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Fishing fleet capacity and profitability

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ABSTRACT

The individual transferable quotas (ITQ) system is a popular fisheries management system applied in many countries. Here, vessels are scrapped or sold out of the fishery, and their quotas are transferred to the remaining vessels, resulting in lower number of active vessels. This consequently reduces the overcapacity of fishing fleets and likely improves financial performance. Unlike previous studies, this paper quantifies the impact of capacity adjustment on vessel profitability through an econometric model. Supply and demand shifters are included in the model to isolate the influence of capacity adjustment. The case studies are the total Norwegian fishing fleet and an important vessel group – the ocean-going cod trawlers. Empirical findings generally indicate a positive impact of capacity adjustment on vessel financial performance. The observed recent decline in financial profitability of the fishing fleet may therefore be attributed to other factors rather than overcapacity.

1. Introduction

The utilization of common pool resources like fisheries is often characterized by excess capacity being employed. Overcapacity leads to economic inefficiency in fisheries, which is a fundamental problem for the global fishery industry [1]. Authorities have gradually introduced different schemes to rectify these problems. Often starting with total quotas, via decommissioning schemes to individual vessel quotas. While avoiding incentives to overinvest, they do not provide measures to deal with already existing overcapacity and the technological innovations that exacerbate this over time. To achieve economic efficiency in fisheries, many economists have argued for transferability of individual vessel quotas [2,3]. The vessels, which transfer quota to other vessels, must withdraw from the fishing industry; this reduces vessel numbers and overcapacity of the fishing fleet. Such individual transferable quotas (ITQ) systems have been introduced in numerous fisheries as a method for improving common resource management and to increase economic benefits for fishing fleets [1,2,4].

Researchers have consistently found that the introduction of ITQ affects vessel numbers and employment in the fishing fleet [1,5–8]. However, little empirical evidence has been provided to quantify the impact on fishing vessel profitability of a reduction in overcapacity. This paper addresses this lack of analysis and seeks to answer the following important and compelling question: Did capacity adjustment under the ITQ system have a significant influence on the profitability of the fishing fleet? For policymakers in Norway, one of the main aims behind the introduction of ITQs was to improve the perceived low profitability among fishing vessels. However, with rational economic actors and well-functioning markets, one would predict that the prices paid for transferred quotas would reflect the value of the future cash-flow generated. Thus, it would have small impact on profitability. This paper aims to shed light on this potential political misinterpretation. In the econometric model, the null hypothesis is that the capacity adjustment does not affect the profitability. Given the rejection of the null hypothesis, the coefficient magnitudes and the simulation results can further reveal to what extent the capacity adjustment under the ITQ system contributes to the profitability of the fishing fleet. Thus, research methods applied in this paper respond to the primary limitation of previous studies. The political implication from empirical findings is relevant to the fishing industry in developed countries and developing countries as well, in terms of income and employment.

The fisheries industry has long been an important industry along the Norwegian coast. Under the Norwegian ITQ system, a vessel's individual quota can be transferred and added to the acquiring vessel's original quota. This requires that the source vessel is scrapped and removed from the fishery industry [6,7]. According to data from the Norwegian Directorate of Fisheries, the number of vessels was reduced by 76.9%, from 25,948 in 1983 to 5884 in 2015. The number of fishermen aboard the vessels declined in response to this and the application of new technology and competition from other sectors as well. The number of fishermen fell from 28,304 to 11,130 between 1983 and 2015. Given a lower decline in total catches, the reduction in the numbers of vessels and fishermen should indicate an improved production efficiency. In fact, between 1983 and 2015, the total catch of

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the Norwegian fishing fleet decreased from 2.8 to 2.3 million tonnes, a reduction of 17.0%, which is much lower than the reduction of vessel number and fishermen number during the same period.

