University of Stavanger

Faculty of Science and Technology

MASTER'S THESIS

Study program/Specialization: Industrial Economics and Technology Management w/ specialization in Project Management	**Autumn semester, 2020** **Open**
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Thesis title: Development of resource rent in Norwegian pelagic and coastal fisheries	
Credits (ECTS): 30	
Key words: - Norwegian fisheries - Pelagic fisheries - Coastal fisheries - Wage Determination System - Resource Rent (RR) - The WACC method - The ROC method	Pages: 39 + enclosure: 0 Stavanger, 10/12/2020

Development of resource rent in Norwegian pelagic and coastal fisheries

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December 10, 2020
Version: Master's Thesis

Abstract

This thesis investigates the development of the resource rent in the pelagic and coastal fisheries in Norway from 2003 to 2018. Two methods are presented in this thesis, but only one of them is used to calculate the resource rent. The first method is based on the weighted average cost of capital of the Norwegian fishing industry, and the second method is based on comparing the return of the capital of fisheries to the general aggregate Norwegian economy. We have mainly focused on the second method. The calculations and results indicate that no resource rent was present until 2008 for pelagic fisheries and 2014 for coastal fisheries. Since that time, the resource rent for the pelagic and coastal fisheries has been, on average, 31.5% and 1.7% of the export value of the fishing industry, respectively. There are several reasons behind this delay for the resource rent to appear, one such reason is the decline of fish catches from 2000 to 2008 and 2014. The industry was rationalizing during this period, and this rationalization led to the reduction of landings, and therefore, no resource rent was produced. Also, the number of fishers and fishing vessels has decreased over time. The resource rent does appear when catches increases in 2008 and 2014. In addition, one can also assume that the weakening of the Norwegian krone contributed to the emergence of resource after 2008 and 2014.

Acknowledgement

First of all, I would like to express my appreciation and thanks to my advisor Sigbjørn Landazuri Tveteraas who has been a tremendous mentor for me. I would like to thank you for motivating and encouraging me to complete this master's thesis. I have been extremely lucky to have a supervisor who cared so much about my work, and who responded to my questions so promptly. You were always available and ready to help when needed and I appreciate that a lot. This thesis would not have been completed without you and again, thank you very much for the supervision.

Secondly, I would like to thank my family and my friends. Thanks for encouraging me and inspiring me to follow my dreams and to complete my master's degree in Industrial Economics and Technology Management. I am especially grateful to my parents for their support and for putting me through school, and believing that I could get through this. They have gone through a lot, just to make sure that me and my siblings have the opportunity to have a better future. I could not have done it if it weren't for them.

I am also grateful to the University of Stavanger and the Faculty of Science and Technology for making it possible for me to study here and to finish my bachelor's degree in Petroleum Engineering and master's degree in Industrial Economics and Technology Management.

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Introduction

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In fisheries the presence of resource rent is an indicator of how well the marine resources are managed (Flaaten, Heen Matthiasson, 2017). For countries like Norway that rely on fisheries to generate economic benefits both in terms of revenues and for employment, the measurement of resource rent is important. This thesis analyzes this issue by estimating how resource rent has developed both for the coastal and pelagic fisheries. Moreover, the thesis looks to what degree employed fishers benefit from any resource rent that is present in the fisheries. [1]

The fishing industry in Norway has played an important role in the nation's economy. In 1835, sale of fresh and processed fish accounted for 39% of the export revenue, while the shipping services accounted for 25%. In 1966, the shipping industry represented around 40% of Norway's export revenues, but fisheries were also a significant contributor; around 5% of the export revenue came from fish and processed fish. Later, the oil and gas industry became the main exporter. Currently, Norway is one of the largest exporter of fish and seafood with an export value around 94.5 billion NOK in 2017. This is the highest export value ever seen in the industry and accounts for 7.9% of the export revenue, while petroleum accounts for 38.5%. [2]

Fisheries and aquaculture have always been regulated by the government. The fisheries are very important for the Norwegian economy, where the importance of it is reflected in the fact that Norway was the first country ever to establish a separate Ministry of Fisheries. The seafood industry is important for public authorities because it generates export revenue and creates value and employment in coastal areas. [2]

It is expected that the Norwegian seafood industry can further increase its contribution to the national economy. It is suggested that there are high expectations and potential for the industry to increase in volume and better utilize raw materials (circular economy). [2]

The management of fisheries in Norway has evolved over decades. The management regime is complex and consists of several instruments including annual total allowable quotas (TACs) and restrictions on access to the different fisheries. There are several differences in the management regimes, depending on the species and vessel type, ranging from regulated open access to individual vessel quota (IVQ). [3]

After recommendations from the ICES, a TAC is established for the species targeted by the Norwegian fishing fleet. According to fixed shares, the quotas are allocated among nations involved for shared stocks. The *Norwegian quotas* are distributed as *group quotas* among three main segments of the fishing fleet (purse seiners, trawlers and coastal vessels). The group quotas are referred to as the total quantity all the vessels within a fleet segment are allowed to catch altogether. For the purse seiners, IVQs are allocated for all targeted species while for the trawler fleet, IVQs are allocated for demersal species. For pelagic species on the other hand, *maximum quotas* dominate. A maximum quota is referred to the maximum amount a vessel is allowed to harvest during a season or year. The fisherman is not guaranteed that he will be allowed to fish the whole quantity since the sum of maximum quota is greater than the group quota. This is referred to as the "*over-regulation*" of the fisheries. For the coastal fleet, the maximum quotas dominate with the exception of cod fishery by conventional vessels above 28 meters, these are allocated by individual quotas. [3]

The introduction of a management system, such as individual transferable quotas (ITQs), into a overcapitalized fishery, leads to a huge amount of efficiency gains according to economic theory [4, 5]. In several cases, profits increased and fleets got smaller as a result of the introduction of the individual transferable quotas (ITQs). Higher profits are the result of both higher revenue and lower cost, this is due to the fact that harvesters organize their fishing to obtain the highest value for their landings rather than maximizing catches [6, 7], while aiming to catch their quota with the lowest possible costs [8]. This system makes it easier to transfer quotas from less to more efficient firms, which eventually leads to the improvement of economic performance. [9]

The introduction of an ITQ system leads to the creation of resource rent (RR) over time [10], which is considered as a special kind of economic rent. The concept of economic rent refers to surpluses after all costs have been paid, including the necessary return on capital, both borrowed and owned [11]. RR comes from the use of natural resources and exists because of

Tab. 1.1: Number of licenses per type of fishing vessel. (Source: *The Norwegian Directorate of Fisheries*)

Year	Purse seiners	Cod trawlers	Shrimp trawlers	Pelagic trawlers
2000	97	101	108	-
2001	95	96	106	-
2002	95	102	112	58
2003	90	98	112	54
2004	89	91	111	52
2005	89	75	107	41
2006	85	61	95	40
2017	83	55	92	40
2018	80	43	81	36
2009	80	42	78	34
2010	80	41	75	33
2011	80	40	74	33
2012	80	38	71	32
2013	79	37	70	32
2014	79	37	70	28
2015	78	37	69	26
20116	78	37	66	25
2017	78	36	66	25
2018	77	36	66	24
2019	74	36	53	24

scarcity. Scarcity is excess demand that cannot be satisfied by the supply that depends on a scarce natural resource. All excess profits generated in industries that do not depend on scarce resources would attract new entrants, while the current producers would increase production if any excess profits were present. This would decrease prices and profits until an equilibrium is reached where profits are normal and similar to other industries. Conversely, profits would not evaporate in industries like fishing, oil and gold since these industries utilize scarce natural resources. [12]

The Norwegian government has promoted sustainability goals which has led to a long period of restructuring of the fishing fleet in the Norwegian fishing industry. These sustainability goals are linked to the sustainable stock management through harvesting rights, to local communities and to excess profits, referred to as the resource rent. Although the reduction in vessels and fishers may be harmful for some communities, it is also clear that fisheries that earlier relied on government subsidies are not sustainable. According to Asche et al. (2018), the three pillars of sustainability do reinforce each other, rather than being in conflict with each other. The question on how far the restructuring should go, Iversen et al. (2018) suggest two answers: [13, 14]

- The maximum restructuring in a manner that allows one to extract the most possible of the resource rent to the benefit of society
- The least possible restructuring, so that the industry through overcapacity contributes to employment in rural coastal societies and in a way that slows down the speed of transition and friction

However, due to technological changes during the last decades, the restructuring has been necessary. What the restructuring does, is that it allows fishers to transfer fishing quotas from two vessels over to one vessel. This reduces the capacity in fisheries, as well as leading to capitalization in the remaining vessels. According to Iversen et al. (2018), there has been a significant increase in investments in remaining vessels and this is bound to affect fishers' salary. [14]

We will look into why fishers' salary is influenced by capitalization. This is mainly because many fishers in Norway are self-employed where their salary is based on a revenue sharing system called the "lott" system. There is a possibility that fishers have a fixed income, but the "lott" is their main source of income. Therefore, the expected revenue and fishers' income should increase if vessels become more efficient in catching fish. This and other related factors that influence salary levels in fisheries will be discussed in detail.

Two different methods on calculating RR generated in fisheries will be presented in this thesis. The first method focuses on calculating the weighted average costs of capital (WACC) and the financial costs, then RR is defined as the sum of earnings before interest and taxes (EBIT) and fishing fees paid to the government, minus the calculated financial costs. There is no fishing fee in Norwegian fisheries, and therefore will be excluded from the equation. The second method compares the return of capital (ROC) in the fisheries and other industries, then RR is calculated based on that difference. Both methods will be explained in detail, but this thesis will mostly focus on the second method. The ROC method is applied only to the period 2003-2018 due to data limitations.

