GDP data from Statistics Norway (SSB) (2023). To calculate the market concentration in the world market, the trade map by the International Trade Center (ITC) is used for the year 2022.

In order to understand the scope of the RRT and RR at the firm level, we have used the four biggest companies in the industry in Norway[7]. These are Mowi Group, Salmar Group, Lerøy Seafood, and Grieg Seafood, these will be referred to as Big 4. The data used are extracted from their annual report for the year 2022, published in 2023.

[6] If this income from other activities is more than 30%, the company is not considered in this survey. In 2022 the Directorate published the reasons behind the representation, and there was a total of 29 companies that didn't answer. The main reasons for this were 1) Not receiving the survey; 2) Not operating (production); 3) Not participating, which is a result of income from other activities or being operating for research. The selection includes both integrated companies, individual companies, and companies of different sizes.

[7] Cermaq Norway would be ideal to include, but we were not able to extract the data needed.

2. Technology

This section will explain the technology used in production and the dynamics between input and output during production. This is relevant because it sheds light on all other inputs that are necessary for the production in addition to the sea. The relevant production phase is called the Grow Out Production (GOP), which takes place in the sea and when the farmers utilize a public natural resource to produce.

The aquaculture industry is one example of an industry in which similar technology is used across countries (Misund & Tveterås, 2020). Therefore, we will assume that is similar for the whole industry at present. The period covered compared to the early 1980s, has been driven by improved technologies and more control over the production process which have been primary drivers of the significant growth in salmon production [8]. This implies in principle a decline in labor costs even if more skilled workers should have been used to control this new technology.

The technology used in this industry implies a separation of production into two stages, first in private land-based tanks called juvenile production, and secondly, GOP in the sea. The period from the initial input in juvenile stages to the emergence of salmon ready for slaughter spans approximately 2 to 3 years. We will describe with some detail these two stages in the following subsections, juvenile production being the first one, and GOP the second.

2.1 Juvenile Production

Juvenile production involves freshwater activities on land and encompasses a sequence of stages following the development of the inputs which in the end will be used in the GOP. Typically, the fish spend 10-16 months in this land-based phase.

The initial phase of salmon farming entails the spawning of adult, sexually mature salmon, during which roe and milk are combined, resulting in the formation of fish eggs known as roe. The roe, with two distinct black dots representing its eyes, undergoes incubation in darkness on land with a continuous flow of freshwater. Upon maturation, these eggs develop into small fish termed fry. These fry are nurtured in larger incubators to promote growth and maturation. Over time, as the fry acquires gills, they transition into the fingerling stage.

[8] The technology today is more automized, i.e., vaccination, feeding and observation. They also have tracking systems allowing to observe each individual fish, and not only the whole pen. Previously these procedures were done by humans.

2.1.1 Smoltification

The final stage in juvenile production is known as smoltification. The objective during this phase is to prepare the fish for the marine environment, a process that involves vaccination against bacterial diseases.

The fish are then moved to the vaccination hall, marking the official designation as smolt, and initiating the smoltification process. In this stage, the smolt returns to the familiar environment where it will feed and grow before ultimately entering the sea.

2.2 Grow Out Production

The second stage of production, GOP is the last and most crucial stage in this production because the salmon is being developed by renting the sea. In this phase, it is about feeding the salmon to a certain size, which is around 4-5kg, and usually takes a little less than 2 years. The fish stays in open cages, which are mainly nylon-based nets attached to circular floating elements consisting of plastic pipes. Figure 1 is a picture of one of Mowi Norway's GOP localities to illustrate this stage of production.

Figure 1 - One of Mowi's Localities

Picture borrowed from Mowi Norway (2023)

The pen cannot hold more than 200,000 fish and is meticulously cleaned when the fish are removed, and it is then left empty for at least three months. This is done to make sure the seabed is properly cleaned before a fresh generation is added to the pen. (Arctic Sea Food, 2023). How fast the salmon grow depends on the sea temperature and the sunlight[9]. (Ntaes, 2023, p.18)

The most important input in the stage of GOP is the smolt. The ratio of smolt[10] to salmon in kilograms was 7 % in 2022 and shown to be relatively stable over the past years but was highest in 2017 and 2018 at 9%. This indicates the same technology over the past years. Production-related losses of salmon in GOP are classified as follows: 1) dead fish; 2) discards; 3) escapes; and 4) other.

2.2.1 Other Inputs and Costs

At the beginning of the aquaculture era, the production technology was simple and at a small scale, however, the period 1980-2000 was filled with a high increase in productivity, which resulted in a significant decline in operational costs, and cost per unit for large firms produced which led to lower prices. However, in more recent times, costs have increased, see Figure 2.

Most expensive, and the most important input other than the smolt is feed. The feed is essential for the fish to remain healthy and grow. The total cost of feed in 2022 was 30,230 mill NOK and accounted for 44% of the total cost.

The second largest expense, and another important input is what is defined as other operating costs, including fish health[11] and environment and maintenance. This helps lower the environmental footprint and contributes to keeping the production environmentally friendly. This expense represents 28% of the total cost.

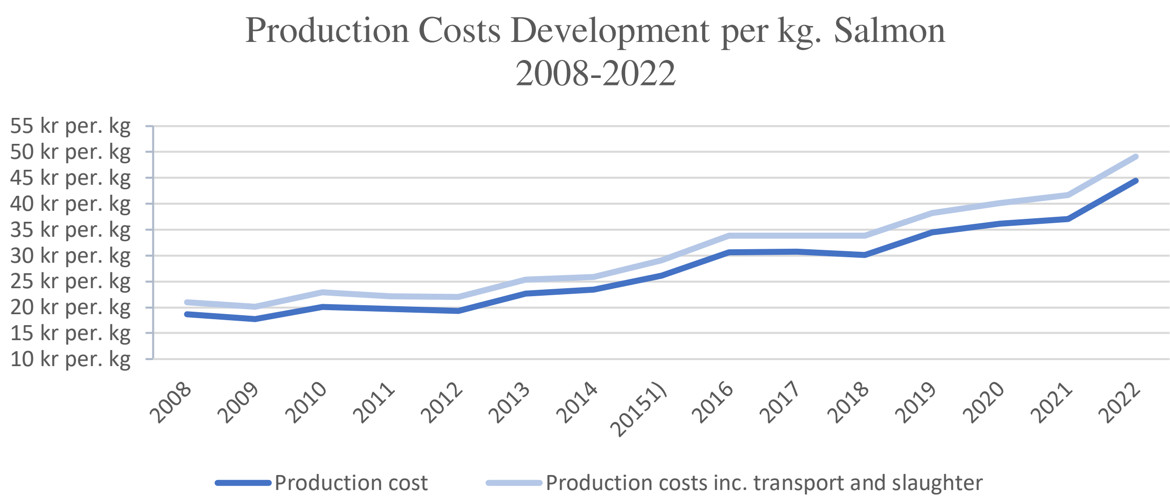
Even though smolt is the most important input in the production, the expenses are not so great. In 2022 it accounted for only 10% of the total cost. Larger farms typically have this production fully integrated into their value chain, and those who don't are frequently on the

[9] The complete salmon life cycle must be supported by the best possible living circumstances in all ocean pens. Salmon is a fish that is designed for long-distance travel, yet it is a herd animal that must coexist with others. They require room to move unhindered, and according to regulations, the pens must have a minimum of 97.5% free room.
[10] The dataset was in units of smolt, but we have converted using an average weight of 0.3kg per smolt.
[11] We assume cleaning fish is a part of fish health. Cleaning fish is a significant input, as it is the most common way to treat salmon lice. That is a parasite that can inflict wounds on the fish that can cause infections and problems with the salt balance.

owner's side of the smolt producers. This makes production planning easier, however, if it reduces cost is not clear due to OECD transfer pricing rules.

Economies of scale[12] should operate by declining this cost per kg, but other reasons operate in the other direction leading to an increase in these costs as seen in the graph. This is much attributed to a general cost increase due to an inflation of 5,8% in 2022, with an average annual inflation year for the period being 2.3%[13]. In addition, the price of feed[14] (mainly imported from Brazil) faced higher prices and increased by 44%. The costs per kilo in 2022 increased by 15% compared to the year before.

Figure 2 - Development of the Cost per kg Salmon Produced



Source: The Directorate of Fisheries
Author's calculations

Labor

GOP is the most labor-intensive phase of production; Grieg Seafood[15] can reveal that 53.5% of their total labor is represented in this phase. This involves location managers, operations operators, service departments, and technical departments. Wages are however, only 7% of the total cost in GOP. Table 1 shows the different expenditures and details about labor in this

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[12] Bigger firms have 15% and 13% less production costs per kg than intermediate and smaller firms, respectively.

[13] Used yearly average CPI from 2008 to 2022: $Average\ Annual\ Inflation\ Rate = (\frac{122.8}{88})^{\frac{1}{15}} - 1 = 2.3\%$

[14] The fish feed is made of vegetarian inputs, like soy and rapeseed oil.

[15] Grieg Seafood is one of the Big 4 companies.

stage. Both the cost and the wages climbed by 14.8% and 14.3%, respectively. Meanwhile, there was a 5% rise in the industry's work force. In 2022, there was a 6% increase in hourly performance and a 6.6% increase in wage expenses per performed hour. Although, both the gross product and the production per performed hour fell by 5.2% and 4.7%, respectively. The final numbers are expressed in terms of fixed 2020 prices.

Table 1 - Labor Input in GOP - 2022

Wages (NOK. Mill)	Wage Costs (NOK. Mill)
4040.989	4788.528

Source: SSB
Author's calculations[16]

Table 2 shows the distribution of the labor force by gender, whereas one can see it is male-dominant, representing 82%.

Table 2- Labor Distribution by Gender in GOP - 2022

2022	Labor Force	Hours Performed
Women	1,287	8,500,505
Men	5,818	1,478,591
Total	**7,105**	**9,979,096**

Source: The Directorate of Fisheries
Author's calculations

Given this description of the technology utilized, we can now understand the market composed by the producers of salmon in Norway. This will be done in the next section.

