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Impact of Resource Rent Tax on Norwegian Salmon Farming Companies

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Abstract

This thesis investigates the impact of the resource rent tax announcement and its implementation in Norway. The dataset consists of daily returns for eight salmon farming companies. Half of these companies are affected by the tax, while the other half are not affected. Our sample period ranges from August 2, 2022, to February 1, 2023, which covers the announcement and implementation day. By applying a difference-in-differences approach, we measure the causal effect that the resource rent tax had on the returns of the affected companies (companies that operate in Norway), relative to the non-affected companies (those that operate outside of Norway). Our findings reveal a statistically significant, large negative return in the affected companies on the announcement day. Return on implementation day was close to zero. This result is consistent with efficient markets, where only new information should move stock prices.

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Preface

This thesis marks the end of our 2-year master's degree in applied finance at the University of Stavanger. During the past couple of months there has been several announcements in the media regarding resource rent tax in Norwegian aquaculture. This caught our interest, and we decided to investigate the impact of this special tax on Norwegian salmon farming companies.

We would like to thank our supervisor, Peter Molnar. Through regular meetings during this semester, you have provided valuable feedback which has improved this thesis. Additionally, we would like to thank everyone who has been providing us with information about the industry and potential consequences of the resource rent tax.

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1 Introduction

The background for this thesis is The Norwegian Ministry of Finance´s proposal to introduce resource rent tax in Norwegian aquaculture (Finansdepartementet, 2022). The proposal was announced on September 28, 2022, and states that fish farms producing salmon, trout and rainbow trout will be affected as of January 1, 2023. This was met with significant protests from coastal municipalities, the industry, and other stakeholders. However, one week later, the government implemented the resource rent tax in Norwegian aquaculture through the National Budget for 2022/2023 (Prop. 1 LS (2022-2023), pp. 128–131). It is worth noting that the specific details of the proposal were not yet adopted by the Norwegian Parliament, leading to several modifications during the fall of 2022 and the spring of 2023. Consequently, this ongoing revision process has increased the unpredictability and uncertainty within the industry, as the tax was implemented several months before its formal adoption by the *Storting* on May 31, 2023 (Brennmoen, 2023).

The aim with this thesis is to investigate the impact on the stock price of the affected companies following the government announcement, and the implementation of the resource rent tax in Norwegian aquaculture. This special tax not only affect the aquaculture industry, but indirectly also the host municipalities and other stakeholders. Moreover, the resource rent tax affects only specific companies within the aquaculture industry, providing a perfect opportunity to study its impact on those affected. Since the implementation on January 1, 2023, there has not, to the best of our knowledge, been conducted any studies on the impact of the resource rent tax on Norwegian salmon farming companies. Our contribution will be to close this gap.

To investigate the impact, we apply a difference-in-differences approach, a commonly known econometrics technique that allows us to measure the impact of the resource rent tax on the affected companies. We divide the selected companies into two groups: a treatment group and a control group. This division will allow for a comparison of the differences in returns. By analyzing the results from both groups, we found that the tax announcement had a significant effect on the returns. The effect occurs immediately on the day of announcement. For the implementation day, our results implies that the market had already adjusted for the resource rent tax at the announcement day.

Our primary focus is the announcement and implementation of the resource rent tax in Norwegian Aquaculture. We do not aim to determine whether there are grounds for additional special taxes within the industry. Furthermore, our analysis depends on stock prices, and thus, only companies traded on the Oslo Stock Exchange or Euronext Growth Oslo are included. The thesis primarily focuses on the resource rent tax, without exploring other taxes the companies and owners face, as we assume that other taxes should already be reflected in the stock prices.

The thesis is structured as follows: Section 2 provides the background of salmon farming in Norway, as well as a description of important aspect from the government proposal. Section 3 contains a detailed description of the dataset utilized in the thesis. Section 4 presents the methodology employed, while section 5 provides the results, discussion, and limitations of the analysis. Finally, section 6 offers a summary of and concludes the thesis.

2 Background

Firstly, this section offers an overview of the salmon farming industry in Norway. Thereafter, we will present the resource rent tax briefly. Lastly, we will move on to presenting important aspects of The Norwegian Ministry of Finance's proposal to introduce resource rent tax in Norwegian aquaculture, as well as the response it has received from the industry.

2.1 Salmon Farming in Norway

With the long coastline, salmon farming in Norway holds a rich history. Since the operations started in the late 1960s, with net cages placed in the fjords by the farmers (Olaussen, 2018, p. 158), the industry has had a substantial growth and has become one of Norway's most important export sectors (Hersoug, 2021). Today, Norway is the global leading producer of salmon (Greaker et al., 2020; Luthman et al., 2019).

Establishing a fish farm in Norway requires two licenses: a production license, and a site license (Hersoug, 2021, p. 6). These licenses keep the production limited, which in turn increase prices and profitability. Over the past decade the stock market for salmon farming has experienced significant volatility (Asche et al., 2019). The growth in the industry stagnated from 2012, but their margins kept increasing (Misund & Nygård, 2018, pp. 247–256). This might have been a result of the governmental and environmental regulations that prevented an increase in production (Bjørndal & Tusvik, 2019, p. 451).

The original salmon pens have undergone a remarkable transformation, not only in terms of their size, but also their functionality. They are now designed to withstand harsh weather conditions (Afewerki et al., 2023, p. 761). There are, however, some challenges within the industry. Disease outbreaks, such as sea lice, and escapes from fish farms, are potential threats to the wild salmon in Norway (Forseth et al., 2017). To meet these challenges, and become more sustainable, the industry is developing new technology, such as land-based recycling aquaculture systems (Afewerki et al., 2023, p. 762). The development of land-based farming is driven by both environmental and market conditions. However, current estimates indicate that the cost of production for land-based farming is expected to be higher compared to the cost of fish pens (Bjørndal & Tusvik, 2019).