Norwegian fisheries

2

2.1 Background

Norway is a large fishing nation. We manage an ocean area that is 6-7 times larger than mainland Norway. This gives us great opportunities, but also a significant responsibility in relation to ensuring that fish stocks are managed sustainably. Many of the stocks are shared between Norway and other countries, and opportunities and responsibilities are therefore shared between the nations through annual agreements. [15]

About 93% of all fish, wild-caught and farmed, are exported to other countries. Norwegian seafood is sold to about 160 different countries, and with about 2000 different products, the industry has contributed to making Norway well known in the world. Fisheries and fish processing are a highly globalized industry. Norwegian products operate in fierce competition with seafood and other foods from other nations, and this competition is intensifying. [15]

This makes the Norwegian fishing industry exposed to competition, and strong political restrictions could reduce competitiveness. Trade conditions, developments in other countries' economies and an increasing need to document processes related to the practice of fishing and fisheries management are also key elements in the development of Norwegian seafood companies. [15]

In fisheries agreement negotiations with other countries, presence at sea is an important factor. This applies both to help Norway retain its administrative rights, and to be stronger in negotiating resource shares to Norway. In this way, the Norwegian fishing fleet also contributes to Norway strengthening its position in connection with interests other than fishing. [15]

The Norwegian fishing fleet is among the most modern and efficient in the world. The fleet is very varied, and consists of everything from small vessels under 10 m in length to factory trawlers and purse seine vessels over 90 m. The first-hand value of the catch in 2005 was about NOK 11.7 billion. The fishing vessels are in a mutually dependent relationship with the fishing industry and the other links in the value chain. Changes that facilitate capacity adjustment in the fleet link will therefore be important for operations throughout the value chain. Similarly, structural changes in the fishing industry could affect delivery opportunities, raw material utilization and price for the fishing vessels. [15]

The industry utilizes a renewable, biological resource and has strong elements of economic distribution between regions and individuals. The management of such a system requires very detailed and complex regulations. This complexity has increased in parallel with developments in the industry, and makes it difficult to implement changes in the regulatory system. [15]

2.2 Structure

The Norwegian fisheries can be divided into a pelagic and a demersal ocean fleet. The pelagic ocean fleet is mainly dominated by purse seine and pelagic trawls in terms of fishing quotas, and accounts for the largest catches by weight. This fleet targets herring, blue whiting, mackerel and other pelagic species. The demersal ocean fleet on the other hand, consists of coastal vessels that targets cod, haddoc, and saithe using purse seine, trawls and gillnets. Compared to the pelagic ocean fleet, the demersal fleet is mainly dominated by many small vessels. In the last decades, landings of pelagic species have varied. This is mainly due to the fluctuations in landing of herring and capelin. [16]

Tab. 2.1: Quantity of catches by catch species (tonnes). (Source: *Statistics Norway*)

	2016	2017	2018	2019
Pelagic fish	1 244 460	1 562 529	1 630 662	1 429 322
Cod and other cod fishes	892 116	894 697	861 329	798 693
Flatfish and other demersal fish	67 978	65 459	70 269	75 051
Cartilaginous fish	1 595	1 740	1 907	2 548
Shellfish, molluscs and echinoderms	245 372	237 600	262 063	293 153
Macroalgae (seaweed)	169 406	164 550	170 694	163 545

The different structure and types of vessels used in the two fisheries, does also have implications for the wage determination system. Both fisheries have a "lott" revenue-sharing system, and the way this is calculated differs between these two. This will be discussed later, first we will describe the fisheries and its structure. [17]

The Norwegian fishing fleet is diversified and technological advanced, consisting of everything from small one-man inshore vessels to large trawlers and purse seiners. As shown in Figure 2.1 below, the number of vessels in Norwegian fisheries has steadily declined over the years. From 2000 to 2009, the total number of fishing vessels decreased by 50%, where the largest reduction has been for the smallest vessels. The reduction of smaller coastal vessels is mainly due to the removal of inactive fishing vessels from the Register of Norwegian Fishing Vessels and the introduction of an annual registration fee for vessels. When the fee was introduced in the early 2000s, many owners of smaller vessels (below 10 meters) chose not to pay the fee because their vessels were inactive, and as a result around 5000 vessels were removed from the register. Also, from 2002 to 2009 coastal vessels without opportunity to structure (below 15 meters) were offered an opportunity of scrapping which was financed by the government and a fee on first-hand sales of fish. This led to the removal of 243 vessels. On the other hand, the main explanation for the reduction of larger coastal vessels is the introduction of the structural quota system. [18]

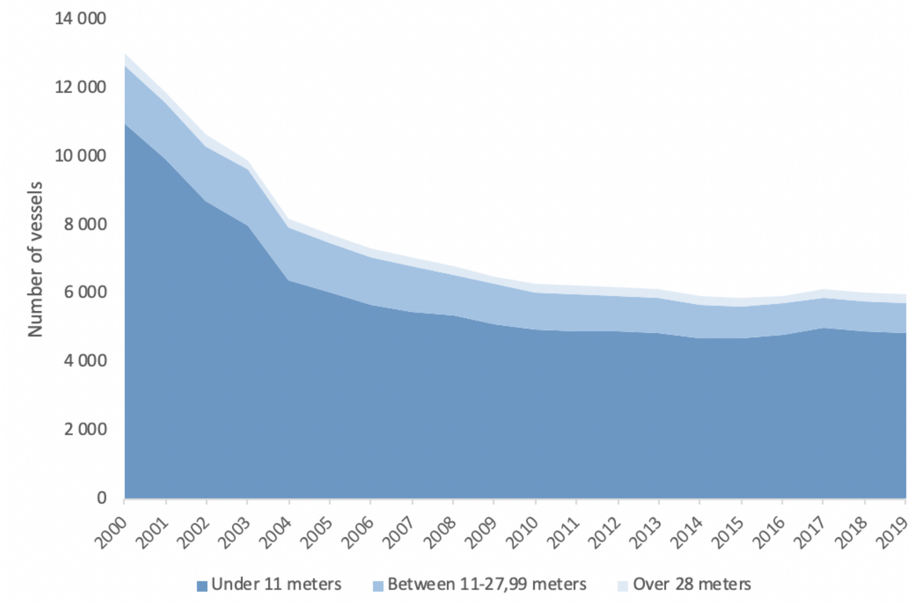

Fig. 2.1: Number of registered vessels in Norwegian fisheries. (Source: *The Norwegian Directorate of Fisheries*)

The number of active fishermen over the last 50 years has decreased significantly, this is mainly a consequence of the reduction in number of vessels. One important reason behind this decline is the general economic development of the country and creation of more attractive employment opportunities. Another factor to be considered is the increased efficiency in fishing methods and equipment, resulting in labour being substituted by capital. Figure 2.2 shows how the number of fishers has decreased from 2000 to 2019, including those who have fishing as a main and secondary occupation. For both groups the number of active fishermen has reduced from around 20 000 in 2000 to 11 000 in 2019. [18]

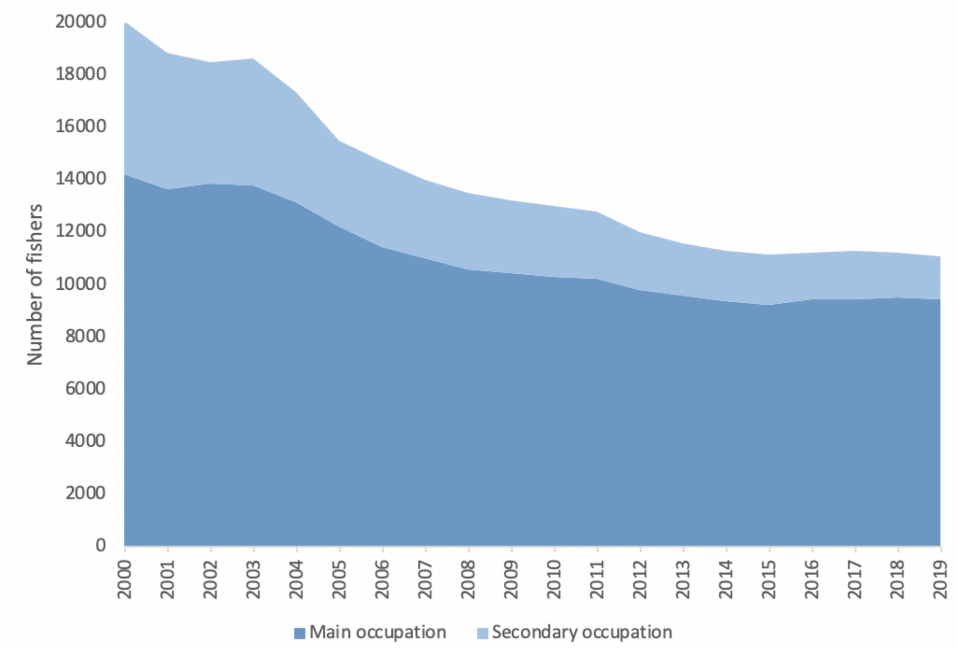

Fig. 2.2: Number of fishers in Norway. (Source: *The Norwegian Directorate of Fisheries*)

The fisheries in Norway are regulated by restricted access through licensing schemes as well as restricting harvesting levels through quotas. For the former, capacity is restricted through licensing schemes in the purse seine and trawler fleets. For the latter, a total allowable catch (TAC) was introduced after recommendations from the ICES. The Norwegian quotas are then distributed among the three main segments of the fishing fleet (purse seiners, trawlers and coastal vessels) as group quotas. Taking this into account, the Norwegian fisheries can be considered sustainably managed. [14]

As presented in Figure 2.3 and 2.4, the fact that the Norwegian fisheries can be considered sustainably managed can also be seen in the landing figures, as volumes remain relatively stable but with higher volatility for pelagic species. Even though the volume of fisheries have remained relatively stable, there is a positive development in the value of cod landing. An implication of this is that the first-hand prices have increased over the years. Looking at the figures, it is evident that prices of pelagic fluctuate, and this appears to be counter to the development of volumes. Therefore, it seems like there is a scarcity effect on prices of lower landings of herring and mackerel. This makes sense knowing that Norway is a key supplier of herring and mackerel and that there are limited close substitutes for these species in the consumer markets. As a result of this price effect, there is a revenue-stabilizing effect which creates more stable conditions for fishers and their income.