3. The Norwegian Aquaculture Industry

In this section we want to see the importance of the industry to the Norwegian economy, and at the same time characterize the industry.

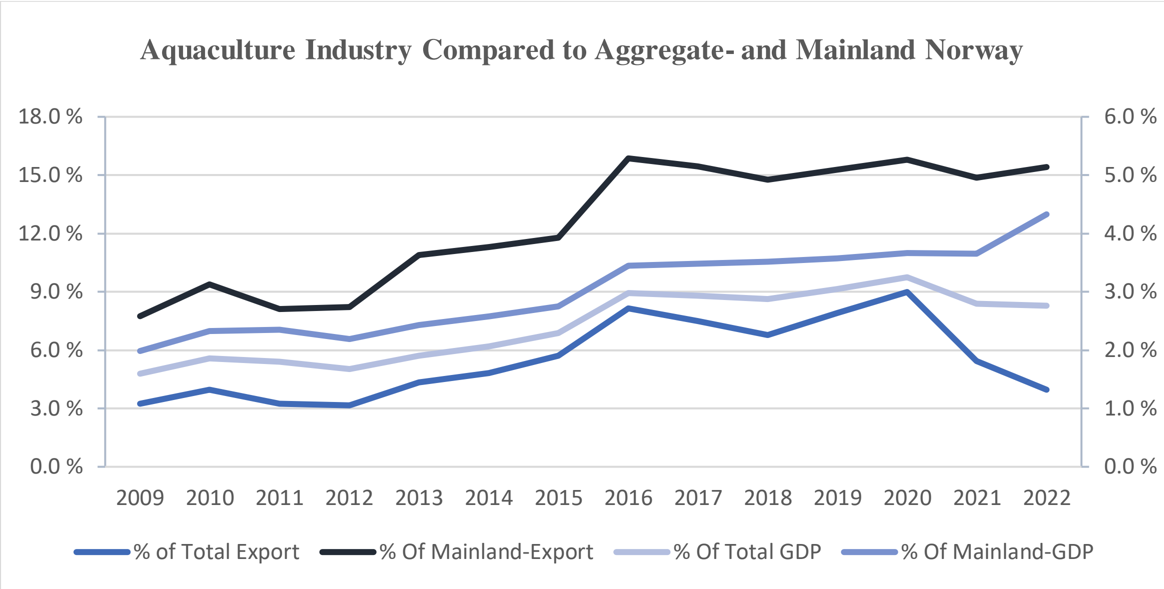
3.1 Aquaculture - Export and GDP

The fishing and aquaculture[17] sector had production value in 2022 of 157,675

[16] The data from SSB provided data separately for fishing and aquaculture from 2015-2020 and as a sector from 2020. I used the average from these 5 years as a proxy to separate the two industries from each other for 2022.
[17] It was unfortunately not possible to separate fishing and aquaculture when measuring gross product.

mill NOK and an increase of 30% compared to 2021. Relative to the mainland[18] GDP, fishing and aquaculture accounted for 4.3%, and 2.8 of total GDP.

Figure 3 - Aquaculture Compared Aggregate and Mainland to Export (left axis) and GDP (right axis) [19]



Source: SSB (2023)
Author's calculations

Salmon accounted for 72% of the export value of all fish species in the year 2022. The year 2022 was a record year for salmon export in terms of value. Out of the total Norwegian exports, salmon in 2022, represented 4% of the total, while compared to mainland export it was 10.2%. Salmon export had an increase of 30% NOK compared with 2021, resulting in an export value of 105,622 mill NOK, even though the volume decreased by 2%. Of total mainland exports, salmon represented 10%, but a decrease compared to its peak in 2020 with 15%.

3.2 The Industry

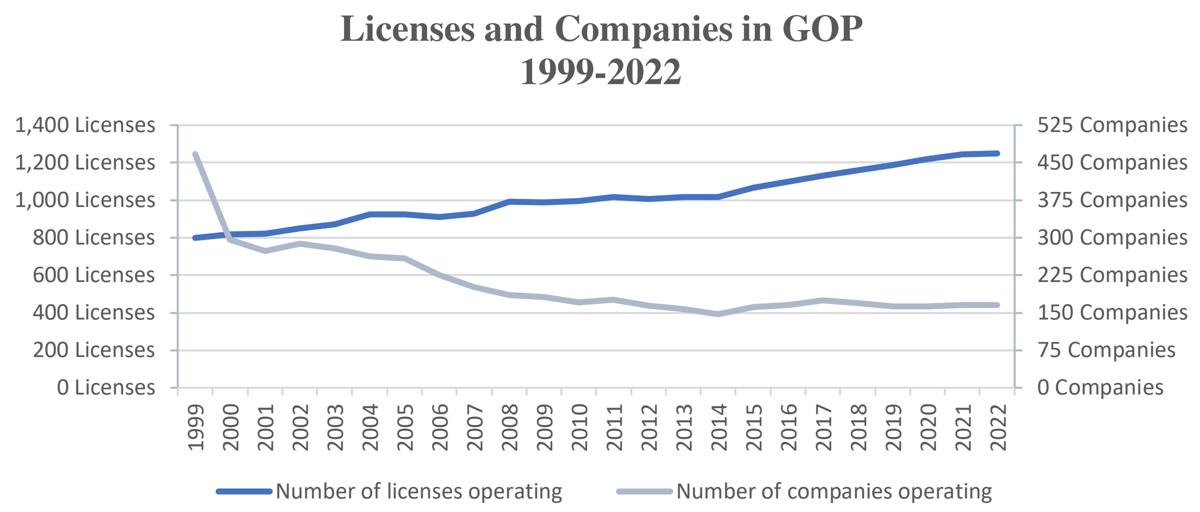
3.2.1 Regulations and Evolution of the Industry

To understand the structure of the industry, namely the rationale of having a small number of large firms, we have two main candidates. One is the reason already cited above for the

[18] In Norway there is separation between mainland and aggregate when referring to macro indicators. Mainland does not include oil, while aggregate does.
[19] When calculating relative to GDP it is used the value added in production of fishing and aquaculture, but salmon holds a representative position of this category. When calculating export, salmon alone is used.

existence of economies of scale shown by the declining unitary cost of production. The second explanation is the one discussed now.

Figure 4 - Licenses and Companies 1999-2022



Source: The Directorate of Fisheries

Author's calculations

Since 1973, the industry has been subject to license regulations. They are granted by the Directorate of Fisheries after §§6 and 7 of The Aquaculture Act which states that one cannot operate salmon farming without being a holder of an aquaculture permit in the register. These permits have historically been granted at irregular intervals and have been based on different criteria over time[20]. Today, the Directorate can extend the capacity of production of existing ones, or they can grant new permits. The regulator may control how many permits are granted, the geographical distribution of the permits handed out, and the selection of qualified applicants according to different priority criteria. The Directorate of Fisheries define the size of the firm, relative to the amount of these licenses the firm have.

What is important to notice about these licenses is that they are *in perpetuity*. This means that once the farmer has the permit, they do not have to repurchase it. However, the permits may be withdrawn, motivated by three reasons: 1) it is necessary for the environment, 2) significant prerequisites exist a reason for the permit has changed, 3) violation of the law, 4) if the permit is not used or only is used to a limited extent, or the necessary time limit for granting the permit has lapsed.

[20] Some criteria can be R&D but may also be environmental criteria like the localities area.

This historical evolution are taken from NOU 2019:18.

In 1973, the temporary Aquaculture Act was introduced, mandating the necessity of a license for aquaculture operations. Subsequent to the enactment of this law, all 287 localities that submitted applications were granted permits. Notably, only one permit was allowed per company at that time.
Between 1973 and 1989, an additional 421 permits were granted *for free*. During this time the capacity in production was regulated by cage volume, in terms of cubic meters (m^3), and there was also a feed quota restricting farmers to only use a certain amount of fish food during a year. The stage of allocating permits one by firm and at a zero cost reaches ended with the filing of the bankruptcy in 1991 of the Fish Farmer's Sale Association. Between 1993 and 2000, a total of 33 farming companies filed for bankruptcy.

By the "Regulations on the awarding of licenses for food fish farming of salmon and trout in seawater" in the Aquaculture Act, the year 2002 was an important year for the licenses because it allowed the Norwegian state to demand a price for the permits. It was announced that 41 permits were for sale, but only 31 were sold, and 28 of them received payment. The price was 5 million NOK[21]. The reason for free permits was the political desire to build up a new district industry in a period where it was characterized by high risk and significant future development work.

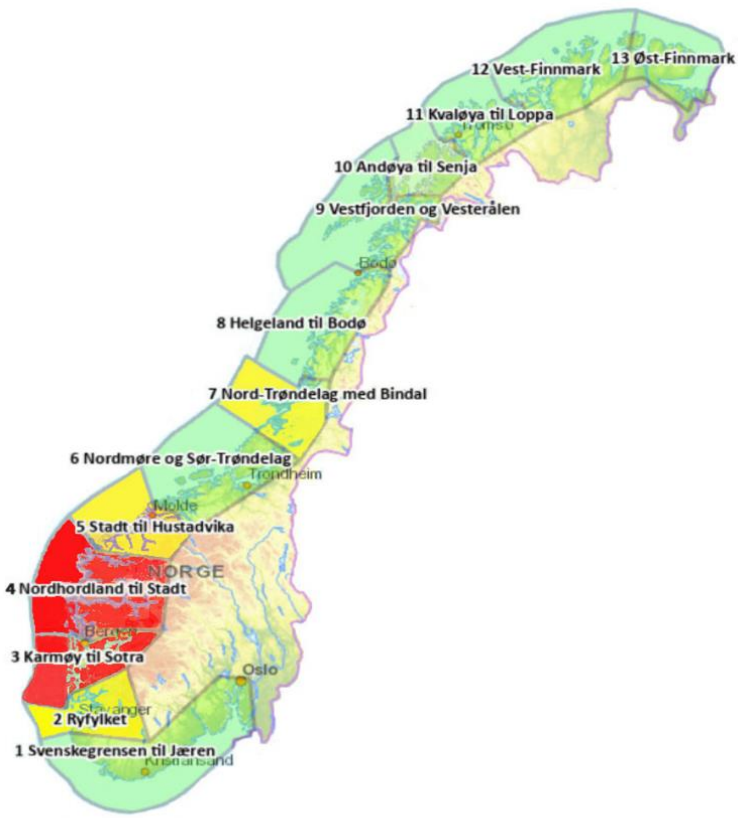
In 2005 the Government made a significant change in regulations in terms of capacity and the stock of fish. The cage volume and feed quota were substituted with Maximum Allowed Biomass (MAB). The MAB decides how many kilograms the farmer can have in the sea at a certain time. This means that the permits granted before the 1st of January 2005 were no longer limited in cage volume but in MAB. The level for a standard permit was 780 tons[22] of fish for all counties, except Troms and Finmark (North-Norway), where the corresponding volume was converted to 900 tons per permit.