2.2 Resource Rent Tax

Resource rent tax, a form of property tax, is collected by the state to ensure that the Norwegian society will receive a share of profits generated from utilizing our scarce, national resources. The excess returns gained by accessing such resources, form the basis of the resource rent tax. By taxing the excess returns, the tax will not affect the company's normal returns (Finansdepartementet, 2023). Resource rent tax has earlier been implemented in both the petroleum and the hydropower industry (Thomassen et al., 2023). For hydropower it was introduced in 1997, and in 2021 the government changed the tax model to a cash-flow-based resource rent tax (*Vannkraft*, n.d.). This cash-flow-based model forms the basis of the proposal of resource rent tax in aquaculture. Note, however, that land-based farms are not subject to the special tax (Finansdepartementet, 2022).

2.2.1 Resource Rent Tax in Norwegian Aquaculture

The discussion of taxation of aquaculture has been going on for several years, with a variety of proposals and changes being made to the tax policy. In September 2018 the government appointed a committee to assess the possibilities of taxation in Norwegian aquaculture. The committee handed over the report to The Ministry of Finance in November 2019, and the majority recommended introducing a resource rent tax at the rate of 40% (NOU 2019: 18, p. 17). This was met by protests both from the industry and other political parties. Arguments suggested that implementing a resource rent tax would affect future investments in sustainable solutions within the industry (Misund, et al., 2020, p. 11). This in turn led the government to introduce a production tax instead, that would benefit the host municipalities. This tax was implemented as of January 2021 (Meld. St. 2 (2019-2020), pp. 73–74).

On September 28, 2022, the government again proposed to introduce resource rent tax on aquaculture. The original proposal stated that the tax rate would be 40%, and that the price of salmon would be a standard price set by Nasdaq. Given the lack of price information on the exchange for both trout and rainbow trout, the government suggested that these prices would be based on the actual prices (Finansdepartementet, 2022). As a price set by Nasdaq could lead to some companies paying over 100% in total taxes (Sinkaberg Hansen AS, 2023; Sjømat Norge, 2023), the government announced that for 2023, companies would set the price themselves, and that they aim to establish an independent price board from 2024

(Finansdepartementet, 2023). This announcement, however, came at the end of March 2023, and up until this point the lack of information increased the uncertainty within the industry and for the host municipalities. Both industry and host municipalities has argued that the uncertainty has been hard to deal with, causing investments exceeding 35 billion NOK to be put on hold (NFKK, 2022). Additionally, they have expressed that the introduction of the resource rent tax has been rushed, and that the government does not fully realize how it will affect the industry both in the short and long term. Common arguments are that models used in other sectors, such as hydropower or petroleum, does not translate well into the aquaculture industry, due to the long value chain (Lerøy Seafood Group, 2023; Mowi ASA, 2022).

As the government announced the proposed resource rent tax, they also stated that there would be a standard deduction level to shield the smallest companies from paying the special tax (Finansdepartementet, 2022). However, calculations have shown that the deduction level has been set too low, resulting in most companies within the salmon, trout and rainbow trout production having to pay the tax (NFKK, 2022). As this was addressed in the open consultations, the amount was adjusted. The industry, however, argued that the increase would not be sufficient to shield the smaller private companies. The intention behind the deduction level was to shield about 70% of the industry from paying the resource rent tax. Yet, calculations indicate that well beyond 30% of the industry will pay the tax (Sjømat Norge, 2023).

In the proposal from September the government suggested a tax rate of 40%. The industry argued that the rate was set unreasonably high, and that the total tax burden of the resource rent tax, in addition to the corporate tax of 22%, would result in Norway having the highest tax level compared to their most important competitors (Grieg Seafood ASA, 2023; Sjømat Norge, 2023). In March the government proposed to reduce the tax to 35% (Finansdepartementet, 2023). Moreover, in May, the tax reduction was further adjusted to 25% before being adopted by the *Storting*. The voting result, which had 93 in favor of the proposition, and 76 against it, indicate that is was not a broad settlement, which increases the likelihood of future adjustments to the tax policy (Brennmoen, 2023).

3 Data

This section describes the collection and processing of data. The sample period spans from August 2, 2022, to February 1, 2023, and the daily returns for each of the companies were imported directly from Yahoo Finance into R studio. Next, we present selection criteria for companies included in our analysis, descriptive statistics of their respective daily returns, and how we used the daily returns to calculate cumulative return, abnormal return, and cumulative abnormal return.

3.1 Selection Criteria

To investigate the impact of the resource rent tax announcement and implementation on Norwegian aquaculture, we employ the difference-in-differences approach. This methodology requires us to categorize companies into either a treatment group or a control group.

As there is a very limited number of salmon farming companies listed on the Oslo Stock Exchange, we also include three companies listed on Euronext Growth Oslo, as they match our other criteria. These companies are all within the control group. Furthermore, we exclude companies that do not produce salmon, as well as those primarily engaged in land-based farming, as they differ from our treatment group. Moreover, companies without any salmon production as of January 2022, are not included in this analysis. Finally, Austevoll Seafood ASA was excluded from the study due to its majority ownership of Lerøy Seafood Group, which is already included in the analysis (Austevoll Seafood ASA, 2022). After applying the selection criteria, our sample is limited to eight salmon producing companies.

3.2 Companies

Our treatment group consist of four large Norwegian companies that will be affected by the newly implemented resource rent tax in Norway. These companies are Mowi, Salmar, Lerøy Seafood Group and Grieg Seafood. They are all well known within the industry, and among the leading producers of salmon in the world.