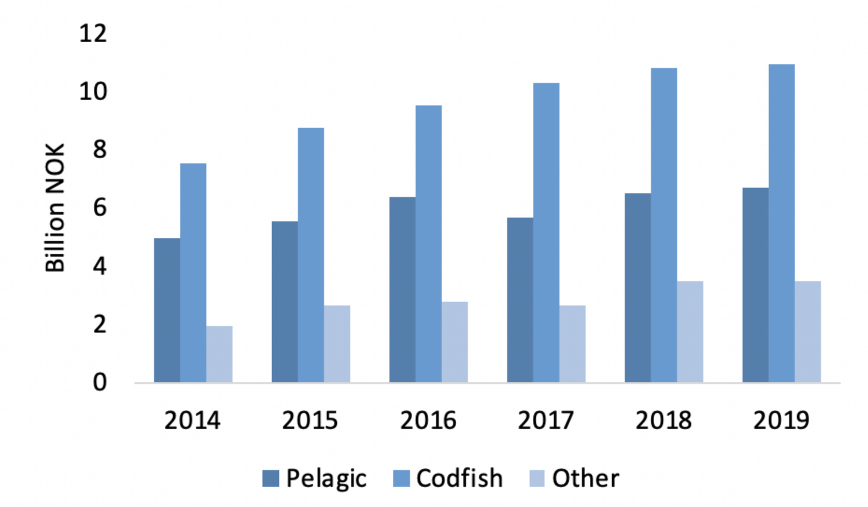

Fig. 2.3: Value of fishery landings. (Source: *Statistics Norway*)

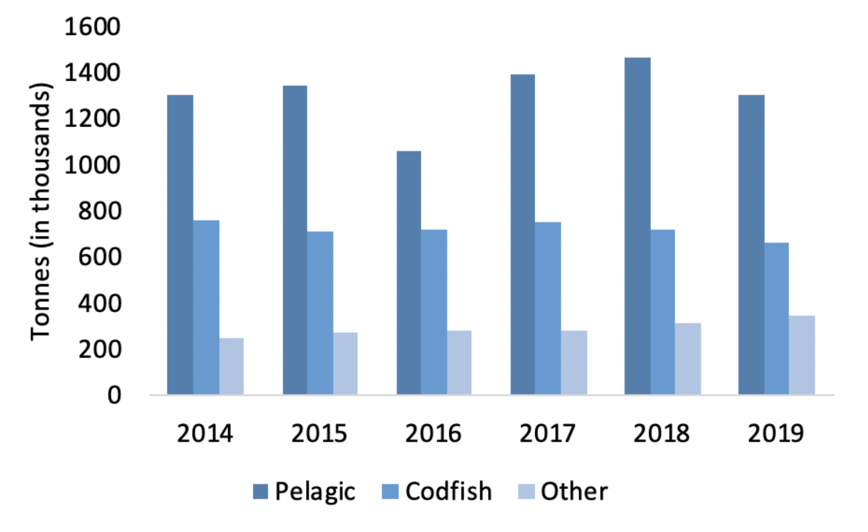

Fig. 2.4: Volume of fishery landings. (Source: *Statistics Norway*)

2.3 Wage Determination System

The wage system among fishers is based on the revenue sharing system called "lott", which is the revenue resulting from the fisheries. The way this "lott" is distributed between the boat owner and the fishers in Norway, is through collective agreements between fishers' unions and the boat owners' federations. When it comes to the coastal fleet, the collective agreements take place between the crew section and the boat-owner section in Norges Fiskerlag (The Norwegian Fishermen's Association). On the other hand, for the trawler and purse seine fleet, the collective agreements take place between Norsk Sjømannsforbund (The Norwegian Seafarers' Union) and Det Norske Maskinistforbund (Norwegian Union of Marine Engineers), on the one side, and Fiskebåt – Havfiskeflåtens forbund, on the other. [17]

To calculate the "lott", two types of revenue sharing schemes are used. For the coastal fisheries using conventional fishing gear, the *net income* is applied to calculate the "lott". For the pelagic fisheries however, the "lott" is calculated from the *gross revenue*. The question regarding why the two fisheries apply different methods to calculate the "lott" is discussed by Bergland and Pedersen (1999). One reason behind this is that landing volume risk is lower in pelagic fleet because larger and mobile vessels lead to more predictable catches. Another reason is that pelagic fishing vessel companies are often listed on stock exchange and therefore may be less dependent on risk-sharing with crew than what is the case for the smaller vessels in the coastal fisheries. [17]

Norges Fiskerlag (The Norwegian Fishermen's Association) describes the distribution of the "lott" in the coastal fisheries based on the fishing gear used, length (feet) and storage volume (m3) of the vessel, and the number of fishers that are onboard. For example, a vessel of 50ft and 22m3 of storage using fishing line and with two fishers onboard, the "lott" should be 52.5% of net revenue. After the operational costs are deducted the two fishers, where one being the owner, should share 52.5% of the net revenue, while the remaining 47.5% is received by the vessel. Normally, the "lott" is shared equally among the fishers, but taking into account factors such as experience and responsibility can affect the distribution. For example, an apprentice will typically receive half of what the regular fishers receive. [19]

Another scheme, which guarantees a minimum salary does also exist. This scheme is attainable when the salary is below 2550 NOK per week during the fishing period. As long as the annual salary does not exceed 600 000 NOK, the daily payments is calculated by multiplying the annual salary with 0.024. This scheme is not used that much and is mainly common among fishers with small vessels in the Nordland county of Northern Norway. It seems like this scheme is not misused and works according to its intention. [20]

Figure 2.5 illustrates the development of fishers' income based on type of fishing vessel. As we can see, fishers onboard large vessels in cod trawling and vessels using purse seine or trawls for pelagic fisheries are those with the highest income levels. On the other hand, coastal vessels based on conventional gear and seine, which are smaller compared to the trawl and purse seine vessels, are the ones with the lowest income levels. Therefore, it seems like capitalization and scale economies does play an important part in the determination of the fishers' pay.

As illustrated, all groups have had a positive development in their income. The real income growth is a result of a situation where the rate of income growth exceed inflation.

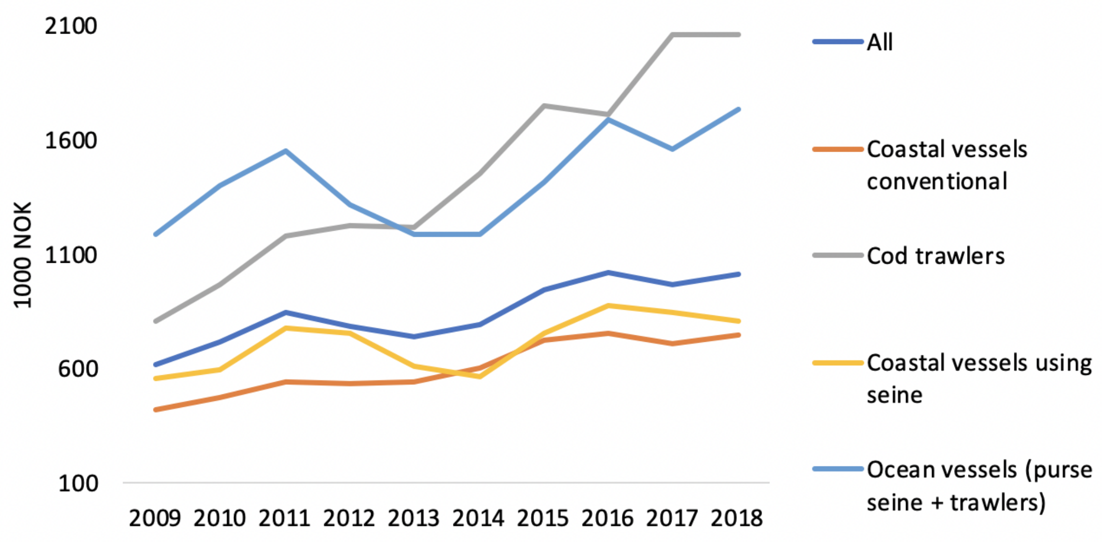

Fig. 2.5: Average nominal annual fisher income levels by groups of vessel types. (Source: *The Norwegian Directorate of Fisheries*)

Compared to the average income level in Norway, the average income level in fisheries has been relatively high during the last years. This indicates that the current economic conditions are good for fishers and that there are no problems in recruiting fishers for vessels that need more fisher crew. This is in accordance with the findings of Nielsen et. al (2008) which states that fishers are being well off. [21, 22]

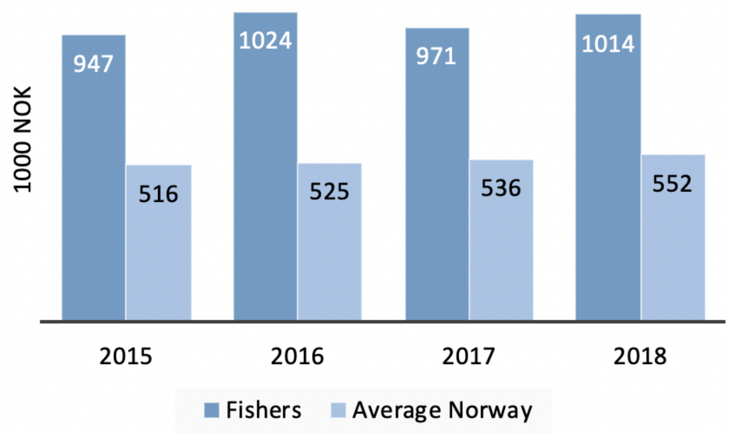

Fig. 2.6: Fishers' pay compared to average income level in Norway. (Source: *Statistics Norway and The Norwegian Directorate of Fisheries*)