[21] The permits in the area of North-Norway, in two different municipalities was set lower at 4 mill NOK each. These areas have historically had a lower price due to lower sea temperatures, which often results in a lower growth rate for the salmon in the sea.
[22] This comes from 65kg x 12,000 m^3.12,000 m^3 was the volume that was restriction for one permit previously.

In 2006, a significant change occurred in the allocation process as it transitioned to auctions for the first time. Unlike previous rounds with fixed prices, adopting a closed bidding format where permits were awarded to the highest bidder. The price interval was between 50,000 and 3 mill NOK depending on the production area.

In 2009, three years after the initial change, the government introduced the option to increase the MAB of a permit in exchange for an additional payment. Subsequently, in 2011 and 2015, farmers were given the opportunity to augment their MAB on existing permits. During these years, the adjustments were made through fixed prices. In 2011, a 5% increase was offered for 150,000 NOK in Finmark and 500,000 NOK in Troms. In 2015, the same increase was offered, reaching a price of up to 1 million NOK.

Figure 5 - Geographical Production Areas



Source: Picture borrowed from NOU 2019:18

The following year, 2016, a trial scheme with a variable MAB limit throughout the year was offered for a fee of 1,5 mill NOK per permit[23].

In 2017, the implementation of the "Traffic Light System" took place. The criteria for determining a new capacity level are now contingent on environmental conditions[24]. Assessments of environmental conditions are conducted biennially to inform decisions on capacity considerations. Figure 6 shows how the production areas are split into different colors, conditional on the environment.

[23] This was so the farmers could utilize the natural temperature variations in the sea better.
[24] Measured through the intensity of sea lice affecting the wild salmon.

If the environmental impact is red, it is unacceptable, and a 6% reduction in capacity is required. If yellow, it doesn't change, and if it is green, either the farmer already owning the permit will get the capacity back[25], or the areas are opened for growth. The areas that are opened for growth will be offered to the farmers at a fixed price, while the rest will be offered at auctions.

The change in regulations described implies that the price per ton in licenses has evolved from being free, to an average of approximately 182,000 NOK in 2023.

3.2.1 The Concentration These Days

We will measure the concentration of the industry using the Herfindahl-Hirschman Index (HHI). The formula is the following:

$$HHI = \sum_{i=1}^{n} s_i^2$$

S represents the market share of firm i as a percentage. Usually, it is considered that a market is deemed competitive if its HHI is less than 1,500, moderately concentrated if it is between 1,500 and 2,500, and highly concentrated if it is 2,500 or higher. If the HHI is 10,000 there is a monopoly market.

Looking to the Big 4, that are composed by Mowi, Lerøy Seafood, Salmar and Grieg Seafood. These have been in present relative position since around the 2000s. Looking to the two indicators volume and sales, we see a clear ranking of these four being the following:

$$HHI_{volume} = 21\%^2_{Mowi} + 12\%^2_{Lerøy} + 13\%^2_{Salmar} + 5\%^2_{Grieg} + (\frac{49\%}{77})^2_{Other} \quad (1)$$

$$HHI_{volume} = 441 + 169 + 144 + 77^{26}$$

$$HHI_{volume} = 856$$

As equation (1) shows, when calculating the HHI using volume harvested in Norway, the concentration in the industry is low, and the market is defined as competitive. Mowi has the

[25] To give an example; Lerøy Seafood has a total of 135 licenses, equivalent to 108,191 MAB in tonnes. These 135 licenses are distributed over different production areas called PO1, PO2, and so on. Their PO3 and PO4 are marked as red, which in 2022 resulted in a decrease in their MAB by 2,641 tonnes. In 2024 there will be a new assessment, and if the color changes, Lerøy will get the capacity back (Lerøy, 2023, p.145).

[26] The marketshare were 49% distributed over 77 companies, leaving 0.6% ≈ 1%

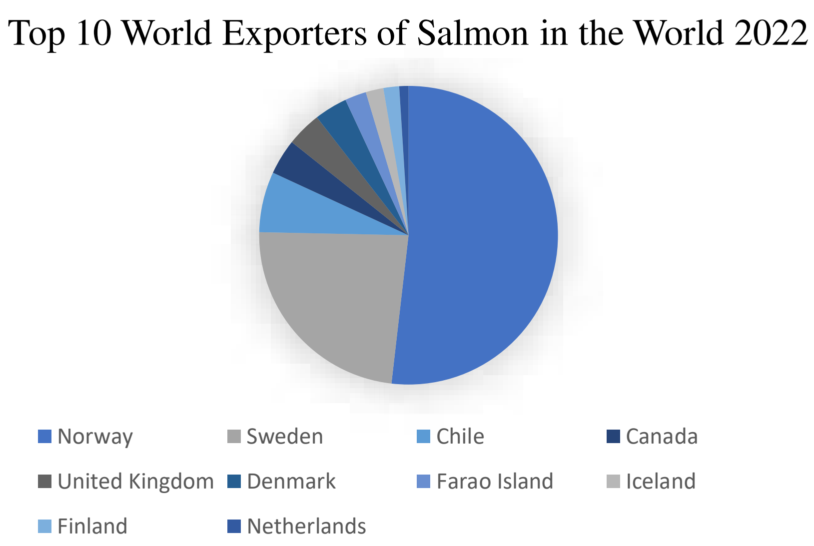
biggest production in Norway, representing 21% of the total. Further, Lerøy, Salmar, and Grieg, follow respectively.

$$HHI_{Sales\ Rev} = 31\%^2_{Mowi} + 24\%^2_{Lerøy} + 17\%^2_{Salmar} + 7\%^2_{Grieg} + \left(\frac{21\%}{77}\right)^2_{Other^{27}} \quad (2)$$

$$HHI_{Sales\ Rev} = 2{,}153$$

When using sales revenue, the HHI drastically changed, resulting being 2,153. This indicates that when using sales revenue, the industry is moderately concentrated. However, it is close the threshold of 2500 where the classification will change to highly concentrated. The concentration observed between volume and sales revenue *may* be an indicator that a company, among Big 4, with lower production volume, still holds a higher price per unit. This phenomenon underscores that volume concentration mainly highlights the physical scale of the production, while sales revenue concentration provides insights into the economic impact of each of the companies' sales. A company that does not manage to keep their volume produced on a large enough scale will get a lower price, and vice versa.

Figure 6 - Top 10 World Exporters of Salmon in Quantities Tonnes in 2022



Source: ITC - Trade Map (2023)
Author's calculations

[27] The market share were 21% distributed over 77 companies, leaving 0.3%≈0%

The production of salmon is predominantly destined for the international market, with exports accounting for 78% of the total value in 2022. To understand the market power of the Big 4, we should consider not just the concentration of those produced in Norway, but how they compare with worldwide producers. We present the importance of Norway in this global market in Fig 4. Norway accounted for 50% of the total exports. The second largest exporter was Sweden, which represented 23% of the total. The 8 other countries accounted for less than 10% of the export each, and the third largest was Chile with 6%.

If we compute the HHI of the exporters measured in volumes (considering that the export of each economy is produced by just one firm) we get the following:

$$HHI = 50\%^2_{Norway} + 23\%^2_{Sweden} + 6\%^2_{Chile} + 4\%^2_{Canada} + 4\%^2_{UK} + 3\%^2_{Denmark} + 2\%^2_{Farao\ Island} + 2\%^2_{Island} + 2\%^2_{Finland} + 1\%^2_{Netherlands} + 1\%^2_{France} + 1\%^2_{USA} + 1\%^2_{Germany} \quad (3)$$

$$HHI = 3{,}122$$

This HHI, see equation (3), indicates a high concentration of this industry in Norway. However, because we are using the total exports of the economy as opposed to the exports of each firm, we can compute a value that is an upper bound relative to the concentration that would be obtained when the exports of each firm in the world would be computed. This is because the formula of HHI is based on the squares of the market shares. Any dominance by a single firm or a few firms within a country will contribute significantly to the overall value. This makes the upper bound since it assumes a maximum value scenario within every country.