The control group consist of companies operating outside of Norway and should therefore be unaffected by the implementation of the resource rent tax in Norwegian aquaculture. The included companies are Bakkafrost, Ice Fish Farm, Icelandic Salmon and Arctic Fish Holding. Bakkafrost is the leading producer of salmon in the Faroe Islands, and is the only company within our control group listed on the Oslo Stock Exchange (Bakkafrost, 2022). Both Ice Fish Farm and Icelandic Salmon are holding companies. Ice Fish Farm is one of the leading salmon farmers in Iceland, while Icelandic Salmon holds exclusive ownership of Arnarlax, the largest farmer and producer of salmon in Iceland (Ice Fish Farm AS, 2022; Icelandic Salmon, 2022). Arctic Fish Holding is the sole owner of Arctic Fish, which is one of the leading salmon farmers in Iceland (Arctic Fish, 2021). It is worth mentioning that Salmar owns the majority stake in Icelandic Salmon, and Mowi has the majority stake in Arctic fish (Mowi, 2022; SalMar, 2022).

3.3 Descriptive Statistics

Table 1 presents an overview and descriptive statistics for the companies included in our thesis. As shown in the table below, *TREAT* is equal to *1* if the company belongs in the treatment group, and *0* if the company is in the control group.

Table 1: Descriptive Statistics of the Returns of the Companies. The sample period covers August 2, 2022, to February 1, 2023.

NAME	TICKER	TREAT	N	MIN	MEDIAN	MEAN	SD	MAX	SKEW	KURT
Grieg Seafood ASA	GSF.OL	1	131	-0.267	-0.003	-0.003	0.034	0.070	-3.447	25.873
Lerøy Seafood Group ASA	LSG.OL	1	131	-0.275	-0.002	-0.001	0.033	0.106	-3.845	31.886
Mowi ASA	MOWI.OL	1	131	-0.189	-0.001	-0.001	0.024	0.049	-3.560	27.999
SalMar ASA	SALM.OL	1	131	-0.303	-0.008	-0.002	0.036	0.096	-4.155	34.328
Artic Fish Holding AS	AFISH.OL	0	131	-0.092	-0.004	-0.001	0.047	0.253	1.843	7.816
Ice Fish Farm AS	IFISH.OL	0	131	-0.117	-0.006	-0.001	0.050	0.128	0.355	-0.035
Icelandic Salmon	ISLAX.OL	0	131	-0.066	-0.001	-0.001	0.031	0.114	0.634	1.431
P/F Bakkafrost	BAKKA.OL	0	131	-0.128	-0.001	-0.001	0.025	0.086	-0.799	5.328

After choosing the companies and the length of the sample period, we are left with a total of 1048 observations (131 observations for each of the eight companies) in Table 1. The spread between minimum and maximum shows that the treatment group fell more than the control group in the sample period. The median, mean, and standard deviation (SD) for both groups shows similar values. The skewness (SKEW) for the treatment group is negative and high compared to the control group. As for the kurtosis (KURT), the treatment group have relatively high values here as well. These findings indicate that there are more extreme and negative returns found within the treatment group, indicating that the tax announcement had an effect. However, this is just an initial observation based on the descriptive statistics. In section 5, we will further analyze the treatment effect by applying difference-in-differences regression models.

3.4 Cumulative Return

We calculate the cumulative return for the companies individually over the sample period, as shown in Figure 1. The equation to calculate cumulative returns is composed as follows:

$$Rc_{i,t} = (P_{i,t} / P_{i,0}) - 1 \tag{1}$$

Where $Rc_{i,t}$ is the cumulative return of company i at time t. The subscript, i, denotes different companies and t is indexing time (trading days). The variable $P_{i,t}$ represents the price of company i at day t. Finally, $P_{i,0}$, represents the price of company i at time 0, the starting point of the time period in which we are calculating the cumulative returns.

Figure 1 presents the plot of the cumulative returns for each company in our thesis based on Equation (1). The companies are separated into treatment and control groups. The x-axis represents the date, ranging from August 2, 2022, to February 1, 2023, while the y-axis shows the cumulative return. Each line represents a different company, and the two vertical dashed lines indicate the date of the tax announcement, in red, and the date of tax implementation, in purple.