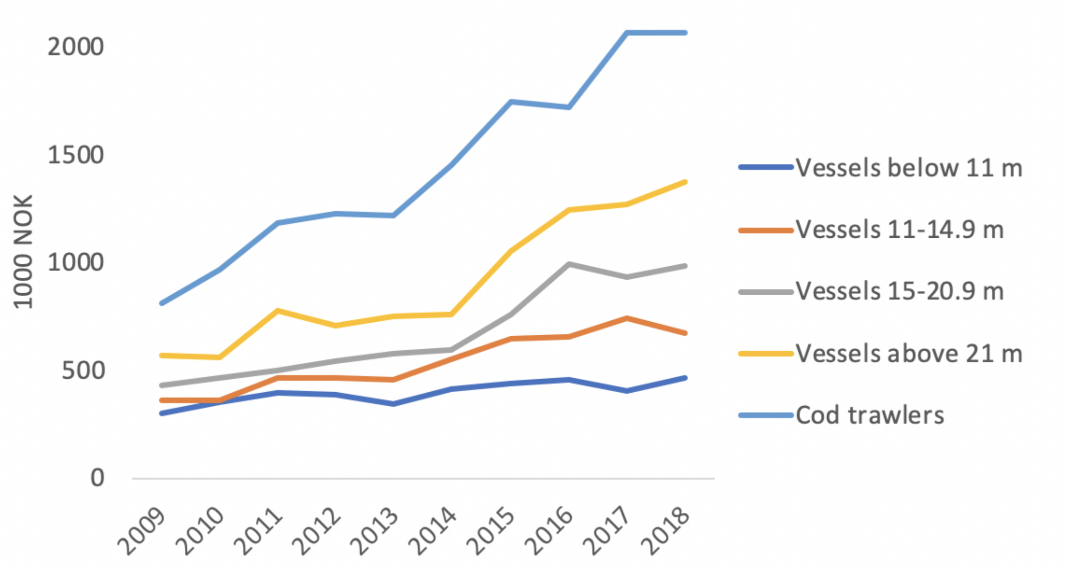

Fig. 2.7: Average nominal annual fisher income levels by size in cod/whitefish fisheries. (Source: *The Norwegian Directorate of Fisheries*)

Figure 2.7 illustrates clearly the role of the vessel, which includes coastal vessels using traditional gear and cod trawlers. These vessels usually target cod and other demersal whitefish species. As we see, the average income of fishers increase with respect to the size of the vessel. For the largest cod trawlers, the average income was over 2 million NOK in 2017 and 2018. For the smallest vessels (below 11 meters), the average income was roughly over 460 000 NOK in 2018.

2.4 Resource Rent

One question to be asked is who extracts the resource rent? Is it the fisher and its crew or is it the owner? Some parts of the resource rent have already been extracted through the transactions of fishing quotas. Therefore, one answer to this question is that fishers who owned quotas and left the fisheries by selling their fishing rights have extracted a considerable amount of it.

The high level of income among fishers indicate that resource rent remains. However, as we discussed above, the highest income levels are associated with large vessels. To yield more resource rent, it is suggested that further restructuring is required. In other words, one should remove several smaller vessels in favor of fewer larger vessels. This is in accordance with the view of Steinshamn (2019), were he concludes that there is little resource rent remaining with the current industry structure as a result of overcapacity being present. [23]

As we saw earlier in Figure 2.1, most of the vessels in Norwegian fisheries are small, having a size below 11 meters. If the government continued their restructuring of the fleet in favor of larger vessels, there would be more resource rent to society (if taxed), but would also lead to the removal of resource rent from the coastal communities (unless it is transferred back).

Materials and Methods 3

3.1 Calculating Resource Rent (RR)

There are several issues related to the measurement of resource rent (RR) that is generated in fisheries, where one such issue is the definition of RR. Rent in general, is defined as the profit remaining after the total assets have been compensated based on the opportunity cost. However, there is a possibility that there is more than one source of rent in fisheries, and distinguishing between those can be almost impossible. For example, one such rent is the intramarginal rent. This rent exists because vessels are heterogeneous in terms of capital and labor. Therefore, some vessels will be more cost efficient than a marginal one that earns no profit. A second issue is related to the calculations of input costs, specially calculations that are related to the opportunity costs of capital and labor. Although operating costs usually record the correct costs, i.e. the opportunity costs, the same may not hold for capital and labor. Therefore, the costs of using capital and labor must be adjusted to consider the fact that operating accounts reveal only the accounting costs of using these inputs, but not the true economic costs. At last, one must assess the reinvestment necessary to maintain the operations of the industry. [24]

Taking into account all issues discussed above and the uncertainty that comes with it, two methods will be presented in this thesis to increase the accuracy. The first method is called the weighted average cost of capital (WACC) and estimates the rent based on the estimated cost of capital. The second method, which is called return on capital (ROC), estimates the RR based on the difference in the return of capital between the fishing industry and the average ROC of enterprises that operate in the Norwegian economy, excluding the fishing industry. We will discuss both methods in detail, but this thesis will mainly focus on the second method. [24]

3.2 Data

The data that is used in this thesis comes from two Norwegian public sources, such as The Norwegian Directorate of Fisheries (Fiskedirekoratet) and Statistics Norway (Statistisk sentralbyrå). The fisheries data provided by Statistics Norway consists of data on catches, the fleet size, markets and exports. In addition, it also provides the financial data of the fishing industry. The accounting data include information on the costs, revenues, and profits, as well as assets and liabilities, including equity.

The Norwegian Directorate of Fisheries is a government agency and is responsible for advising and executing the ministry's policy. The agency is mainly charged with monitoring the Norwegian fishing industry and the daily administration of the fisheries management in Norway.

3.3 The WACC method

The weighted cost of capital shows the full cost of capital by calculating both the cost of borrowing and the opportunity cost of equity. The WACC is defined as [24]:

$$WACC_t = W_{d,t}K_{d,t}(1 - tax_t) + W_{e,t}K_{e,t} \tag{3.1}$$

where $W_{d,t}$ is the proportion of the capital stock in the whole fishing industry, which was funded by borrowing in year t, and $W_{e,t}$ is the proportion that was funded by equity. $K_{d,t}$ and $K_{t,e}$ is the cost of borrowing and opportunity cost of equity, respectively. tax_t is the corporate tax rate. To calculate $W_{e,t}$, one can use the following equation [24]:

$$W_{e,t} = \frac{Equity_t - Value\ of\ fishing\ rights_t}{Assets_t - Value\ of\ fishing\ rights_t} \tag{3.2}$$

$W_{d,t}$ is then calculated as follows [24]:

$$W_{d,t} = 1 - W_{e,t} \tag{3.3}$$

To calculate the cost of equity $K_{e,t}$, we have to apply the capital asset pricing model (CAPM) each year that this study spans. The CAPM model is defined as [24]:

$$K_{e,t} = R_{f,t} + \beta(R_m - R_{f,t}) \tag{3.4}$$

where β is defined as [24]:

$$\beta = \frac{Covar(R_{i,t}, R_{m,t})}{Var(R_{m,t})} \tag{3.5}$$

where $R_{f,t}$ is the risk-free rate, $R_{m,t}$ is the return of the market, and β is a numeric value that measures the fluctuations of a stock to changes in the overall stock market [24].

The financial cost in year t, CFT_t, can be calculated using the following equation [24]:

$$CFT_t = WACC_t(Assets_t - Value\ of\ fishing\ rights_t) \tag{3.6}$$

where assets are defined as the sum of debt and equity. The calculated financial cost (CFT_t) is measured by multiplying WACC to the total assets minus the book value of fishing rights for each year. Thus, this this cost represents the cost of capital and the opportunity cost of owned capital for all assets, except for fishing rights (quota). [24]

$$RR_t = EBIT_t + Fishing\ fee_t - CFT_t \tag{3.7}$$

The resource rent (RR) can finally be calculated using Eq. 3.7. The RR is estimated to be the reported EBIT (earnings before interests and taxes) in fishing and processing, plus the fishing fee for the particular year, minus the calculated financial cost (CFT_t). Since there is no fishing fee in the Norwegian fisheries, one can exclude that from the equation [24].