4. Resource Rent and Resource Rent Taxation

4.1 The Economics of the Tax

The existence of natural resources is not a reason per se to defend public intervention in the use of those resources. Namely when those are renewable resources such as the seawater. Therefore, it is not clear that the use of the sea in the 70s was creating congestion effects, or negative externalities in other activities which could imply the regulation of the market. However, the government decided to do it more lightly by conceding free permits to those already in production. This type of intervention itself imposes power on the incumbent firms relative to those that would like to operate. Even if more than those initial licenses were given for free, there is a decision of whether to grant them and to whom. Existing farmers could enjoy entry to the market for a cost of zero. Speculatively, one can think of it as giving the farmers a market power, at zero cost. The government sought to regulate the industry and demand a price for permits, as well as incentivize farmers to disperse along the coast to mitigate geographical disparities. As described in section 3.2.1, the regulatory trajectory has evolved to encompass the described MAB and traffic light system up to the present day. These regulations have transformed the use of the sea by salmon producers into a scarce commodity, limiting its use compared to the earlier unrestricted access. This fact creates a permanent rent for those who obtain it (after the deduction of the price paid for the license). Additionally, it resulted in an unaccounted negative externality, where the salmon lice prevalence, for example, that increased farming exacerbated adverse effects on others using the sea. On the other hand, the government has used the granting of licenses to develop less a central region of Norway, by creating incentives for the localization of firms in those coasts by selling licenses there at a discount.

These days the discussion around the introduction of the salmon tax comes from the idea that profits (called by rents) in the industry are too high. We could claim that these profits (or rents) are the ones needed to compensate for the initial investment obligatory by the need to pay for a new license or to extend the scope of application of older ones. In addition, the objective is to internalize externalities, ensuring that the industry pays its fair share for utilizing the sea as a resource. Efforts to determine the appropriate rate for this tax, and how to collect the rent have been the subject of a political debate.

> *"In September of last year, the government presented our proposal. It has been under consultation, and we received over 400 responses from the consultation. We actively sought input and comments, went on visits, and listened. And we have received positive and valuable feedback."*
>
> - *Prime Minister Jonas Gahr Støre at the press conferance (2023)*

As the quote of the Prime Minister says, many inputs and comments after the proposed rate of 40%, resulted in an adjustment settling at 25%.

4.2 The Tax Law[28]

The RRT is a part of the Norwegian Income Tax Act and is presented in Chapter 19 as "Special Rules for the Taxation of Aquaculture". The tax is according to §19-1 subject for all farmers with an aquaculture license.

The following states how it will be applied in 2024.

Simply put, according to §19-5 the taxable income is computed in the following way where all annual gross income from the sale of salmon, rainbow trout and trout is assessed. This also includes the sale of live fish and gains on the realization and withdrawal of assets used in the rent of the sea [29] .

Deductible costs mentioned in §19-6 are mainly operating costs that are directly associated with farming. Furthermore, investments in assets used in the water are also deductible. These are immediately deducted for when purchased after January 1st, 2023. For investments done pre-2023, the depreciations are also deducted. Also, corporate income and production tax is deducted, as it has already been paid. The same applies to the R&D fee that is paid to The Norwegian Seafood Council. A very important deduction is what concerns the licenses paid, where there is given 40% deduction from the purchasing value of licenses done in 2018, 2020, and 2022 of the RR income.

A flat tax rate of 25% is applied to the following base: sales minus operational and investment costs, corporate tax, production tax, and a research and development (R&D) tax, with a standard deduction of NOK 70 million. This structure ensures that smaller firms, falling below the deduction threshold, are exempt from the tax.

There is additional tension to regulate the market by the definition of the target price. This is motivated by the sometimes difficulty in setting the real value of the fish at the edge of the cage, as well as a part of the sale done through a fixed price. These prices will differ from the

[28] The whole law is translated into English to the best extent and can be found in Appendix B.
[29] Negative RR will be after §19-7 carried forward with interest, and if activities cease the value of negative RR will be disbursed. The Ministry will assess how a disbursement claim at cessation could potentially be mortgaged.

spot price. For this reason, there will be a Price Board from 2024, which is the same framework used in the oil and petroleum sector (Finansdepartementet, 2023).

4.3 Sectoral Resource Rent

First, we will calculate the sectoral rent using the same framework as in Flåten & Pham (2017). They calculated the RR in the sector using the Profitability Survey done by the Directorate of Fisheries, for 2016. The paper is one among others that were used as a motivation for the discussion of the RRT that started in 2017. Following their approach, we will calculate the sectoral RR for the period 2017-2022. Further, we will try to evaluate the payment due by the Big 4 at the beginning of 2024, which is the first time that the RRT will be implemented. It is worth noticing, that these calculations are only calculating the RR in the sector. For what it concerns the deductions will not be introduced here, but at a firm level, which is realized in the next subsection.

Total income includes all forms of revenue, both income from salmon and rainbow trout, as well as insurance receivables and other forms of income. Salmon accounted for 88.5% of the total income in 2022. Depreciation and amortization are included in costs, and the operating cost includes the same costs as described previously.
When calculating the return on capital, we have used the same interest rate as Flåten & Pham (2019) at 4%. This is based on suggestions for the opportunity cost of capital for long-term public investment projects made by the Ministry of Finance. There has been a public discussion about the level of this rate, however, Greaker & Lindholt (2019) argue that this doesn't have a major impact, since aquaculture is not very capital intensive.

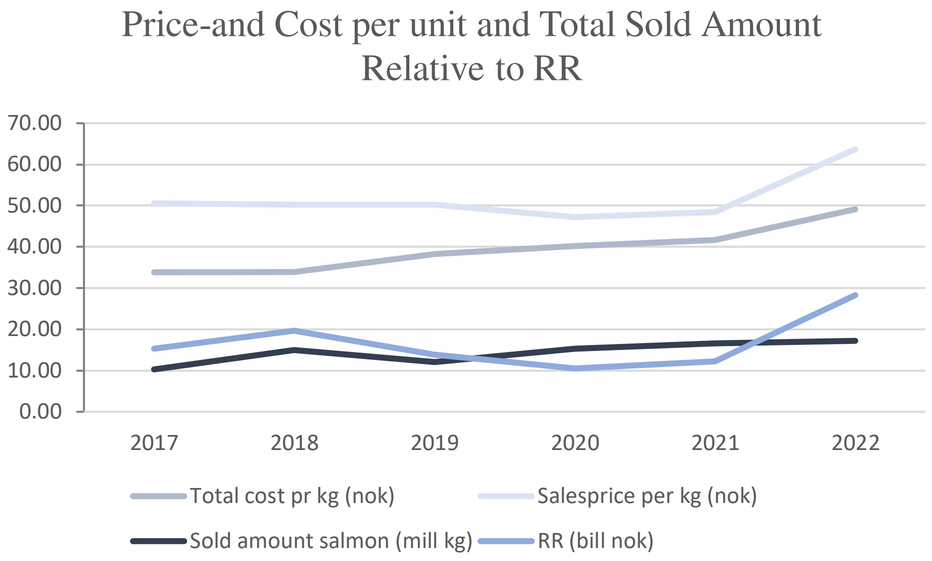
Table 3 - Sectoral RR 2017-2022

MILL NOK	2017	2018	2019	2020	2021	2022
Total Income	47,999.7	63,359.2	53,674.6	66,922.7	73,049.4	100,285.2
(-)Total Operating Costs	31,731.0	42,802.8	38,855.1	55,510.8	59,876.2	71,118.5
(-) Return on Capital	1,038.9	380.2	975.5	895.8	1,026.2	884.9
Resource Rent	**15,229.8**	**19,726.1**	**13,843.9**	**10,516.1**	**12,147.1**	**28,281.9**

Source: The Directorate of Fisheries
Author's calculations

As the table shows, the RR peaked in 2022 by more than double, when compared to 2021. The Directorate of Fisheries' (2023) published profitability survey argues that this is due to an increase in salmon prices.

Figure 7 - Unit Cost/Price Relative to Total Output



Source: Directorate of Fisheries

Author's calculations

By looking at Figure 7, one can get a better picture of what is behind the numbers. In 2018, the peak pre-2022 is very much attributed to increased quantities sold, complimented by marginally lower unit costs compared to the year before. From 2018 the RR is more dependent on the unit price and cost. In 2020 and 2021, the period when COVID-19 drastically changed the world, the RR in the salmon industry faced increased costs and lower prices. Nonetheless, the industry experienced increased salmon sales compared to previous periods, albeit at a lower price and higher costs. Consequently, this led to a historically lower RR during the examined period. In 2022 the sold amount was relatively stable compared with 2020 and 2021, however, there was an increase in the unit price by 18%, which resulted in the RR being higher than ever, and double the year before. By just looking at this graph, one could assume that the RR is more attributed to the unit price rather than the costs and sold amount the last three years.

However, NOU 2019:18 (2019) claims that the willingness to pay for the licenses, will in principle, reflect the value of the current value of future excess returns on the license (after ordinary tax). A well-done auction with high competition, will therefore contribute to a large part of the expected RR, and be captured through the auctions. If this is the case, price data from an auction can therefore be used to estimate the size of the base rate in an industry. When they used this method using the average of 2018 auction prices, as a proxy for profit per ton in the allowed biomass in the industry, this would mean the future RR would be 170 billion NOK. When correcting for corporate tax, it would be approximately 220 billion NOK. When they used the same return on capital used in Flåten&Pham, as is also used in Table 1 at 4%, the resulting yearly RR is approximately 9 billion NOK. This is not a too far-off estimate for the realized RR at 10 and 12 billion in 2020 and 2021, respectively.

4.4 Big 4 Resource Rent and Resource Rent Taxation

This subsection will present a hypothetical exercise of numerical values of the salmon tax. This means if the tax were implemented at the beginning of 2023, this indicates the amount of the rent that would potentially been captured based on the result the Big 4 firms obtained in 2022.

The data we just presented refers to the sector. But we know that the focus of the tax was to reach the biggest firms. Another interpretation is that these 70 mills NOK reflects the (partial) payment in investment in permits.

We will quote The Prime Minister from the press conference on RRT in March 2023:

"The standard deduction is set to 70 million NOK, this way only the companies with big profits will pay the resource rent taxation".

– Prime Minister Jonas Gahr Støre, 2023

We will for this reason focus on the Big 4 companies – Mowi Group, Lerøy Seafood Group, Salmar Group, and Grieg Seafood Group[30].