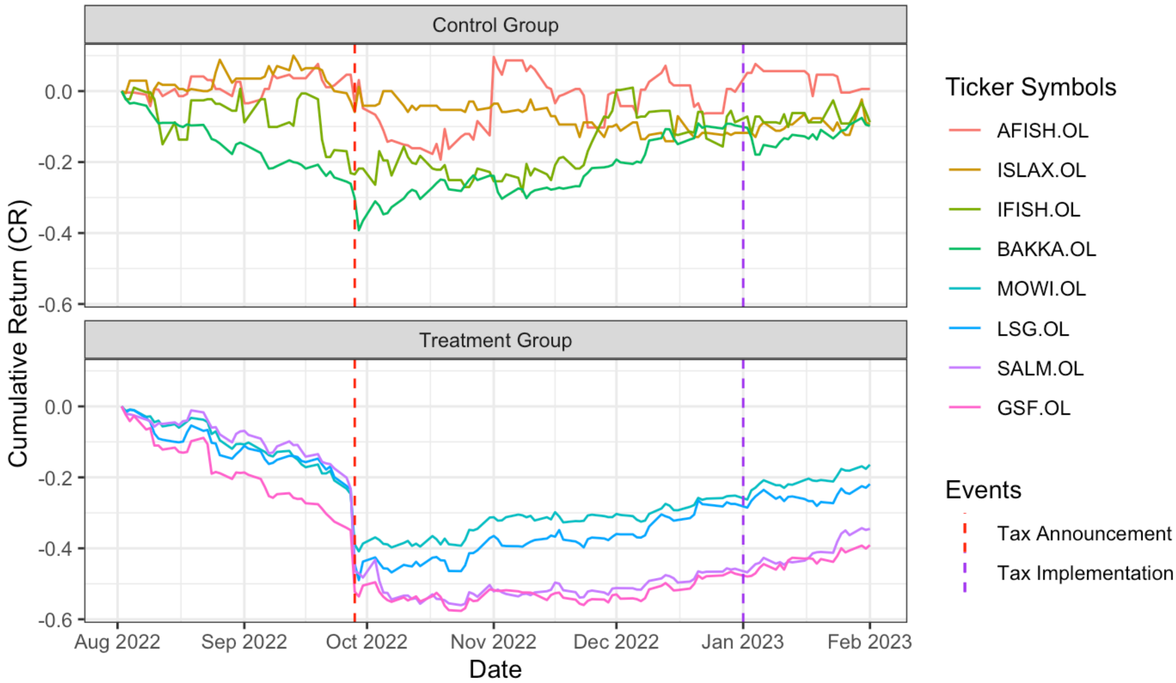

Figure 1: Plot of Cumulative Returns for Treatment and Control Groups

Figure 1 shows a downward trend, indicating that the market is on a decline prior to the announcement. However, it is observable that the market shows a negative reaction on the announcement day in the lower panel. In the upper panel, the control companies appear to be affected much less. Additionally, there are signs of recovery for cumulative returns in most companies after the announcement date. To further study the effect of the tax announcement on the returns of the companies, we calculate the abnormal return and cumulative abnormal return in the following sections.

3.5 Abnormal Return

The abnormal return is calculated by taking the actual return minus the expected returns. The equation is composed as follows:

$$AR_{i,t} = R_{i,t} - E\left(R_{i,t}\right) \tag{2}$$

Where $AR_{i,t}$ represents the abnormal return for company i in our sample period t. $R_{i,t}$ is the actual return and $E(R_{i,t})$ is the expected return. The equation for expected return is as following:

$$E\left(R_{i,t}\right) = \alpha + \beta R_{m,t} \tag{3}$$

Where $E(R_{i,t})$ represents the expected return for company i in our sample period t, $R_{m,t}$ is the market return, and α and β are estimated from the Capital Asset Pricing Model. The prices for the stock market were extracted directly from Yahoo Finance in R Studio using Oslo Børs All Share Index as the benchmark.

3.6 Cumulative Abnormal Return

The cumulative abnormal return is the sum of abnormal returns over the whole sample period (from τ_1 to τ_2). Thus, we can show the effect of the tax announcement over a longer period (MacKinlay, 1997). We use the abnormal return from Equation (2) to calculate the cumulative abnormal return. Hence, the cumulative abnormal return can be composed by the following equation:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i,\tau} \tag{4}$$

Figure 2 presents the plot for cumulative abnormal return based on Equation (4). We have kept everything the same, from the sample period to the plot design, for consistency throughout our thesis. The difference is the Y-axis of Figure 2 that presents the cumulative abnormal return for the selected companies in our thesis.

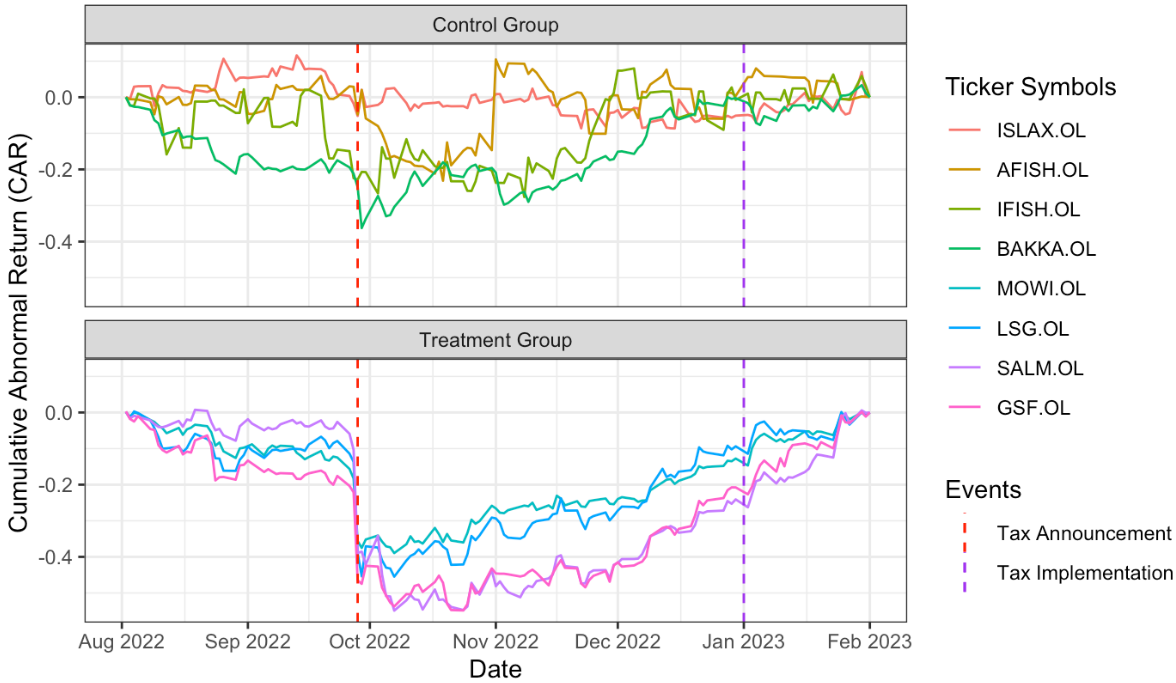

Figure 2: Plot of Cumulative Abnormal Returns for Treatment and Control Groups

The treatment group in the lower panel of Figure 1 shows a downward trend prior to the announcement day. This downward trend is caused by the general market movement. Whereas in Figure 2, we look at the abnormal returns instead of return. There is not a downward trend in the lower panel for the treatment group up until right before the announcement day. On the day of announcement both figures show a sharp decline in the companies within the treatment group. There is also a small decrease on the day of implementation, however, this indicate that the greatest impact was on the announcement day for the treated companies. The companies within the control group show a milder reaction on the announcement and implementation day. Overall, Figure 1 and Figure 2 are showing similar trends, in both panels.