3.4 The ROC method

The method is referred to as the return of capital, and estimates the resource rent (RR) by using the ROC of the aggregate Norwegian economy and compares that to the ROC of the fishing industry. The data that are necessary to calculate the ROC of the aggregate economy and the fishing industry were not available before 2003, and therefore does this analysis start in 2003. To calculate the ROC, Eq. 3.8 can be applied. The ROC shows how much profit is generated by the business. A higher ratio points out that more profits are generated by the amount of capital employed. This ratio is a good way to see how effectively a company or industry uses its capital. The ROC should always be greater than the borrowing cost, because if not, then the companies are losing money. [24]

$$ROC_{A,t} = \frac{EBT_t + Financial\ cost_t}{Assets_{A,t}} = \frac{EBIT_t}{Assets_{A,t}} \tag{3.8}$$

$$ROC_{F,t} = \frac{EBIT_t + Fishing\ fee_t}{Assets_{F,t} - Value\ of\ fishing\ rights_t} \tag{3.9}$$

Using Eq. 3.8 and Eq. 3.9, the RR can be calculated as following [24]:

$$RR_t = (ROC_{F,t} - ROC_{A,t})(Assets_{F,t} - Value\ of\ fishing\ rights_t) \tag{3.10}$$

Eq. 3.8 will be used to calculate the aggregate ROC of all companies that operates in the Norwegian economy for each year of the study, except the fisheries. On the other hand, Eq. 3.9 is going to be used to calculate the ROC of the fishing industry. $ROC_{F,t}$ is earnings before interest and taxes (EBIT) plus fishing fee divided by all assets except for the book value of fishing rights. There is no fishing fee in the Norwegian fisheries, and therefore can be excluded from Eq. 3.9. Also, there is no data on the value of fishing rights in Norwegian fisheries and is therefore not included in our tables and calculations. A reason why these data are not public in Norway is because the rules for transactions on fishing quotas is complicated and the transactions are not that transparent. The lack of data on the value of the fishing rights will bias the estimates of resource rent upwards. Finally, taking into account the information regarding the value of fishing rights and fishing fee, the annual RR can be calculated using Eq. 3.11, where the difference in ROC between the fishing industry and the aggregate economy $(ROC_{F,t} - ROC_{A,t})$ is multiplied by the total assets of the fishing industry. [24]

$$RR_t = (ROC_{F,t} - ROC_{A,t}) * Assets_{F,t} \tag{3.11}$$

where $ROC_{A,t}$ is then given as:

$$ROC_{F,t} = \frac{EBIT_t}{Assets_{F,t}} \tag{3.12}$$

3.5 Calculations

In this section we will calculate the resource rent (RR) for the pelagic and coastal fisheries in Norway. As discussed above, to calculate the RR we have to use Eq. 3.10. Firstly, we need to calculate ROC of the aggregate Norwegian economy, excluding agriculture, forestry and fishery ("*jordbruk, skogbruk og fiskeri*"). Statistics Norway (SSB) has provided us with data to calculate *EBIT* and *Assets* for all years that this study spans. These have been calculated by taking the *EBIT* and *Assets* for all industries in the Norwegian economy minus the *EBIT* and *Assets* for agriculture, forestry and fisheries. These numbers have further been used to calculate ROC for each year this study spans.

Table 3.1 shows the calculated ROC for aggregate Norwegian economy. To show how we have proceeded to calculate the $ROC_{A,t}$, a calculation of ROC for year 2003 has been demonstrated below. The same method has been used for the remaining years.

$$ROC_{A,2003} = \frac{EBIT_{2003}}{Assets_{A,2003}} = \frac{231035}{3983258}$$

$$= 0.0295$$

Tab. 3.1: ROC of the aggregate Norwegian economy. (Source: *Statistics Norway*)

Year	EBIT (MNOK)	Assets (MNOK)	ROC
2003	231 035	3 983 258	0.0580
2004	322 707	4 456 827	0.0724
2005	451 684	4 983 522	0.0906
2006	532 883	6 083 888	0.0876
2007	512 593	7 179 250	0.0714
2008	589 820	8 094 184	0.0729
2009	412 792	8 104 425	0.0509
2010	502 157	8 833 161	0.0568
2011	610 641	9 221 632	0.0662
2012	599 539	9 627 931	0.0623
2013	566 233	10 198 943	0.0555
2014	474 438	10 705 698	0.0443
2015	354 389	11 105 602	0.0319
2016	347 924	11 254 543	0.0309
2017	495 364	12 041 898	0.0411
2018	587 560	12 834 603	0.0458

Calculating ROC for pelagic fisheries

Now we have to calculate the ROC of the pelagic fisheries. The data for the pelagic fisheries are shown in Table 3.2. Both *EBIT* and *Assets* are provided to us by Statistics Norway. As we mentioned earlier, there is no data on the value of fishing rights in Norway, and thus, is excluded also from our calculations. The data on *EBIT* and *Assets* for the pelagic fisheries in Norway have been used to calculate the ROC of pelagic fisheries between year 2003 and 2018. The ROC for all years are calculated using the following method:

$$ROC_{F,2003} = \frac{EBIT_{2003}}{Assets_{F,2003} - Value\ of\ fishing\ rights_{2003}}$$

$$= \frac{1015488}{34434859 - 0}$$

$$= 0.0295$$

Tab. 3.2: ROC of the pelagic fisheries in Norway. (Source: *Statistics Norway*)

Year	EBIT	Assets	ROC
2003	1 015 488	34 434 859	0.0295
2004	2 409 983	37 777 599	0.0638
2005	3 812 261	41 694 059	0.0914
2006	3 514 345	52 924 978	0.0664
2007	4 300 482	72 528 783	0.0593
2008	4 589 862	74 688 866	0.0615
2009	3 619 019	65 863 230	0.0549
2010	5 244 988	71 144 984	0.0737
2011	7 414 017	70 364 061	0.1054
2012	4 108 546	73 791 792	0.0557
2013	2 370 461	79 427 866	0.0298
2014	2 900 018	94 071 980	0.0308
2015	5 195 030	100 338 358	0.0518
2016	7 715 844	110 237 158	0.0700
2017	6 145 582	128 233 516	0.0479
2018	8 490 493	155 515 202	0.0546

Calculating ROC for coastal fisheries

The ROC of coastal fisheries is presented in Table 3.3. Again, both EBIT and Assets are provided to us by Statistics Norway. On the other hand, the value of fishing rights in Norwegian fisheries are obtained the same way as explained earlier. The data on EBIT, Assets and Value of fishing rights have been used to calculate the ROC of coastal fisheries between year 2003 and 2018. The ROC for all years are calculated using the following method:

$$ROC_{F,2003} = \frac{EBIT_{2003}}{Assets_{F,2003} - Value\ of\ fishing\ rights_{2003}}$$

$$= \frac{30893}{1213531 - 0}$$

$$= 0.0255$$

Tab. 3.3: ROC of the coastal fisheries in Norway. (Source: *Statistics Norway*)

Year	EBIT	Assets	ROC
2003	30 893	1 213 531	0.0255
2004	41 638	1 361 159	0.0306
2005	86 588	1 871 083	0.0463
2006	158 716	2 110 138	0.0752
2007	177 937	2 109 763	0.0843
2008	115 378	2 688 304	0.0429
2009	100 227	2 349 744	0.0427
2010	81 166	3 256 705	0.0249
2011	186 274	4 476 745	0.0416
2012	176 385	4 809 138	0.0367
2013	137 890	5 410 105	0.0255
2014	192 592	5 290 324	0.0364
2015	396 526	5 305 684	0.0747
2016	689 661	8 370 828	0.0824
2017	483 303	6 499 226	0.0744
2018	372 721	7 660 861	0.0487

Now that ROC of the aggregate Norwegian economy, ROC of the pelagic and coastal fisheries is in place, one can now proceed with calculating the resource rent generated in Norwegian fisheries. First, we will calculate RR that is generated in the pelagic fisheries, and then for the coastal fisheries.

Table 3.4 contain all values needed to calculate the RR that is generated in pelagic fisheries. Values for the ROC of pelagic fisheries and the aggregate ROC of the Norwegian economy are extracted from previous tables, the same with data on *Assets* for the pelagic fisheries. The RR of pelagic fisheries for year 2003 and for the remaining years is calculated as following:

$$RR_{2003} = (ROC_{F,2003} - ROC_{A,2003})(Assets_{F,2003} - Value\ of\ fishing\ rights_{2003})$$

$$= (0.0295 - 0.0580) * 34434859$$

$$= -981393$$

Tab. 3.4: The potential resource rent (RR) generated in pelagic fisheries.

Year	$ROC_{Pelagic}$	$ROC_{Economy}$	$Assets_{Pelagic}$	RR
2003	0.0295	0.0580	34 434 859	- 981 393
2004	0.0638	0.0724	37 777 599	- 324 887
2005	0.0914	0.0906	41 694 059	33 355
2006	0.0664	0.0876	52 924 978	- 1 122 010
2007	0.0593	0.0714	72 528 783	- 877 598
2008	0.0615	0.0729	74 688 866	- 851 453
2009	0.0549	0.0509	65 863 230	263 453
2010	0.0737	0.0568	71 144 984	1 202 350
2011	0.1054	0.0662	70 364 061	2 758 271
2012	0.0557	0.0623	73 791 792	- 487 026
2013	0.0298	0.0555	79 427 866	- 2 041 296
2014	0.0308	0.0443	94 071 980	- 1 269 972
2015	0.0518	0.0319	100 338 358	1 996 733
2016	0.0700	0.0309	110 237 158	4 310 273
2017	0.0479	0.0411	128 233 516	871 988
2018	0.0546	0.0458	155 515 202	1 368 534

Table 3.5 contain all values needed to calculate the RR that is generated in coastal fisheries. Values for the ROC of coastal fisheries and the aggregate ROC of the Norwegian economy are extracted from previous tables, the same with the data on *Assets* for the coastal fisheries in Norway. The RR of coastal fisheries for year 2003 and for the remaining years is calculated as following:

$$RR_{2003} = (ROC_{F,2003} - ROC_{A,2003})(Assets_{F,2003} - \textit{Value of fishing rights}_{2003})$$

$$= (0.0255 - 0.0580) * 1213531$$

$$= -39440$$

Tab. 3.5: The potential resource rent (RR) generated in coastal fisheries.