These are Norwegian companies that have a great history of contributing to building Norwegian aquaculture over the years. Big 4 are publicly traded on the Oslo Stock Exchange, which accounted for around 48% of all licenses in 2022. In order to do so, we have used the law to the best extent feasible with the publicly accessible data at the firm level. Due to the fact that not all details are public, there has been a need to make some assumptions as follows:

To separate Norway from all production, we have taken the volume harvested in Norway and used it as a percentage of the total income statement. We assume all production tax (where it

[30] It would be ideal to include Cermaq Norway, however, the data needed for the computations was not available.

is mentioned) is paid to Norway. The same is done for corporate tax, where we have used the taxes paid to the Norwegian state as a percentage of total taxes paid. Interest is not accounted for since financial costs are not deductible. We also assume all depreciation and amortization already has been deducted.

A very relevant deduction is what concerns §19-6, paragraph 1, letter h in Appendix B. This law says that 40% of the investments done in the purchase of licenses of the 2018-, 2020- and 2022 auctions and fixed-price sales can be deducted. All the sales were made public by the Directorate of Fisheries, which means that we were able to calculate and deduct this for all four firms. As mentioned in subsection 4.3, these auctions should reflect the expected RR, which means that the firms have already paid a part of the rent in these auctions.

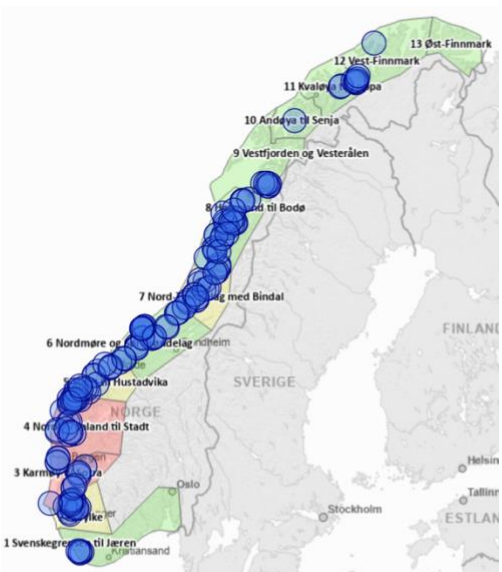
We will now present the hypothetical numeric values for the RRT and RR for the Big 4. Additionally, we will try to understand the evolution of the Big 4's position in the industry relative to their license history[31].

Mowi Group

The data is from Mowi's Annual Report 2022 (2023).

Mowi is by far the world's largest salmon farmer. They have been in the industry since the very beginning and started their history in 1964. Until today, they have had many changes through different mergers and acquisitions and were until 2018 named Marine Harvest. Throughout these years, the farming company has developed a robust license portfolio, holding 225 GOP permits, distributed over 125 localities, see Figure 8.

Figure 8 - Mowi's Localities



Source: The Directorate of Fisheries
Illustration done by the author using their visualization program.

Mowi did not purchase any new licenses in the 2022 auction, however, it increased its portfolio in 2023.

[31] The licenses subject to this dissertation are only commercialized GOP licenses. The firms have other licenses as well but these will not be taken into account.

In 2022 the firm harvested 63% of its total in Norway, where it also has its headquarters. They also operate abroad in Scotland, Chile, Canada, Ireland, and at The Faroe Island.

Mowi could account for 18% of the total calculated sector rent above, making them the largest company and contributor in terms of the respective RRT. As Table 3 shows, using 2022 numbers, Mowi Group could hypothetically pay 1,2 billion NOK in RRT.

Table 4 - Mowi RR - 2022

Resource Rent Mowi	
NOK 1,000[32]	2022
Sales Revenue	30,972,887
Operating Costs	23,702,333
EBT	**7,270,554**
Deduction Corporate Income Tax	-1,868,782
Deduction Production Tax	-235,080
Deduction Research Fee Seafood Council	-58,509
Deduction 40% - 2020 Auction	- 120,202.1
Standard Deduction	-
Taxable Resource Rent	**4,987,982**
Resource Rent Taxation	**1,246,995**

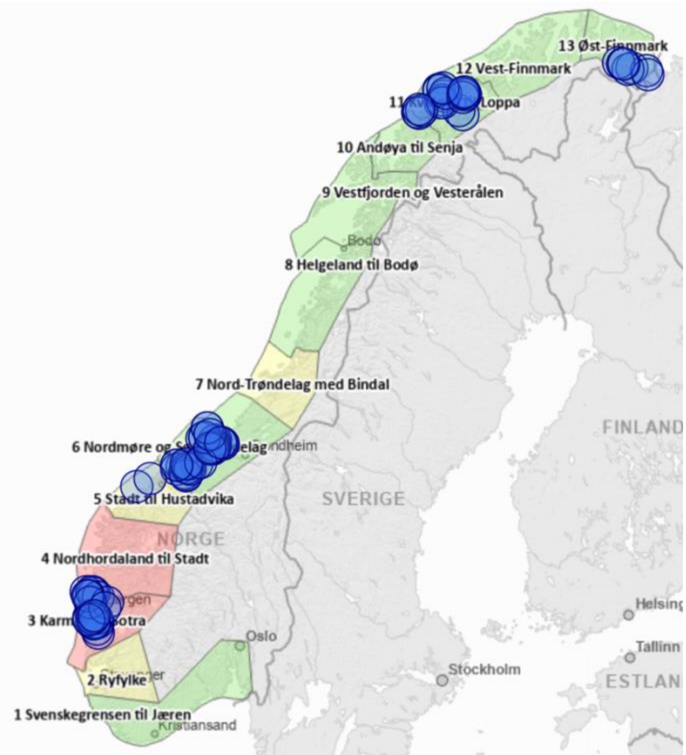
Source: Mowi
Author's calculations

[32] Mowi's annual report is in EUR, so we have converted it into NOK using the average exchange rate from EUR/NOK in December 2022.

Lerøy

The data is from Lerøy Seafood Annual Report 2022 (2023).

Figure 9 - Lerøy's Localities



Source: The Directorate of Fisheries
Illustration by author using their visualization program.

Lerøy's history started in 1899, and has their headquarters in Bergen, Norway. They harvested 91% of their total in Norway, but also operate abroad. Lerøy has been a pioneer in the Norwegian industry, however, it wasn't until 1999 they made their first investment in salmon farming. Since then, they have been through acquisitions and are now owned by Austevoll[33] Seafood. However, their portfolio of licenses is distributed through Lerøy Middle -Aurora, and – West. This has resulted 113 licenses[34], in 87 localities, see Figure 9.

They had the second largest income after Mowi in 2022 and would have contributed 370,698 thousand NOK to the Norwegian state based on their 2022 annual report. Their rent was in 2022, 5% of the total sector RR.

[33] Also a farming company, but primarily operating in The Faroe Islands.
[34] Lerøy West, Middle and Aurora has 25-, 53-, and 35 permits respectively.

Table 5 - Lerøy RR - 2022

Resource Rent Lerøy	
NOK 1,000	2022
Sales Revenue	24,247,748
Operating Costs	21,863,128
EBT	**2,384,620**
Deduction Corporate Income Tax	-901,829
Deduction Production Tax	-
Deduction 2020 Auction	-28,272.34
Standard Deduction	-
Taxable Resource Rent	**1,454,519**
Resource Rent Taxation	**363,630**

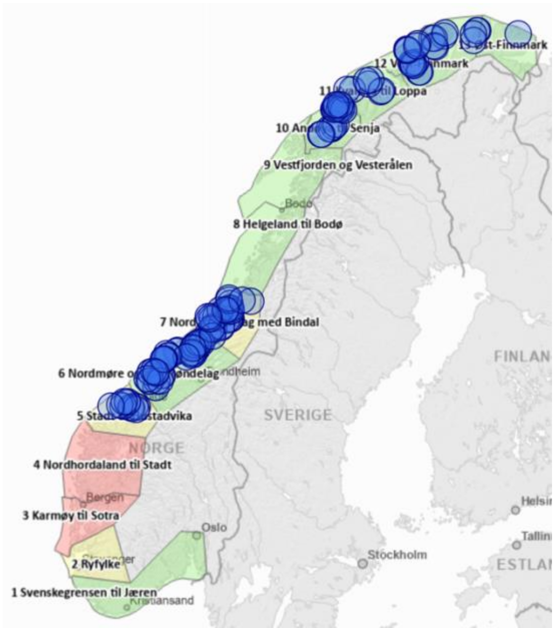
Source: Lerøy
Author's calculations

Salmar

The data is from Salmar Annual Report 2022 (2023).

Salmar was founded in 1991 on an acquired bankrupt estate consisting of one license for farming salmon. This happened during the most troubled periods in the industry, which later led to the bankruptcy of The Fish Farmer's Sales Association. In 2022 the firm became the second biggest farming company due to a merger of three other companies. In 1992 they purchased two more licenses, and in the next years acquired licenses from other farming

Figure 10 - Salmar's Localities
Source: The Directorate of Fisheries
Illustration by author using their visualization program



companies increasing their license portfolio. Today, the company can account for 145 commercialized GOP licenses, distributed over 131 localities, as Figure 10 shows.

They harvested 193,700 tons of salmon in 2022, where 91% was in Norway. According to our hypothetical calculation, they would pay 719,897 thousand NOK in RRT in 2022 and represent 2.5% of the sector's total revenue..