3.7 Diagnosis Checks

We performed diagnosis checks for both regression models in Table 2 and Table 3, to see whether there is evidence of autocorrelation or heteroskedasticity when running our regression models. The test in our thesis checks for heteroskedasticity using the Breusch-Pagan (BP) test, and for autocorrelation the Durbin-Watson (DW) test is used (Evans, 1992). The BP test indicates that there is heteroskedasticity present in both models. Similarly, the DW test also suggests that there is evidence of autocorrelation. Hence, we correct for these by following the methodology of White (1980) to calculate the robust standard errors, in which the standard errors adjust the model to account for heteroskedasticity and autocorrelation in our regression models.

4 Methodology

In this section we present the methodology and models applied in order to investigate the causal effect of the tax announcement on affected companies in our analysis. To address our research question, two potential methodologies were considered: the event study and the difference-in-differences approach. The event study usually applies the market index as the benchmark in an analysis (MacKinlay, 1997). Therefore, we did not pursue this method as it would not be suitable for our thesis because it may not fully capture how salmon farming companies could be influenced by other factors, e.g., the salmon price. Given this limitation, we chose to go forward with the difference-in-differences approach.

4. 1 Difference-in-Differences

The difference-in-differences approach is a commonly known econometrics technique, used to estimate the impact of policy changes by comparing a group who are affected by the change (treatment group), with a group who are not (control group) (Fredriksson & Oliveira, 2019; Lechner, 2011). The approach is a suitable method for our thesis as we have a treatment group that are affected by the resource rent tax in Norway, and a control group that are unaffected by this tax. We apply the difference-in-differences approach to measure the impact that the announcement and implementation day had on the companies in our thesis. Our regression models in section 5.1 are composed by the following equation:

$$Y_{i,t} = \alpha + \beta_1 * Treat_i + \delta_0 * Announcement_t + \delta_1 * Treat_i * Announcement_t + u_{i,t} \qquad (5)$$

Where $Y_{i,t}$ is the dependent variable that represents the returns of the companies in our thesis. $Treat_i$ and $Announcement_t$ are dummy variables that have values equal to *1* or *0*. $Treat_i$ is equal to *1* for companies within the treatment group, and equal to *0* for companies in the control group. For $Announcement_t$ we have defined two event windows, one is the announcement day, and the other is the announcement day plus the following trading day. A regression is run for each event window. The event windows will have a value equal to *1*, while all other dates are equal to *0*. The interaction term, $Treat_i * Announcement_t$, shows the difference in returns for the treatment group relative to the control group, as it captures the causal effect of the treatment.

Our regression models in section 5.2 are constructed as shown in Equation (6):

$$Y_{i,t} = \alpha + \beta_1 * Treat_i + \delta_0 * Implementation_t + \delta_1 * Treat_i * Implementation_t + u_{i,t} \qquad (6)$$

The difference between Equation (5) and Equation (6) is that $Announcement_t$ has been changed to $Implementation_t$ as we there investigate the impact of the implementation day. In both cases, we consider two event windows. To capture the impact of the resource rent tax the first window only includes the relevant (announcement/implementation) day, and the second window includes the relevant day plus the following trading day.

5 Results

In this section, we present our findings from the difference-in-differences regression models. First, we present the results for the regression models that investigates the effect of resource rent tax on announcement day. Second, we present the results for the regressions models that investigates the day when the tax came into effect. We then proceed with a discussion of our findings, before we present the limitations of our thesis.

5.1 Regression Results for the Announcement Day

Table 2 presents two regression models. The main difference lies in the variable $Announcement_t$. In regression (0), the variable $Announcement_t$ is equal to *1* for only the announcement day. Similarly, in regression (0,1), the variable $Announcement_t$ is equal to *1* for announcement day and the following trading day. For all other trading days in our sample period, the $Announcement_t$ is equal to *0*. The regressions are defined this way to investigate the effect of the announcement day and its immediate aftermath. We will in the following paragraphs present and discuss the results of our regression models in Table 2.

Table 2: Difference-in-Differences Model for Returns on Announcement Day with Robust Standard Errors

	Dependent variable: Returns ($Y_{i,t}$)	
	(0)	(1)
$Treat_i$	-0.0002	0.0001
	(0.002)	(0.002)
$Announcement_t$	-0.042^{***}	-0.017
	(0.014)	(0.023)
$Treat_i$ * $Announcement_t$	-0.216^{***}	-0.132^{***}
	(0.025)	(0.047)
Constant (α)	0.0004	0.0003
	(0.001)	(0.001)
Observations	1048	1048
R^2	0.241	0.156
Adjusted R^2	0.239	0.154
Residual Std. Error (df = 906)	0.029	0.030
F Statistic (df = 3; 906)	110.782^{***}	64.386^{***}
Note:		*p<0.1; **p<0.05; ***p<0.01

The subscripts "i" and "t" denote the company and time index.

In Table 2, regression (0), we investigate the effect of the announcement day. The coefficient of the *$Announcement_t$* variable is negative (statistically significant at the 1% level) and shows negative daily return by an estimated 4.2% on the announcement day. This implies that the daily returns for the control group was on average -4.2% on the announcement day. Thus, the news revolving the resource rent tax may have influenced the market and made a negative impact on the Norwegian industry's return, because of the uncertainty around the tax.