Year	$ROC_{coastal}$	$ROC_{economy}$	$Assets_{coastal}$	RR
2003	0.0255	0.0580	1 213 531	- 39 440
2004	0.0306	0.0724	1 361 159	- 56 896
2005	0.0463	0.0906	1 871 083	- 82 889
2006	0.0752	0.0876	2 110 138	- 26 166
2007	0.0843	0.0714	2 109 763	27 216
2008	0.0429	0.0729	2 688 304	- 80 649
2009	0.0427	0.0509	2 349 744	- 19 268
2010	0.0249	0.0568	3 256 705	- 103 889
2011	0.0416	0.0662	4 476 745	- 110 128
2012	0.0367	0.0623	4 809 138	- 123 114
2013	0.0255	0.0555	5 410 105	- 162 303
2014	0.0364	0.0443	5 290 324	- 41 794
2015	0.0747	0.0319	5 305 684	227 083
2016	0.0824	0.0309	8 370 828	431 098
2017	0.0744	0.0411	6 499 226	216 424
2018	0.0487	0.0458	7 660 861	22 216

Fig. 3.1 and 3.2 shows the roughly estimated resource rent generated in pelagic and coastal fisheries, respectively. As we see, there is a large difference in RR that is generated in both fisheries. For instance, RR for the pelagic fisheries is much more higher and is in millions unlike for the coastal fisheries, which only is in thousands. One reason for this may be that a large part of the Norwegian fisheries contain pelagic species, and thus, there is potentially larger RR that can be generated. For the pelagic fisheries, year 2011 and 2016 produced the highest RR, while for the coastal fisheries, only year 2016 accounted for the largest portion of RR. We will further discuss the resource rent generated in both fisheries in the sections below, first lets plot both graphs into one to demonstrate how big of a difference there is in the fisheries compared to one another.

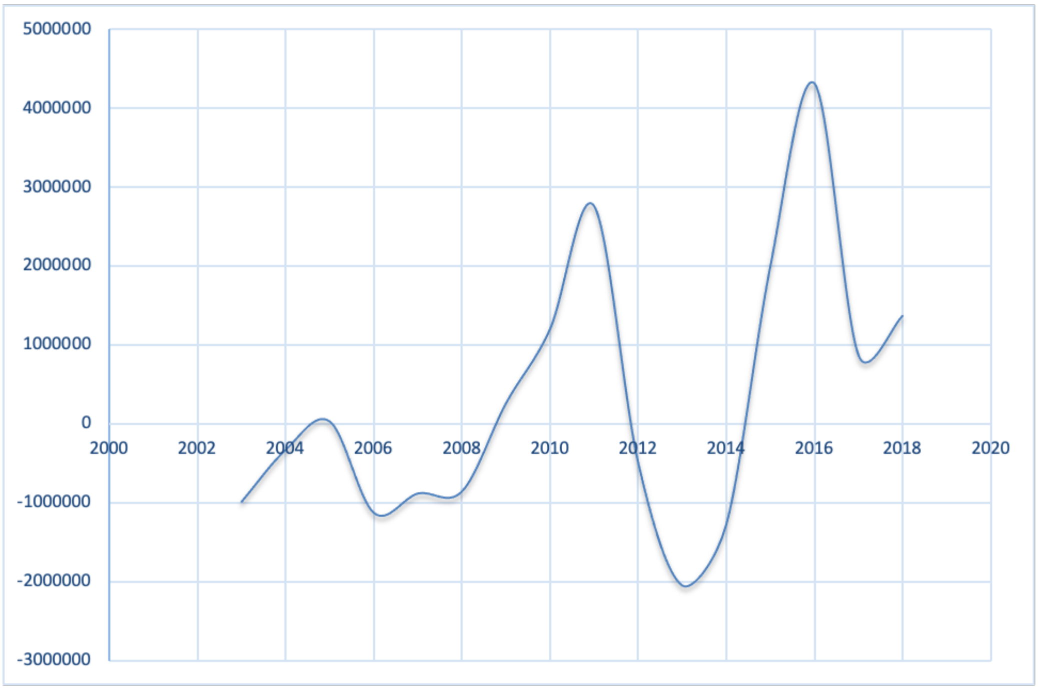

Fig. 3.1: The estimated resource rent (RR) generated in pelagic fisheries in Norway from 2003-2018.

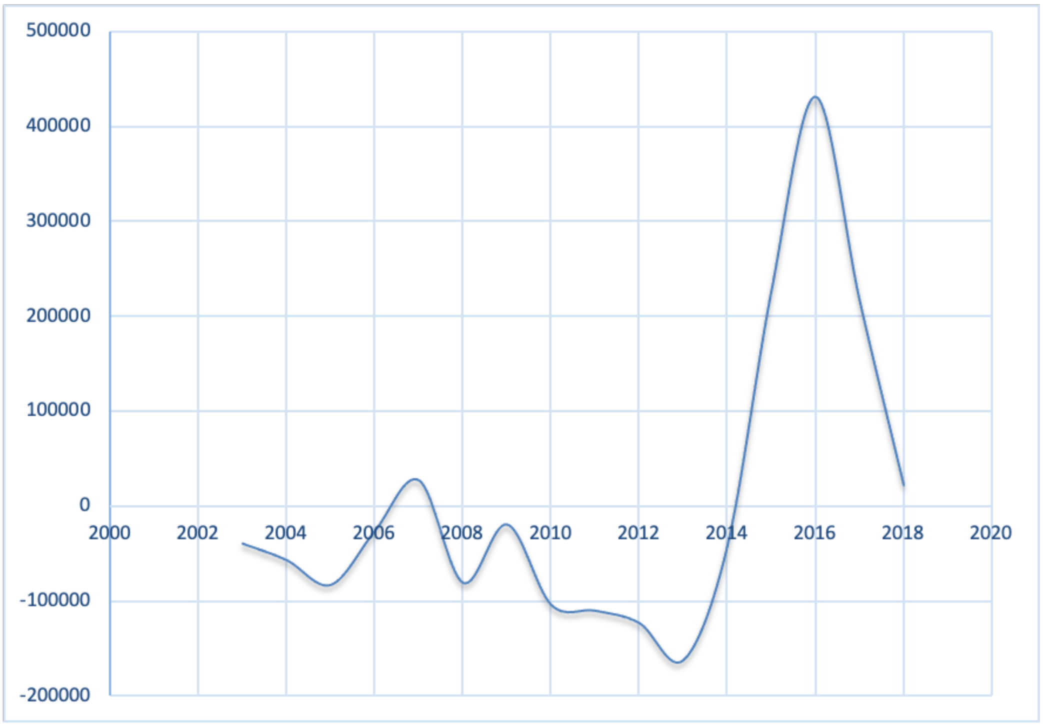

Fig. 3.2: The estimated resource rent (RR) generated in coastal fisheries in Norway from 2003-2018.

Fig. 3.3 illustrates the difference in both fisheries. As mentioned earlier, there is a huge difference in the RR generated in both fisheries. The year 2016 accounted for the largest RR generated in both fisheries. For the pelagic fisheries the RR was around 4.3 MNOK in 2016, while for the coastal fisheries it was about 430 000 NOK. On the other hand, the lowest produced RR for both fisheries was in year 2013. The RR for the pelagic and coastal fisheries that year was roughly -2 MNOK and -160 000 NOK, respectively.

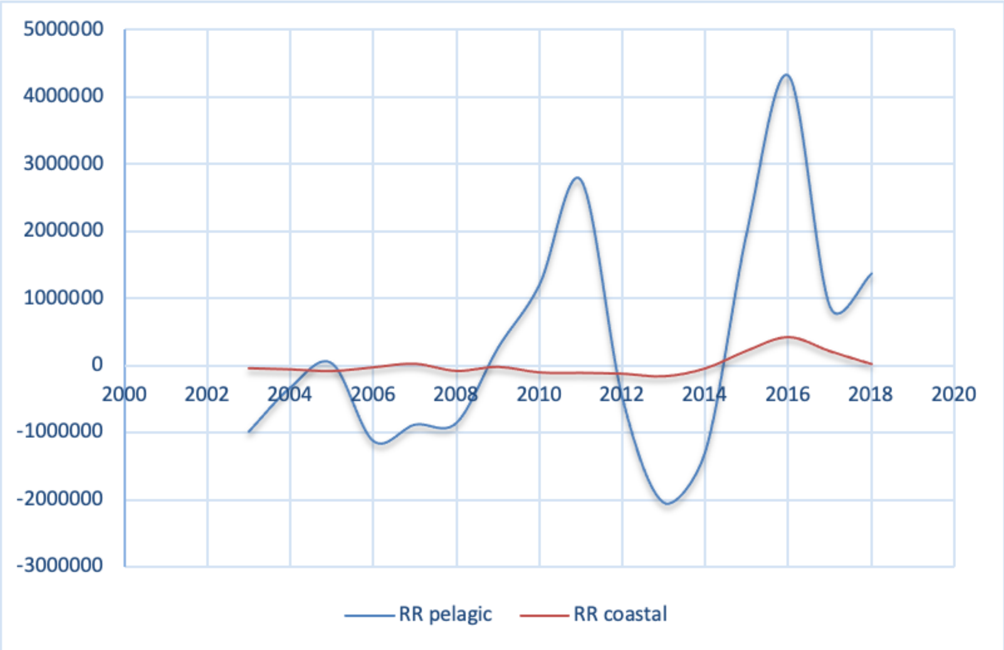

Fig. 3.3: Comparison of the estimated RR generated in pelagic and coastal fisheries.

For a better visualization of the RR that is generated in both fisheries, we can calculate the RR as a percentage of the export value of Norwegian fisheries. Since almost all fish products are exported, this measure is therefore a good measure of the revenues of the industry. Statistics Norway has provided us with the data for the export value of Norwegian fisheries for the years between 2000 and 2019. Table 3.6 and 3.7 shows the exported values of pelagic and coastal fisheries in thousands (1000 NOK) from year 2003 to 2018, respectively. For the pelagic fisheries, we have gathered data on two types of fish; atlantic herring (*sild*) and atlantic mackerel (*makrell*). On the other hand, for the coastal fisheries we have gathered data on fish types such as; atlantic cod (*torsk*), pollock (*sei*), haddock (*hyse*), common ling (*lange*), cusk (*brosme*) and atlantic halibut (*kveite*).