Table 6 - Salmar RR - 2022

Resource Rent Salmar	
NOK 1,000	2022
Sales Revenue	16,932,954
Operating Costs	13,194,700
EBT	**3,738,255**
Deduction Corporate Income Tax	-858,596
Deduction Production Tax	-72
Deduction 2018 Auction	-145,244.40
Deduction 2020 Auction	-704,110.66
Standard Deduction	-
Taxable Resource Rent	**2,030,231**
Resource Rent Taxation	**507,558**

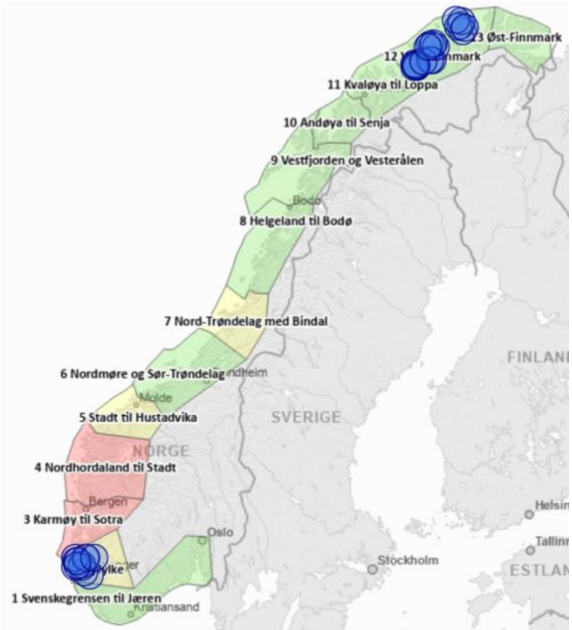
Source: Salmar
Author's calculations

Grieg Seafood

The data is from Grieg Seafood Annual Report 2022 (2023).

Grieg Seafood is the smallest farming company out of the Big 4 but still holds a significant position in the market. Their history started in 1992 and has their headquarters in Bergen, Norway. Apart from Norway, they also operate in British Colombia and Shetland. Grieg

Figure 11 - Grieg Seafood's Localities



Source: The Directorate of Fisheries - Illustration by author using their visualization program.

Seafood was started in the early 90s by two brothers in Western Norway and has from that time expanded to Northern Norway (see Figure 11). In the period 1994-1998, they acquired multiple licenses, as well as smaller farming companies.

In 1998 they established Grieg Seafood Rogaland (Western Norway), and in 2006 they established Grieg Seafood Finmark (Northern Norway). Through this time, they have ended up holding a total of 27 licenses in Finmark, and 15 in Rogaland distributed over localities as Figure 11 shows.

As Table 7 shows, they would in 2022 pay a total of 417,473 thousand NOK, their total rent is 1.4% of the whole sector.

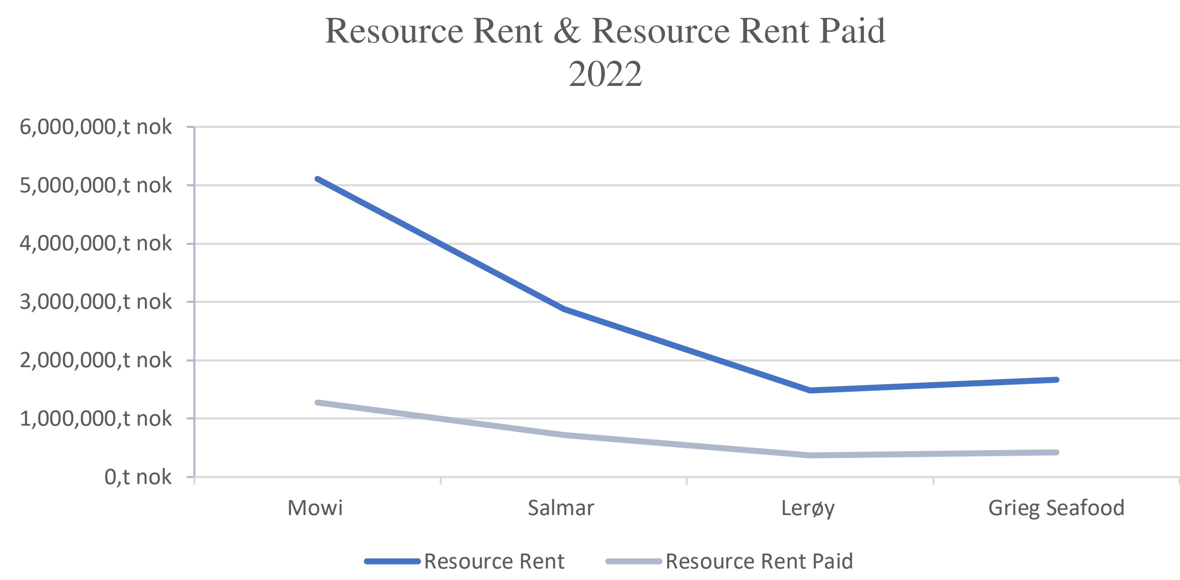
Table 7 - Grieg Seafood RR - 2022

Resource Rent Grieg Seafood	
NOK 1,000	2022
Sales Revenue	7,195,446
Operating Costs	5,249,422
EBT	**1,946,024**
Deduction Corporate Income Tax	-249,784
Deduction Production Tax	-26,350
Deduction 2020 Auction	-39,971.90
Standard Deduction	-
Taxable Resource Rent	**1,629,919**
Resource Rent Taxation	**407,480**

Source: Grieg Seafood
Author's calculations

In total, in 2022 the Big 4 accounted for 40% of the total RR in the industry. In this hypothetical exercise, could together paid 2,785,113,000 NOK of taxes to the Norwegian state in 2022, which means 10% of the total sectoral RR would be captured. And as previously mentioned, the realized income will probably be higher since we haven't included all relevant companies. Half of this estimated RRT will go to the municipalities, where the companies have their localities.

Figure 12 - Resource Rent & Rent Paid by Big 4 - 2022



Source: Mowi-, Salmar-, Lerøy- and Grieg Seafood Annual reports
Author's calculations

By looking at Fig 12, one can see that even though Lerøy had a higher income than Salmar, their RR is lower than Samar's. This is because Lerøy has higher total operating costs than Salmar. As mentioned earlier, technologies are comparable across firms. Therefore, firms of the same size should be subject to identical RRT. Those with greater volume and sales, owing to enhanced efficiency through economies of scale, are expected to have a higher RRT per unit of production or sales. This is not the case for Big 4, as both Salmar and Lerøy have higher RRT per kg produced than Mowi.
Mowi's RRT per kg is 230 NOK, versus 247- and 471 NOK for Salmar and Lerøy, respectively. Grieg Seafood, on the other hand, is the smallest firm and pays the smallest RRT per kg produced, being 154 NOK.

It's important to note that this expectation might not always align with reality, as evidenced by the fact that both Lerøy and Salmar have higher RRT per kilogram produced than Mowi, despite Mowi being the largest and anticipated to have the highest RRT per kilogram.

As mentioned earlier, labor processes have undergone automation in recent years. This implies that the deducted labor costs could potentially have been higher if automation had not been implemented. Instead, the deduction now involves the amortization of the investment made during the machine's purchase. The utilization of these depreciations in the computation of taxable RR becomes crucial. For instance, owing to increased productivity and a reduction in Full-Time Equivalents (FTEs), Mowi experienced a 1-percentage point decrease in salary expenses relative to sales from 2021 to 2022. In the same year (2022), they maintained stable production volumes with a 2.9% reduction in FTEs compared to 2021. This productivity program, initiated in 2020, contributed to a 6% increase in volumes, while FTEs decreased by 9%. Salmar does not have as a detailed overview of their productivity in the workforce, however, their salary expenses decreased by 1pp relative to sales from 2021.

5. Discussion

The concept of the sea as a renewable resource raises questions about the necessity of government intervention in activities involving its use, akin to the lack of fees for utilizing air. If the sea is indeed renewable, one may question the imposition of licenses and RRT, the air is also renewable, however, no one is regulated to pay rent for the air.

The historical evolution of the regulations in the aquaculture sector provides insights into the government's intervention. Initially, licenses were granted freely, maybe led by bureaucratic challenges, and the intention to have more control over the operators in the sea. Farmers could continue to operate in the same manner as before, but with a permit, as this did not affect aquaculture. New farmers joining the market, however, were unable to operate. This means that the farmers with a permit, were given market power.
The government then started demanding a price for these permits, and at the same time, incentivizing different geographical areas. The definition of the permit changed, meaning that there were different requirements, and granted at certain conditions. Further, the government interventions developed even further, by controlling what the farmers could do in the sea. More or less at the same time, the price increased further, and the geographical incentives

increased even further. Given the entry constraints that are driven by the licenses, the price of these attempted to balance the market power that was created.

These government interventions, especially auctions raise a critical question of how to capture the rent. The auctions have proven, in more recent years, to reflect the market value of the permits. By offering some areas, to the firms that pay the most for it, resulting in much of the rent is captured through these auctions. However, there is a question of how the industry has evolved, using Big 4, which are the ones subject to paying the rent. The fact that they represent nearly half of the total permits, prompts the critical question. If these firms purchased their license in the last 5 years, one would assume they already have paid their rent. A detailed examination of regulatory shifts of time subject to all firms is necessary to discern when these firms began to exert significant influence on the market.
On the other hand, there is a need for more details around this topic to conclude if this is the case. Nevertheless, by looking at their historical license portfolio on the surface, there is no reason to believe that their significance in the industry was after the permits showed their market value and captured a part of the rent. But as said – This demands more details.

The traffic light may be seen as a way of correcting the negative externality that occurs. The aquaculture farmers' usage of the sea may increase the salmon lice in the sea, this will create a negative externality in a way that affects the wild fishing. This means that the more they produce, the less others can use the sea. However, by only allowing the farmers to increase their production through strict regulation, may reduce the negative externality that occurs, but on the other hand, this is not paid for. By grant out new permits or an increase in capacity in certain production areas, are a way of not penalizing others.

Another topic is whether or not all firms should pay the rent. The firms may not want the tax, and rather pay for the marginal in licenses, however, there may be political pressure to tax big firms. While small firms benefit from standard deductions, which may be politically motivated, the economic focus shifts to whether large firms manipulate the market. There is no reason to believe so since the market is shown by the HHI to be competitive with a low market concentration. At the firm level, the industry is also facing international competition, which indicates the market may be less concentrated than it is shown in this dissertation.