Our variable of interest *$Treat_i$ * $Announcement_t$* (interaction term) in regression (0) measures the effect that the treatment had on the treatment group (relatively to control group) on the announcement day. We observe that the interaction term yields a negative return, as the treatment group's daily return is -21.6% relative to the control group, and is statistically significant at the 1% level. This implies that there is strong evidence that the resource rent tax announcement had a negative impact on the returns of the affected companies.

In regression (0,1), we investigate the announcement, assuming that announcement has impact on the announcement day and the following trading day. First of all, we observe that regression (0) has higher explanatory power than regression (0,1). Our independent variables explain an estimated 24.1% and 15.6% of the variance for the returns of the selected companies. Therefore, model specification (0) is more appropriate than specification (0,1). The interaction term, $Treat_i * Announcement_t$, is still significant at the 1% level. It yields a return 13.2% lower for the treatment group relative to the control group. The magnitude of the treatment effect is approximately twice as large when only considering the exact day of the tax announcement compared to adding another trading day to the regression. This implies that the most significant part of the effect occurs immediately and then diminishes. In Figure 1 and Figure 2, the greatest drop in returns is observable on the announcement day for the treated companies. Specification (0,1) spread the announcement effect over two days, and therefore the estimated impact per trading day is approximately one half.

Altogether, regressions (0) and (0,1), imply that the tax announcement had a significant effect on the returns. Moreover, specification (0) is more appropriate, and this is the specification we should focus on.

5.2 Regression Results for the Implementation Day

The resource rent tax was implemented as of January 1, 2023. As the first trading day on Oslo Børs All Share Index was January 2, we consider this as the implementation day in our regression analysis. In regression (0), in Table 3, the variable is equal to *1* for only the implementation day. Similarly, regression (0,1) is equal to *1* for implementation day and the following trading day. All other trading days in our sample period is equal to *0*.

Table 3: Difference-in-Differences Model for Returns on Implementation Day with Robust Standard Errors

	Dependent variable: Returns ($Y_{i,t}$)	
	(0)	(0, 1)
$Treat_i$	-0.002	-0.002
	(0.002)	(0.002)
$Implementation_t$	0.016	-0.002
	(0.012)	(0.010)
$Treat_i$ * $Implementation_t$	-0.030**	0.007
	(0.012)	(0.013)
Constant (α)	-0.0002	0.0002
	(0.001)	(0.001)
Observations	1048	1048
R^2	0.003	0.001
Adjusted R^2	-0.0003	-0.002
Residual Std. Error (df = 906)	0.033	0.033
F Statistic (df = 3; 906)	0.895	0.421
Note:		*p<0.1; **p<0.05; ***p<0.01

The subscripts "i" and "t" denote the company and time index.

The regression models for the implementation day utilize Equation (6). The interaction term, $Treat_i$ * $Implementation_t$ is statistically significant at the 5% level in regression (0). There is a minor decrease observed, this is consistent with Figure 1 and Figure 2, which shows a small decline at the implementation date. The effect found on the announcement day is economically very small and indicates that the market already mostly adjusted for the resource rent tax at the announcement day, as shown in Figure 1 and Figure 2. This result is consistent with the efficient market hypothesis, where only new information will move stock prices (Fama, 1970).

5.3 Implications of the Resource Rent Tax

The process around the implementation of the resource rent tax in Norwegian aquaculture can be characterized as an untidy process. Ever since the announcement, and up until the revised proposal was adopted by the *Storting* in May, the Norwegian salmon industry has been in a state of disarray. According to Misund et al. (2020), a resource rent tax in Norwegian aquaculture could lead to reduced investments within the industry. We observe that shortly after the government announcement in 2022, planned investments were put on hold, as a direct consequence of the proposal. According to our findings, there was a sudden decrease in stock prices of affected companies on the day of the announcement. This could imply that investors might look elsewhere for better investment opportunities. One might argue that a more thorough investigation before the announcement could have led to less uncertainty within the industry, and possibly prevented some of the investment being pulled or held back.

According to research by Misund & Nygård (2018), the industry's production growth had already begun to stagnate in 2012, despite an increase in margins. The license system in use prevents the industry's increase in production, even though their margins and the salmon price kept increasing (Hersoug, 2021; Misund & Nygård, 2018). This implies that there is a demand for an increase in production. Therefore, the focus towards a more sustainable way of producing salmon has been growing, especially focusing on building land-based farms. This, however, seems to be more expensive than investments in regular fish pens (Bjørndal & Tusvik, 2019). Land-based production will reduce disease outbreaks and escapes, which will be a step in the right direction regarding a more sustainable industry (Afewerki et al., 2023). Considering that land-based farms are currently exempt from the resource rent tax, one should expect companies to invest more into this segment. Yet, several companies have announced that investments are being put on hold because of the resource rent tax (NFKK, 2022). This indicate that they fear that land-based salmon farming will be subject to the resource rent tax in the future. A potential outcome of the implementation of the special tax could be that larger companies move their production abroad, instead of investing in sustainable solutions in Norway. However, the resource rent tax should not affect the companies' normal returns, therefore all projects yielding a positive net present value before the implementation, should still be a positive investment (Finansdepartementet, 2023).

As the implementation of the resource rent tax has been on-going up until May 2023, our research offers insight to a broader context in the existing research. Our analysis shows that the treatment effect is statistically significant, and we can be confident that there is a relationship between the variable it represents and our dependent variable. As some salmon farming companies have large profit margins and can handle the impact and losses in short-term, it might not be the same case for smaller companies. Especially if the effect is sustained over a longer period. This could lead to compulsory sales of smaller companies to larger corporations, resulting in even higher market shares. To avoid protests and uncertainty, a more thorough investigation should be in place before announcing a special tax that potentially can have a major impact on an industry. Moreover, as the Norwegian salmon industry is facing a lot more taxes than competitors in other countries, one could risk that large companies move their production out of Norway. However, as the tax rate has been adjusted downward from 40% to 25%, it could potentially encourage investors continued engagement.