Tab. 3.6: Export value of pelagic fisheries in 1000 NOK. (Source: *Statistics Norway*)

Year	Atlantic herring	Atlantic mackerel	Total
2003	2 510	2 056	4 566
2004	2 792	2 258	5 050
2005	3 483	2 316	5 799
2006	2 914	1 710	4 624
2007	3 267	1 796	5 063
2008	3 767	2 270	6 037
2009	4 026	2 183	6 209
2010	3 718	3 068	6 786
2011	4 245	3 591	7 836
2012	4 182	3 004	7 186
2013	3 158	2 905	6 063
2014	2 725	4 129	6 854
2015	2 339	3 827	6 166
2016	3 124	4 063	7 187
2017	2 806	4 116	6 922
2018	2 630	3 819	6 449

Tab. 3.7: Export value of coastal fisheries in 1000 NOK. (Source: *Statistics Norway)*

Year	Atlantic cod	Pollock	Haddock	Common ling	Cusk	Atlantic halibut	Total
2003	4 251	1 498	865	257	152	30	7 053
2004	4 264	1 321	644	270	144	20	6 663
2005	4 479	1 534	688	276	142	23	7 142
2006	4 994	1 869	1 038	364	181	148	8 594
2007	6 216	1 752	1 022	321	162	347	9 820
2008	5 503	2 001	806	381	162	368	9 221
2009	5 076	1 937	1 064	297	162	361	8 897
2010	5 725	2 105	1 342	315	180	416	10 083
2011	6 163	2 163	1 539	294	182	456	10 797
2012	5 606	1 791	1 452	240	181	441	9 711
2013	5 812	1 682	1 289	188	176	497	9 644
2014	7 233	1 861	1 488	234	161	576	11 553
2015	7 909	2 021	1 251	300	183	771	12 435
2016	8 760	1 801	1 445	312	155	781	13 254
2017	9 136	1 904	1 682	328	187	930	14 167
2018	9 440	2 121	1 679	345	168	871	14 624

Table 3.8 shows the resource rent (RR) for the pelagic and coastal fisheries as a percentage of the export value for the time period between 2003 and 2018. In the next chapter, we will plot the RR for both fisheries and further discuss the results and compare these two.

Tab. 3.8: The RR in pelagic and coastal fisheries as a percentage of the export value.

Year	RR pelagic	RR coastal
2003	- 21.5%	- 0.6%
2004	- 6.4%	- 0.9%
2005	0.6%	- 1.2%
2006	- 24.3%	- 0.3%
2007	- 17.3%	0.3%
2008	- 14.1%	- 0.9%
2009	4.2%	- 0.2%
2010	17.7%	- 1%
2011	35.2%	- 1%
2012	- 6.8%	- 1.3%
2013	- 33.7%	- 1.7%
2014	- 18.5%	- 0.4%
2015	32.4%	1.8%
2016	60.0%	3.3%
2017	12.6%	1.5%
2018	21.2%	0.2%

Results

4

Figure 4.1 and 4.2 presents the estimated RR for pelagic and coastal fisheries for the period from 2003 to 2018 as a percentage of the export value of Norwegian fisheries, respectively. Almost all Norwegian fish products are exported, and this measure is therefore a good measure of the revenues of the industry. The revenues coming from selling fish to processing firms are automatically cancelled out by the export value, and therefore, double counting of revenues is avoided. By showing the of RR as a percentage of the export value, its portion is shown to remain at constant prices, because inflation affects the RR and export value equally.

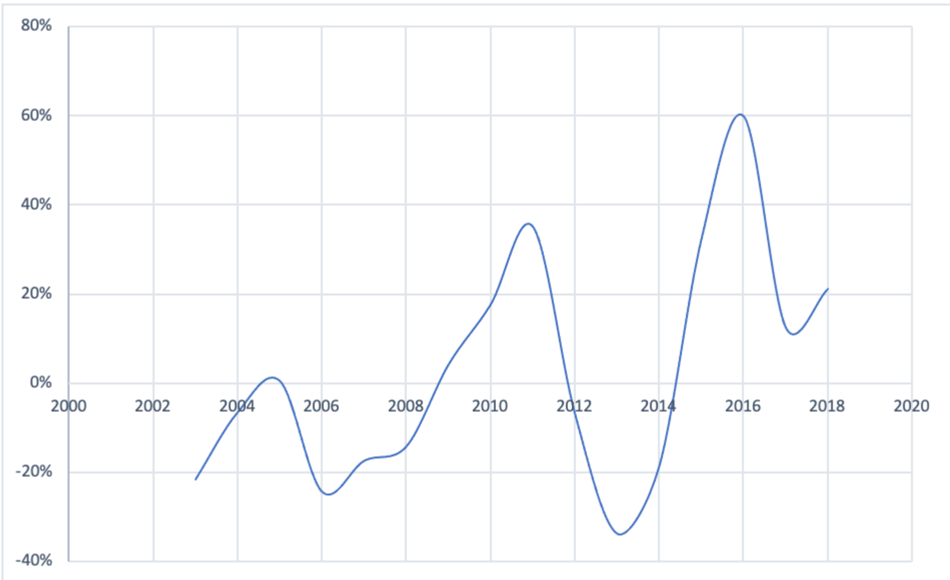

Fig. 4.1: Resource rent as a percentage of the export value in pelagic fisheries.

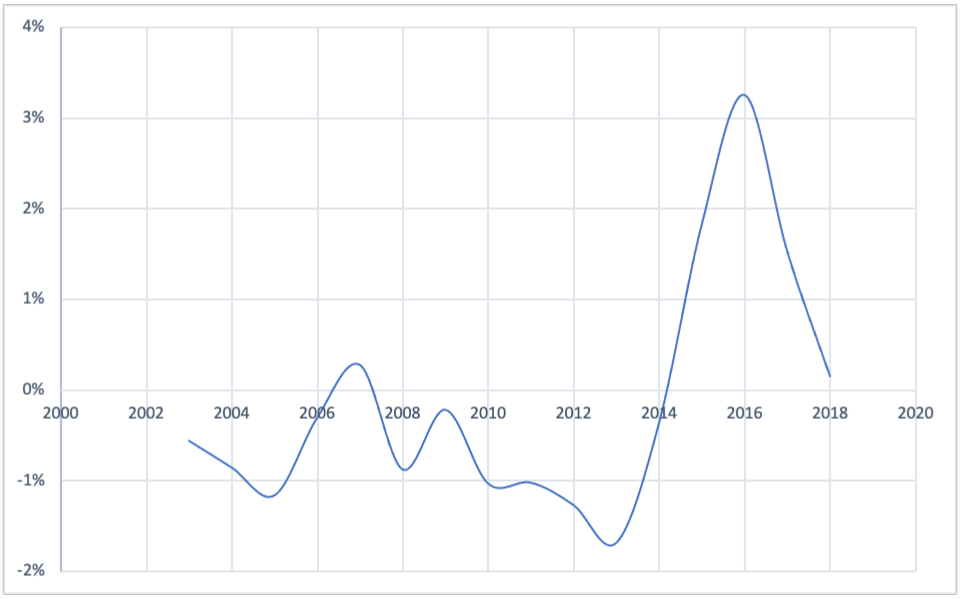

Fig. 4.2: Resource rent as a percentage of the export value in coastal fisheries.

Both figures show a clear and interesting story. As we see, there was no RR present in the Norwegian fisheries for the first years, and RR does not appear until 2008 for the pelagic fisheries and 2014 for the coastal fisheries. Some exceptions are observed though: there is a small RR of 0.6% in 2005 for the pelagic fisheries and a minor RR of 0.3% in 2007 for the coastal fisheries. One reason behind the RR between 2004-2006 is most likely due to the fall of the Norwegian krona that year, which resulted in good profitability of the industry. For the coastal fisheries, from 2003-2014 the average RR was -0.8% of the export value, therefore one assumption is that the industry did not produce RR during that period. The year 2014 was a "game changer" for both fisheries and no RR was observed. However, starting in 2015 the rent was, on average, 31.5% of the export value for the pelagic fisheries and 1.7% of the export value for the coastal fisheries.

The RR generated in coastal fisheries provides similar RR to that of the pelagic fisheries, but is much lower, as the average RR was -0.1% and 2.6% of the export value from 2003-2018, respectively. The difference between the two fisheries is greatest in 2011 and 2014. The ROC method estimates RR by using the difference in ROC between fisheries and other parts of the economy, and therefore its estimate is not sensitive to interest rates. The two fisheries have provided a quite similar increase since 2014. One reason behind this similarity is that since 2014, the profitability of the industry has been consistent and satisfactory. Also, the Norwegian economy at that time was relatively stable, with reasonable interest rates, and little change in the exchange rate was observed. This similarity in the estimated RR for the two fisheries strengthens the assumption that these calculations are reliable and precise to some extent.

Even if the data on the average ROC for the aggregate Norwegian economy were available, one can assume safely that the ROC method would not have shown any RR generated in the two fisheries before year 2006. One exception would perhaps be 2005 for the pelagic fisheries, when the ROC for the pelagic and coastal fisheries was 9.14% and 4.63%, respectively. The reason behind this assumption is that ROC for both fisheries, was on average low from 2000 to 2018, which was around 5.91% for the pelagic fisheries and 4.96% for the coastal fisheries and is unlikely to be higher than the estimated ROC for the aggregate Norwegian economy if the data were available to calculate it. The ROC for the pelagic and coastal fisheries was on average 5.1% and 6.3% respectively since 2014, and generated the RR because the average ROC for the aggregate Norwegian economy was only 3.9% at that time.