The debate over tax rates revolves around finding a balance between the interests of firms, especially the Big 4, which indicates the difficulty in how to capture the correct amount of rent. The government's initial grant of the (speculative) monopoly power, without capturing associated rent has set the stage for the taxation dilemma. The RRT is designed to correct historical pricing inaccuracies. Nevertheless, determining an equitable tax rate involves navigating the complexities of initial investments, including permits obtained at a very low cost, and at the same time ensuring fairness between both large and small enterprises.
A more complex task involves modeling the actions of businesses to determine how RR taxation may impact business choices on investments, sea usage, and output levels. Additionally, whether these modifications are significant enough to incentivize Norwegian companies to relocate their production—or increase their output—to areas where the tax is not imposed. The thesis does not address these interesting questions.

6. Conclusion

This dissertation aimed to understand more about implemented RRT in the Norwegian aquaculture industry, by digging deeper into the reasons behind the big RR values, and at the same time questioning the way of capturing the rent through the tax using the law.
Firstly, the investigation into industry characteristics highlights the significant impact of technology, unveiling economies of scale inherent in larger firms. The sector's reliance on technological advancements underscores the crucial role of innovation in enhancing efficiency, production, and overall competitiveness. Simultaneously, a historical analysis of government interventions unravels the industry's evolution from freely granted licenses to a more regulated system. The historical government intervention seems by our findings to be the biggest contribution to the scarcity of the sea, resulting in an industry with a small amount of large firms.

In assessing the efficacy of the RRT, a hypothetical exercise provides valuable insights. The simulation utilizing 2022 figures and projecting its implementation in 2023, offers a glimpse into the tax revenues that are taken from the industry, assuming firms' decision-making does not change even though they know their RR will be taxed.
This exercise becomes crucial in correcting historical pricing inaccuracies and aligning the industry with contemporary economic realities. Challenges in determining an equitable tax rate are apparent, considering the industry's historical trajectory, initial low-cost permits, and

the diverse scales of enterprises. Striking a balance between rent capture and fostering industry growth emerges as a complex task, especially given the differing characteristics of large and small firms.

This dissertation has contributed with valuable insight into the industry, and we hope to have added to the characterization of the industry and set a groundwork for further research in this field. However, looking ahead, the historical influence of major firms and a nuanced analysis of the optimal tax rate is needed to understand the scope of the tax at a more detailed level. An interesting approach would be to see whether or not the tax distorts future investments in licenses for GOP in the Norwegian Aquaculture industry.

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Appendix A

1973: The law that demanded a license to operate was determined, and all farmers who operated were granted a permit, the number was 287 farmers.
Between 1973 and 1989 it was provided a total of 421 permits, these permits were granted out *for free.* An important regulation here was that there was only allowed one permit per company, meaning that these permits went to different companies. At this time, it was the Fish Farmer's Sale Association[35] that was organizing the industry.

1991: The Fish Farmer's Sale Association filed for bankruptcy, and it was not possible for companies to acquire others, which also included their permit to operate.
Between 1989 and 2002 there were no new licenses granted. However, in 1996 it was implemented a new regulation – a feed quota, which meant that each permit was only allowed to use a certain amount of fish feed throughout the year. This encouraged having a stronger focus on utilizing the feed as well as possible, decreasing costs and the environmental footprint. The capacity was at this time restricted in volume, meaning the cages were limited in volume in terms of m^3.

2002: An important year for the Norwegian State, because it became possible for the state to demand a price when granting permits, the granting is done by the Directorate of Fisheries. This year it was announced 41 permits, of which 31 of them were granted, however, it was only paid a price for 28 of them. The fact that some of them were free was a consequence of a political desire to build up a new district industry in a period when the industry was characterized by high-risk and significant development work. The profitability survey from The Directorate of Fisheries from 2002 shows that between 1993 and 2000, 33 companies in GOP went bankrupt. The prices were also different for all of them, and for two municipalities in the area Troms and Finmark[36] (North-Norway), had a price of 4 mill NOK, and the rest of Norway 5 mill NOK. In 2003, 60 new geographically distributed permits were announced, and the prices were the same as in year 2002.

2005: A significant change in regulations in terms of capacity and the stock of fish in the sea. The volume and feed quota were substituted with Maximum Allowed Biomass (MAB). The

[35] Directly translated from the Norwegian name "Fiskeoppdretternes Salgslag".
[36] Have a colder water, so the growth of salmon may take longer time.

MAB decides how many kilograms the farmer can have in the sea at a certain time. This means that the permits granted before the 1st of January 2005 were no longer limited in volume but in MAB. This happened after the Directorate of Fisheries was asked by the Ministry of Fisheries to set up a working group to prepare a new system for production regulation. The committee included representatives from the various sector authorities and within the industry They discussed various regulation models (emission, area, feed, volume and biomass-based), they ended up recommending a transition to a biomass-based system.
The MAB level for a standard permit was 780 tonnes[37] for all counties, except Troms and Finmark. There the corresponding volume was converted to 900 tonnes of MAB. The argues for this was that the growth is lower in Troms and Finmark because of colder water.
This regulation change resulted in an increase on production capacity by around 30% without having to pay to the state.
This form of permit means that farmers cannot have standing biomass in the sea that exceeds the value of the permit (780/900 tonnes). However, if the farmer has several permits, the farmer may (with certain limitations) have standing biomass that makes up the sum of the permits. Each permission is associated with an or several locations, which means a physical sea area along the Norwegian coast where farming activities of a certain scale can take place. Also, the localities are delimited based on MAB.

2006 & 2009: In both years it was granted new permits. In 2006 it was done through closed bidding (auction), 10 permits were handed out with a price interval of 50,000 and 3 mill NOK.
In 2009 it was granted 65 new permits, and three of them were in Finmark with a price of 3 mill NOK. The 58 others were in the rest of the country, with a price of 8 mill NOK.
Five of these permits were earmarked for organically certified production. In this round the authorities considered 255 applications, where 16 of these were related to the earmarked permits.
In 2009 the Aquaculture Act was also changed so the state could demand a price for an increase in the capacity of MAB on already granted permits. In 2011 the farmers in Troms and Finmark were offered to increase their production on their permits by 5%, and all farmers accepted the offer for a price of 500,000 NOK in Troms, and 150,000 in Finmark. The same happened in 2015 but was offered an increase of 5%, equivalent to 39-47 tonnes for a price of

[37] This comes from 65kg x 12,000 m³.12,000 m³ was the volume hat was restriction for one permit.

1 mill NOK. Strict requirements were laid down for farmers who chose to make use of the offer. The requirements meant that the permitted level of salmon lice was significantly and permanently reduced, as well as strict restrictions were placed attached to the medicinal treatment of salmon lice within the production cycle.

2013: It was offered 45 “green” permits, meaning with special environmental conditions. 20 of these were in Troms and Finmark, while the others did not have any geographical limitations. 15 of these that weren’t geographically limited, were granted through a closed auction with prequalification, where the 10 others were sold at a fixed price.

2016: A trial scheme with a variable MAB limit throughout the year was offered in 2016 for a fee of 1,5 mill NOK per permit. The scheme aimed to facilitate growth in that the ceiling for how much fish can stand in the sea, is increased in the best growth period, against that it is lowered for the rest of the year. This was to make it possible for the farmers to be able to utilize the natural temperature variations in the sea better. 21 permits were registered for the scheme, and the total paid was 31.5 mill NOK.

2017: A new regulation for capacity adjustment was implemented called the “Traffic Light System”. This means that the growth in MAB in the different areas happens every second year, and the criteria for a new capacity level will be determined based on the salmon lice, which indicates the environmental condition in the production area, see Figure 4. If the environmental impact is red, the environmental impact is unacceptable, and a 6% reduction in capacity is required. If yellow, it doesn’t change, and if it is green, either the farmer already owning the permit will get the capacity back, or the areas are opened for growth. The areas that are opened for growth will be offered to the farmers at a fixed price. The rest will be offered at auctions.

2018: The areas that were defined as green were offered to increase their MAB by 2%. The price was 120,000 NOK per tonne MAB increase. The total income of the fixed prices was 1 billion NOK.
After this allocation round with fixed prices, the summer of 2018 was additionally an auction round. The new permits accounted for approximately 4% of the capacity in the areas where it was opened for allocations. In the period 18-20 June 2018, just under 15,000 new tonnes were sold for a consideration of 1,9 billion NOK. The price varied from 132,000 to 252,000

NOK per tonne depending on the production area. The average price was 195,000 NOK per tonne, which corresponds to 152 mill NOK for a standard permit of 780 tonnes MAB. 97% of all offered capacity were sold. In the first public auction, 14 companies purchased new salmon permits for a total of 2.9 bill NOK.

September 2018, there was a residual auction, where most of the remaining capacity was sold for a fee of 81 mill NOK. Of the total of 4 bill NOK, 80% went to municipalities and county municipalities, and 20% to the state.

2020: New auction and the permits sold peaked at price at 6 bill NOK, doubled from the previous auction. The capacity offered was 37,189 tonnes, and it all was sold. Out of the 42 companies that were registered for the auction,30 of them ended up purchasing more capacity. The areas of these capacities are distributed over the 13 production areas as Figure 4 shows.

2022: Granted a total of 24,644 tons MAB, with a total price of 3,8 billion. The offered MAB was 32,887 tonnes, which means that 25% were not sold. In this auction round, the authorities had set a minimum price for each tonne depending on the production areas. These minimum prices were between 100,000 and 128,000 NOK per tonne.

2023: Residual auction from the 2022 auction, where 8,243 tonnes of MAB were offered, and it all was sold. The total income was just above 1,5 billion NOK. Five companies purchased capacity.