Although our results shows that Norwegian salmon farming companies are on the rise, the affected companies have not yet completely recovered to where they were before the announcement. The tax rate is set at 25%, but as it was not a broad coalition among the political parties, the special tax is potentially subject to modifications in the future.

5.4 Limitations

A limitation of this study is the small sample size. Furthermore, it should be noted that three out of four companies within the control group are holding companies. Since many salmon producing companies remain private, the number of listed salmon producers on the Oslo Stock Exchange is relatively small. Additionally, to employ the difference-in-differences approach, it was necessary to include companies beyond those directly impacted by the resource rent tax. Therefore, we included salmon farming companies listed on the Euronext Growth Oslo in our control group. As companies on different exchanges are subject to different rules and regulations, companies on the Oslo Stock Exchange and Euronext Growth Oslo might not react the same to news and policy changes (Abrahamsen & Sveen, 2023).

Moreover, it is important to acknowledge that the companies in our control group may have been influenced by other domestic factors during the sample period, potentially impacting our findings. Additionally, the fact that both Mowi and Salmar holds the majority stake in two of our control group companies, could influence our results. A parent company and their subsidiary could lead to a biased result, as the decisions made by parent companies might influence the subsidiary. However, our control companies did not seem to react to the resource rent tax the same way the parent companies did, as shown in Figure 1 and Figure 2.

6 Conclusion

In September 2022 the government announced to implement a resource rent tax in Norwegian aquaculture as of January 2023. This caused the industry and coastal municipalities to protest, arguing that the proposal did not take the complexity within the industry into consideration. Furthermore, there has been an ongoing discussion regarding the tax rate, and the price of salmon, which has caused uncertainty and unpredictability within the industry.

In this thesis, we aimed to investigate the impact of the resource rent tax announcement and its implementation on Norwegian salmon farming companies. Our data sample consist of eight salmon producing companies, and our sample period spans from August 2, 2022, to February 1, 2023, covering both the day of announcement and implementation. The selected companies were divided into two groups, treatment group and control group. To measure whether the tax announcement and implementation had an effect on the returns of the treated companies, we applied a difference-in-differences approach.

According to our findings, the treatment group experienced a significant negative effect on their stock price due to the announcement of the resource rent tax during our sample period. Our analysis reveals that there was an estimated 21.6% decrease in stock price for the treatment group relative to the control group on the announcement day. On the other hand, we find weak or no effect (depending on the model specification) on the implementation day. This implies that the market already adjusted to the resource rent tax in the days following the announcement, which is in line with the efficient market hypothesis.

To conclude, our analysis provides clear evidence that the resource rent tax announcement caused an immediate reaction in the market for the affected companies on the announcement day. However, as our study only captures the immediate effects, we do not have enough evidence or data to conclude about the long-term effects caused by the implementation. Therefore, we leave it to future research to investigate the long-term impact of the resource rent tax in Norwegian aquaculture.

References

Abrahamsen, T., & Sveen, L. M. (2023, January 5). *What you should know about a Euronext Growth Oslo listing*. Thommessen. https://www.thommessen.no/en/news/euronext-growth

Afewerki, S., Asche, F., Misund, B., Thorvaldsen, T., & Tveteras, R. (2023). Innovation in the Norwegian aquaculture industry. *Reviews in Aquaculture*, *15*(2), 759–771. https://doi.org/10.1111/raq.12755

Arctic Fish. (2021). *Annual Report 2021*. https://www.arcticfish.is/wp-content/uploads/bsk-pdf-manager/2022/05/Arctic-Fish-Annual-Report-2021.pdf

Asche, F., Misund, B., & Oglend, A. (2019). The Case and Cause of Salmon Price Volatility. *Marine Resource Economics*, *34*(1), 23–38. https://doi.org/10.1086/701195

Austevoll Seafood ASA. (2022). *Annual Report 2022*. https://www.auss.no/media/1494/annual-report-2022-austevoll-seafood-asa.pdf

Bakkafrost. (2022). *Annual Report 2022*. https://bakkafrost.cdn.fo/media/4112/bakkafrost-annual-report-2022.pdf?s=lM_iy_XuFLhBZnZ9GFwHKpPZYcc

Bjørndal, T., & Tusvik, A. (2019). Economic analysis of land based farming of salmon. *Aquaculture Economics & Management*, *23*(4), 449–475. https://doi.org/10.1080/13657305.2019.1654558

Brennmoen, M. (2023, May 31). Lakseskatten er vedtatt. *Finansavisen*. https://www.finansavisen.no/sjomat/2023/05/31/8012438/lakseskatten-er-vedtatt

Evans, M. (1992). Robustness of size of tests of autocorrelation and heteroscedasticity to nonnormality. *Journal of Econometrics*, *51*(1), 7–24. https://doi.org/10.1016/0304-4076(92)90027-O

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 383–417. JSTOR. https://doi.org/10.2307/2325486

Finansdepartementet. (2022). *Høringsnotat—Grunnrenteskatt på havbruk*. https://www.regjeringen.no/contentassets/dfe403fd8a8b4d40af2165583e25c747/horingsnotat-grunnrenteskatt-pa-havbruk.pdf

Finansdepartementet. (2023, March 28). *Regjeringens forslag om grunnrenteskatt på havbruk*. Regjeringen. https://www.regjeringen.no/no/aktuelt/regjeringens-forslag-om-grunnrenteskatt-pa-havbruk/id2968430/

Forseth, T., Barlaup, B. T., Finstad, B., Fiske, P., Gjøsæter, H., Falkegård, M., Hindar, A., Mo, T. A., Rikardsen, A. H., Thorstad, E. B., Vøllestad, L. A., & Wennevik, V.