Overall, the broad picture is clear. There is no RR generated in the Norwegian fishing industry until the period between 2014 and 2015. What was the reason behind this? Why did the fishing industry and ITQ management system in Norwegian fisheries require several decades to rationalize and yield a significant RR? There are several explanations to these questions. One important explanation is the reduction of the catch of Norwegian fishing vessels from 2000 to 2019. During the whole period, the industry was rationalizing. Almost all factories were closed, many boats were scrapped, and firms merged, with many ceasing operations. However, the rationalization of the industries led to a reduction in the total catch. This is evident when the number of fishers are charted. The number of fishers with fishing as a main and secondary occupation decreased by 34% and 72% from 2000 to 2019, respectively (Fig. 2.2), as a consequence of the reduction in the catch. However, the industry started to generate significant RR when the landings started to increase. The catch increased by 19% since 2016 (Fig. 4.3), whereas the number of fishers and others working in the processing industry increased by 3%. The rationalization of the industry paid off with a significant RR.

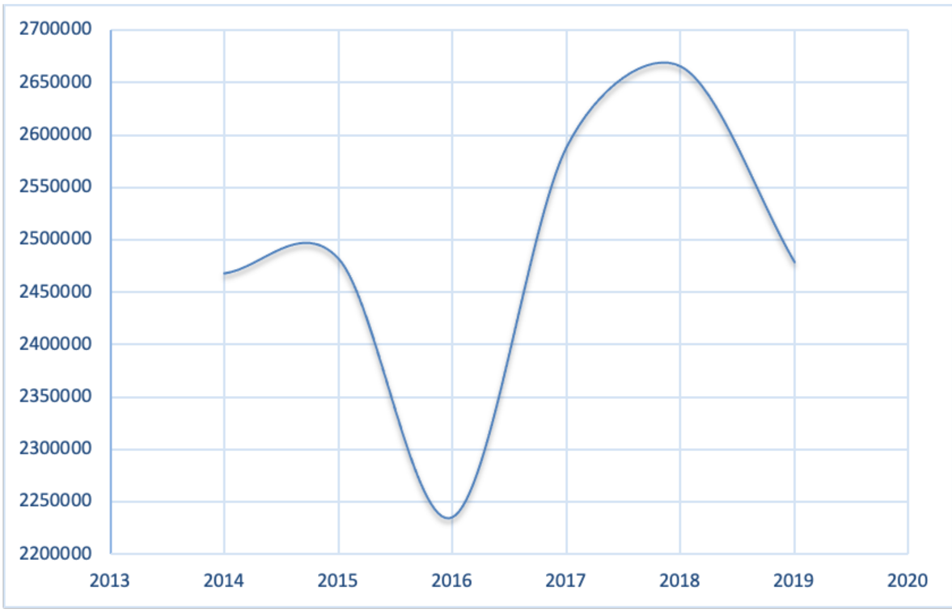

Fig. 4.3: The number of fish catches in Norway between 2014-2019. (Source: *Statistics Norway)*

The spectacular fall of the Norwegian krona, is one other important explanation behind the emergence of RR in 2014. Early in year 2014, the Euro was 8.4 NOK, whereas in the end of the year it was 9.3 NOK. The real exchange corrects the exchange rate to the price level of the average consumption basket. When the real exchange rate of the Norwegian krona increases, it means that the prices in Norway have increased compared to other countries that were measured in foreign currencies, if the exchange rate did not change. Since almost all fish products are exported and paid for in foreign currencies, the Norwegian fishing industry does benefit from the weakening of the real exchange rate. However, a large portion of costs are in NOK, and therefore, revenues in local currency increases due to a weakening in the Norwegian krone.

Finally, one should consider the fact that the ITQ system requires time to yield its full benefit. The ITQ system does have several benefits, one such benefit is the long term vision which is provided to quota holders. They can optimize production, fishing, processing and marketing. However, it takes time and requires a learning process for the benefits to occur, in which the staff and the managers grasp how to apply better technology, improve quality, and produce better and higher-paying markets. One good example of this, is the development of Icelandic pelagic industry. About 90% of the Icelandic pelagic catches were processed for animal feed, namely fishmeal and and oil, in the 1990s. The industry has started to process more of these species for human consumption, this is due to factors such as improved processing technology, automation, better access to markets, and more advanced quality control. Also, different pelagic species, such as mackerel and herring, which are better than capelin for human consumption has led to a higher proportion of the pelagic catch being processed for human consumption. Because of this, almost half of the pelagic catches in Iceland and a huge amount of the pelagic catches in Norway has been processed for more valuable human consumption. This development is the result of the ITQ system, which provides the quota holders with a sufficient incentive to invest and maximize value rather than focusing on the quantity of the catch. There has been seen a similar development in the demersal fisheries also. Today, a huge amount of groundfish species is processed, both in Iceland and in Norway, and transported to markets in Europe. Again, the ITQ system has contributed to make this possible, because it allows quota holders manage fisheries, processing, and marketing, and makes regulating an even supply to supermarkets possible. The Norwegian fishing industry has a competitive edge over its competitors because of this regular supply and strict quality control. [25, 26]

5 Discussion

The fishing industry in Norway is one of the most profitable in the world and should generate significant resource rent (RR). However, it requires several decades under fisheries management according to ITQ principals to achieve this success and for the rent to appear. Some may ask if these results are unique for Norwegian fisheries and if other countries also can attain similar profitability and RR in fisheries when managing them effectively with an ITQ system? The answers to these questions are no these results are not unique for the Norwegian fisheries and yes other countries can also attain similar profitability and RR. One such example is the Icelandic fisheries which generates a significant RR as a result of good ITQ management. What the ITQ system does is that it provides the quota holder with an incentive and long-term vision to maximize profitability, and therefore, rent. The ITQ system does also increase the catch value, because managers choose to organize their fishing to increase revenue and profits. The system does also lead to the transfer of fishing rights from less efficient firms to more efficient firms. This occurs when they sell their fishing quotas. This is not only meant for the Norwegian or Icelandic fisheries, but is universal and should apply to all fisheries. Therefore, the Icelandic fisheries is a good example of how much RR a well-managed fisheries can produce.

One question to be asked is who receives the RR? A huge amount of the RR produced was grandfathered when the original quota receivers sold their fishing rights to those that still work or operate in the fishing industry. The selling and purchase of these quotas have increased the debt burden of the industry and reduced its profitability. It is difficult to assess the quantity of this portion and warrants further study, but is said to be significant. In Iceland, the fishing fee has captured some of the RR while some portion is also captured by the Icelandic government through corporate taxes. There is no fee in Norwegian fisheries, and one can therefore safely assume that this would contribute to a significant RR in Norwegian fisheries since no RR is captured by the fishing fee. Since there is no fishing fee in Norway, some of the RR is potentially captured by the government. At last, the remainder of the RR is received by those that are still operating in the fishing industry.

Another factor which has contributed to the emergence of RR in Norwegian fisheries is the impact of the rebuilding that important fish stocks have had on profitability. One good example of this is the cod stock, which is one of the most important species in Norwegian fisheries. The cod stock in 2000 was around 1 182, but due to reduction in catches the fishable cod stock increased to 2 613 thousand tonnes in 2019.

In this thesis, the assumption was made that there was no fishing fee in Norwegian fisheries, and hence, was excluded from the equation. Also, due to limitations on data on the value of fishing rights in Norwegian fisheries, it was also excluded from the equation. In general, RR should be generated based on those two factors to get a more exact RR. Excluding the value of fishing rights most likely leads to an overestimation of the resource rent, since the value of fishing quotas is high. According to the Norwegian government, the value of fishing rights vary between 500 000 NOK to 15 MNOK, depending on the fisheries, fish type, and the fleet size. Therefore, including such large values into our equation would give a lower resource rent than our estimates. Also, the Norwegian fishing industry is vertically integrated, which refers to people who are involved in fishing as well as selling their own products. This results in revenues and profits being transferred from the harvesting components of these companies to the processing part. The price of the landed catch is an intermediary product for these vertically integrated companies, and the pricing of the catch is in some way arbitrary. Also, the fishers' wages are determined by the catch value, and therefore, the pricing of the catch is very important for the vertically integrated companies. Therefore, if the pricing of the landings is lowered, then their their profits would increase.

By using the WACC method, there is a possibility of overestimation when the intramarginal rent is included in the estimated RR. This occurs because the WACC method estimates the cost of capital for borrowed and owned capital. On the other hand, we can safely assume that there is no intramarginal rent included when using the ROC method to estimate RR in this thesis. This is because no difference was observed in the intramarginal rent between fisheries in Norway and in other parts of the economy. The ROC method estimates the RR in Norwegian fisheries by taking the difference in the ROC between the fishing industry and and other parts of the economy.

6 Conclusion

The economic literature has declared that fisheries which are managed using an ITQ system should generate excessive profits over time. This excessive profit is referred to as the resource rent. The calculations and results indicate that no RR was present in Norwegian fisheries until 2008 for pelagic fisheries, and 2014 for coastal fisheries in Norway. After 2008 and 2014, the rent has been significant for the pelagic and coastal fisheries, respectively. The reason behind the delay for the rent to appear, is the decline in fish catches from 2000 to 2016. This is due to the fact that the industry during this period was rationalizing, which resulted in reductions of landing. Therefor, no RR was produced. When catches started to increase in 2008 and 2016, the rent appeared for pelagic and coastal fisheries. In addition, the weakening of the Norwegian krone during those years contributed to the emergence of RR. As a result, this thesis therefore shows that managing fisheries using an ITQ system can definitely generate economic returns in excess of those found in other industries that do not rely on natural resources, but it may take time for the RR to appear. Therefore, patience and long-term planning are needed to achieve this excess profits.

Since 2009, the fishing fee in Iceland has captured around one-sixth of the resource rent that was generated. This would of course be avoided here in Norway, as there is no fishing fee in Norwegian fisheries. This would again lead to some of the rent being distributed to the general public through taxation. Also, the taxation of the resource rent shows that well-managed fisheries can generate rent and become a source of income for the Norwegian government.

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