Appendix B

Act on Taxation of Wealth and Income (the Income Tax Act)

Chapter 19. Special rules for the taxation of aquaculture activities

- Chapter added by Act 16 June 2023 no. 44 (effective from the income year 2023).
- RR= Resource Rent
- RRT = Resource Rent Tax

§ 19-1. Scope

The provisions of this chapter apply to the taxation of economic rent from activities based on permits as mentioned in sections 6 and 7 of the Aquaculture Act, cf. section 4, cf. the Salmon Allocation Regulation chapter 3.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-2. Tax Subject

The holder of aquaculture permits as mentioned in § 19-1 shall pay RRT to the state according to the rules of this chapter. This applies even if the holder has leased the permit according to section 19, third paragraph of the Aquaculture Act.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-3. Definitions

In this chapter, the following definitions apply:

a. A parent company, together with one or more subsidiaries, forms a group.
b. A company is a parent company if, due to an agreement or as the owner of shares or interests, it has decisive influence over another company. The other company is considered a subsidiary. If one group company or several group companies together have decisive influence over another company, this company is also considered a subsidiary.

c. If a natural person, alone or together with close associates, has decisive influence over two or more companies or parent companies, these companies and their subsidiaries are also considered a group.

d. A natural person or a company shall always be considered to have decisive influence if the person or company owns so many shares or interests in a company that they represent the majority of votes in the other company, or if the person or company has the right to appoint or dismiss a majority of the members of the board of the other company. In the calculation of voting rights and rights to appoint or dismiss board members, the rights held by the parent company and the parent company's subsidiaries shall be included. The same applies to rights held by someone acting on their own behalf but on behalf of the parent company or a subsidiary.

e. Close associates mean:

1. Spouse and a person living with the individual in a marriage-like relationship;

2. Relatives in the direct ascending or descending line and siblings;

3. Relatives in the direct ascending or descending line and siblings of a person mentioned in no. 1 and no. 2;

4. Spouse and a person living in a marriage-like relationship with someone mentioned in no. 2 and no. 3;

5. Companies where the individual or someone mentioned in no. 1 to 4 has such decisive influence as mentioned in letter d.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-4. Determination of Economic Rent Tax

(1) Taxable RR income is calculated as follows:

a. Deductions from the total annual gross income determined according to § 19-5 include costs according to § 19-6 and carried forward negative economic rent income from previous years, cf. § 19-7, second paragraph. Negative economic rent income in a previous year shall be deducted in its entirety before deductions are made for negative economic rent income in a later year.

b. In the calculation basis according to letter a, negative and positive economic rent income can be coordinated as described in § 19-7, first paragraph.

c. In the calculation basis according to letters a and b, a basic deduction described in § 19-8 can be deducted.

(2) RRT on taxable RR income is determined according to the first paragraph and a rate decided by the Storting for the respective year.

(3) In the determined RRT according to the second paragraph, the production fee can be deducted as described in § 19-9.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-5. Gross Income and Tax Settlement Prices

(1) The following is included in the total annual gross income:

a. Annual gross income from the sale of salmon, trout, and rainbow trout. Gross income in the previous sentence is set at the market value at the edge of the sea of sold salmon, trout, and rainbow trout multiplied by the slaughter volume.
b. Income from the sale of live fish in the sea phase.
c. Gain on the realization and withdrawal of assets used in the economically taxed activity. For assets mentioned in § 19-6 letter c, the gain is recognized in the realization year. For other assets, the gain is recognized according to the rules in chapter 14, and the gain is allocated according to the assessment in the previous income year. Section 9-3, seventh paragraph, applies to the overall realization of aquaculture activities.

(2) Income gained also from activities not taxable under this chapter shall be allocated in a manner suitable to provide correspondence between income share and benefit for each activity.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).
- Amended by Act 16 June 2023 no. 44 (effective from the time determined by the King).

§ 19-6. Deductible Costs

(1) In the gross income determined according to § 19-5, the following costs are deductible:

a. Incurred operating costs that regularly follow aquaculture production, including costs for the purchase or production of fingerlings, feed, care, prevention, and treatment of diseases, etc., labor costs and other personnel costs, costs for maintenance, insurance, and administration.

b. Consideration for the purchase of live fish in the sea phase.

c. Costs of the income year related to floating aquaculture facilities at sea, which are otherwise subject to activation, can be deducted in the year the costs are incurred. Such facilities include physical installations such as cages, floating modules, feeding machines, feed storage, living quarters, sanitary facilities, and the like, as well as anchors, weights, and the like for anchoring, and other physical devices related to the facility exclusively for use in the economically taxed activity according to § 19-1. However, this does not apply to such assets as mentioned in this paragraph letter f.

d. The annual depreciation of assets not included in letter c, for use in the economically taxed activity according to § 19-1, can be deducted from the RR income according to the general rules of the Income Tax Act when they are wholly or partially used as input factors in the economically taxed activity.

e. The annual depreciation of the tax remaining value of assets mentioned in letter c acquired before 1 January 2023 shall be deducted according to the rules in chapter 14. However, no deduction is allowed for depreciation of unlimited aquaculture permits.

f. The annual depreciation of assets transferred to the taxpayer according to § 19-2 from a company mentioned in § 19-3. The annual depreciation is determined based on the transferring company's tax values of the transferred assets at the time of transfer. The assets are depreciated according to letter e.

g. Loss on the realization and withdrawal of assets used in the economically taxed activity. The loss is timed according to the rules in chapter 14.

h. 40 percent of the paid consideration for the purchase of permits and capacity at auctions in 2018 and 2020 and the fixed-price allocation in 2020, distributed over the years 2023–2027 with equal amounts and adjusted by the tax rate on ordinary income. The deduction is granted to the holder of a permit as mentioned in the first sentence for the income year for which the deduction can be claimed.

i. Property tax on floating aquaculture facilities at sea, cf. the Property Tax Act § 4, third paragraph, and other property tax on aquaculture facilities used wholly or partly for the farming of salmon, trout, and rainbow trout in the sea phase.
j. Research fee as determined in accordance with the Act of 7 July 2000 no. 68.

(2) Costs that by their nature fall under the first paragraph and that also benefit an activity not taxable under this chapter shall be allocated in a manner suitable to provide correspondence between cost share and benefit for each activity.

(3) A calculated corporate tax for the part of the activity that is economically taxed is deducted from the economic rent income. The tax rate is set at the rate for ordinary income in the income year. The same income and cost amounts are included in the calculation as those included in the economic rent income. However, expenses for assets deducted according to the first paragraph letter c shall be depreciated according to the general rules of the Income Tax Act in the basis for the calculated corporate tax. Gain as mentioned in § 19-5 first paragraph letter c second sentence shall be recognized according to the general rules of the Income Tax Act in the basis for the calculated corporate tax. Calculated negative corporate tax is carried forward to be deducted in the calculated corporate tax for later income years.

(4) The following costs are not deductible

a. Sales and marketing costs.
b. Financial costs.
c. Consideration for the acquisition of aquaculture permits, except for permits mentioned in the first paragraph letter h. No deduction is allowed for consideration for the conversion of development permits.
d. Costs related to the acquisition of aquaculture permits.
e. Costs for the lease of aquaculture permits where an exemption for leasing is granted according to section 19, third paragraph, of the Aquaculture Act.
f. Consideration for the acquisition of assets developed based on the taxpayer's development permit.

g. Payments to municipalities, local communities, etc.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-7. Coordination and Carryforward of Negative Economic Rent Income

(1) If a limited liability company and equivalent company and association, cf. § 10-1, first paragraph, have negative RR income according to the calculation in § 19-4, first paragraph, letter a, up to the entire negative RR income can be deducted from positive RR income in another company belonging to the same group according to the same provisions as in § 10-4, at the end of the income year. However, such coordination cannot result in the company with negative RR income having positive RR income as a result of the coordination.

(2) If the RR income for a company becomes negative according to the calculation in § 19-4, first paragraph, letters a and b, negative RR income can be carried forward for deduction in later years' RR income calculated for the economically taxed company. Negative RR income is carried forward with interest determined by the Ministry in a regulation. Negative RR income cannot be deducted from the economically taxed individual's other income.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-8. Standard Deduction

The Storting (Government) decides each year on a basic deduction. When calculating RR income, the basic deduction is adjusted by the tax rate on ordinary income. The basic deduction can be deducted from positive RR income calculated for the income year. The basic deduction can only be deducted once at the group level, cf. § 19-3. The basic deduction in the group is distributed proportionally among the companies with fish farming permits based on the maximum allowed biomass held by each company in the group. Unused basic deduction cannot be carried forward for deduction in future RR income.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-9. Production Fee

Production fees on fish production set according to the Excise Tax Act can be claimed deducted from the determined RRT to the state. Unused production fees for deduction for limited liability companies and equivalent companies and associations, cf. § 10-1, first paragraph, can be deducted from the determined RRT according to the same provisions as in § 10-4, in another company belonging to the same group, at the end of the income year. An economically taxed individual cannot have the RRT determined negatively as a result of deducted production fees. Production fees that cannot be deducted in the income year's RRT cannot be claimed deducted in the RRT in a future income year. Production fees cannot be deducted from ordinary income.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-10. Treatment of Losses or Losses in Other Income Sources

Losses or losses in other income cannot be deducted from positive RR income calculated according to this chapter.

- Interpreted by Act 16 June 2023 no. 44 (effective from the income year 2023).

§ 19-11. Realization or Termination of Economically Taxed Aquaculture Activities

The calculation basis for RR income on the realization or termination of aquaculture activities economically taxed is determined as follows:

a. For the transferor, RR income equivalent to the consideration, minus the sum of the tax value of assets used in the economically taxed activity. However, consideration attributable to aquaculture permits shall not be included in the determination of RR income. Any negative RR income for carryforward is deducted, cf. § 19-7, second paragraph.
b. For aquaculture activities transferred to a new owner during the income year, RR income shall be determined proportionally for the transferor and acquirer according to each individual's circumstances and ownership time.

c. If there is negative RR income at the termination of economically taxed activity, the economically taxed individual can claim the tax value paid out by the state.

and a rate decided by the Storing for the respective year.