(2017). The major threats to Atlantic salmon in Norway. *ICES Journal of Marine Science*, *74*(6), 1496–1513. https://doi.org/10.1093/icesjms/fsx020

Fredriksson, A., & Oliveira, G. M. de. (2019). Impact evaluation using Difference-in-Differences. *RAUSP Management Journal*, *54*(4), 519–532. https://doi.org/10.1108/RAUSP-05-2019-0112

Greaker, M., Vormedal, I., & Rosendal, K. (2020). Environmental policy and innovation in Norwegian fish farming: Resolving the sea lice problem? *Marine Policy*, *117*, 103942. https://doi.org/10.1016/j.marpol.2020.103942

Grieg Seafood ASA. (2023). *Høringssvar grunnrenteskatt på havbruk fra Grieg Seafood ASA*. https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=f0e0baf4-df67-4a5a-adac-b6859fae1b1f

Hersoug, B. (2021). Why and how to regulate Norwegian salmon production? – The history of Maximum Allowable Biomass (MAB). *Aquaculture*, *545*, 737144. https://doi.org/10.1016/j.aquaculture.2021.737144

Ice Fish Farm AS. (2022). *Ice Fish Farm Annual Report 2022 Consolidated financial statements for the year 2022*. https://assets.website-files.com/5ef0d4f070e13ebc659f3bd7/646dcd6910c8367f06029ede_Ice%20Fish%20Farm%20Annual%20Report%202022.pdf

Icelandic Salmon. (2022). *Consolidated Annual Report 2022*. https://arnarlax.is/wp-content/uploads/Arnarlax-Annual-report-2022.pdf

Lechner, M. (2011). The estimation of causal effects by difference-in-difference methods. *Foundations and Trends® in Econometrics*, *4*(3), 165–224. http://dx.doi.org/10.1561/0800000014

Lerøy Seafood Group. (2023). *Høringssvar—Grunnrenteskatt på havbruk*. https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=b91b74af-6c77-4f5c-8917-0727ca0a28f8

Luthman, O., Jonell, M., & Troell, M. (2019). Governing the salmon farming industry: Comparison between national regulations and the ASC salmon standard. *Marine Policy*, *106*, 103534. https://doi.org/10.1016/j.marpol.2019.103534

MacKinlay, A. C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature*, *35*(1), 13–39. http://www.jstor.org/stable/2729691

Meld. St. 2 (2019-2020). *Revidert nasjonalbudsjett 2020*. Finansdepartementet. https://www.regjeringen.no/contentassets/f7f31a9baf3e49c1ad1fa72da5585003/no/pdfs/stm201920200002000dddpdfs.pdf

Misund, B., & Nygård, R. (2018). Big Fish: Valuation of the World's Largest Salmon Farming Companies. *Marine Resource Economics*, *33*(3), 245–261. https://doi.org/10.1086/698447

Misund, B., Osmundsen, P., Tveterås, R., Folkvord, B., Nystøyl, R., & Rolland, K. H. (2020). *Grunnrenteskatt i havbruk – Et kunnskapsgrunnlag Faglig sluttrapport*. UiS Scholarly Publishing Services. https://doi.org/10.31265/usps.46

Mowi. (2022). *Integrated Annual Report 2022*. https://mowi.com/wp-content/uploads/2023/03/Mowi-Integrated-Annual-Report-2022.pdf

Mowi ASA. (2022). *Mowi—Høringssvar grunnrenteskatt på havbruk*. https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=edea837c-f167-4a05-a6db-2fa6fce4d510

NFKK. (2022). *Høringsuttalelse fra Nettverk Fjord- og Kystkommuner—Grunnrenteskatt på havbruk [Høringssvar]*. https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=f8235510-c400-4239-8960-a0de409a45df

NOU 2019: 18. (2019). *Skattlegging av havbruksvirksomhet*. Finansdepartementet. https://www.regjeringen.no/no/dokumenter/nou-2019-18/id2676239/

Olaussen, J. O. (2018). Environmental problems and regulation in the aquaculture industry. Insights from Norway. *Marine Policy*, *98*, 158–163. https://doi.org/10.1016/j.marpol.2018.08.005

Prop. 1 LS (2022-2023). *For budsjettåret 2023—Skatter, avgifter og toll 2023* (pp. 128–131). Finansdepartementet. https://www.regjeringen.no/no/dokumenter/prop.-1-ls-20222023/id2931482/

SalMar. (2022). *Annual Report 2022*. https://ml-eu.globenewswire.com/Resource/Download/a1b33242-6c5a-4ebf-96d6-e6870f9d8994

Sinkaberg Hansen AS. (2023). *Høringssvar—Grunnrenteskatt på havbruk*. https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=18359b1f-e9d8-490e-9a3a-0053230f5f0e

Sjømat Norge. (2023). *Høringssvar – Høringsnotat grunnrenteskatt på havbruk*. https://www.regjeringen.no/no/dokumenter/horing-grunnrenteskatt-pa-havbruk/id2929159/?uid=b9cf981f-4106-4f3d-b04f-254c53a39706

Thomassen, E., Semet, T., & Gran, T. (2023). Grunnrente. In *Store norske leksikon*. https://snl.no/grunnrente

Vannkraft. (n.d.). Skatteetaten. Retrieved May 13, 2023, from https://www.skatteetaten.no/bedrift-og-organisasjon/rapportering-og-bransjer/bransjer-med-egne-regler/vannkraft/#naermere-om-grunnrenteskatten

White, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica*, *48*(4), 817–838. https://doi.org/10.2307/1912934