This study investigates the impact of fishing capacity adjustment on the financial performance of the Norwegian fishing fleet. Capacity adjustment is represented by changes in the numbers of vessels and fishermen. Although ITQs can reduce overcapacity, fishing capacity also depends on other factors, such as technology and vessel characteristics such as size and engine power. Export price and sea temperature are control variables to represent demand and supply shocks, respectively. Profitability is measured as return on sales (ROS) and return on assets (ROA). While ROS reveals the contribution of sales to the operating margin, ROA represents the return on investment for shareholders and creditors. The empirical study considers the entire Norwegian fishing fleet as a whole and to explore the driving forces behind vessel's financial performance at the industry level. In addition, cod trawlers are another case study, as this is a relatively homogenous and stable vessel group that has seen considerable capacity reduction and cod being the most important species.

The next section briefly reviews existing literature and addresses the development of capacity-related aspects of the Norwegian fishing fleet. The econometric methods and data sources are then described, followed by a discussion of the empirical results and simulation. This article concludes with a summary of the main findings and implications.

2. Research background

Norway has traditionally managed its fisheries using the individual transferable quotas (ITQ) system [6,7,9,10]. A total quota is allocated to an individual vessel based on an initial quota, which varies according to vessel size. For a particular vessel, the actual quota depends on its initial quota share out of the total initial quotas for all vessels. The degree of transferability for individual quotas has generally increased over time. Norway implemented a new quota transfer system in 1996 and has only marginally modified it since then, but gradually expanded it to include a larger share of the total fleet. This system allows those who acquire a vessel to add a certain fraction of the acquired vessel's quota to their own vessel, on the condition that the acquired vessel be scrapped or sold out of the fishery industry [6]. For example, for two purse seine fishing boats registered in the Northern Norway, 95% of the original quota carried by the acquired boat is automatically transferred to the acquirer's own boat. While the original quota is not limited in duration, the transferred quota is limited to 20 years.

The primary focus of public regulations regarding the conservation of renewable resources is on catch limits and the incentives they establish [11]. This has led to researchers exploring the economic results of fishing quota management systems in Norway [6,9,12] and elsewhere [1,13–17]. Using Norwegian cod as a case study, Armstrong and Sumaila [9] found that the ITQ system may result in economic losses due to the biological disadvantages of harvesting. Arnason [1] pointed out that the low quality of property rights is partly explained by imperfect quota transferability. Surís-Regueiro et al. [14] simulated the annual average return (ARR) of various fishing fleet sectors in the EU and obtained an annual 5.3% ARR for standard European vessels. Few empirical studies have been performed to provide *ex post* evidence of the economic benefits of fisheries management systems regarding typical profitability indicators such as ROS and ROA.

In the literature, there are different methods for measuring profitability. Bottazzi et al. [18] argued that profitability can be represented by return on sales, i.e. ROS. For this indicator, return is defined as the operational margin before financial costs and taxes, which are irrelevant to the extra operational activity. In our case studies, however, financial cost is mainly associated with capacity growth via the acquisition of boats [19]. This means that the positive impact of increased vessel capacity on profitability may be partly offset by increased financial cost. Thus, in order to assess the full impact of fishing fleet capacity on profitability, financial cost is subtracted from the operational margin to calculate ROS of the Norwegian fleet. The other profitability indicator is return on assets (ROA), which indicates how profitable a vessel is relative to its total assets (= equity + debt). Following the examples of many previous studies [20], the return used in ROA is defined as profit/loss before taxation, plus net financial cost.

Data on income statements from 1983 are obtained from the Norwegian Directorate of Fisheries. The terms of the balance sheet were added to the survey as of 2003. These data are used to calculate ROS and ROA. Of the different components, operation cost is the primary factor for calculating ROS and ROA. Among various operation costs (i.e. maintenance fees, fuel, and the purchasing of fishing utilities), salary is a major component. On average, salary accounted for over 36% of the total operating cost. The salary share was initially about 40%, and was reduced to about 33% in the last decade. This decreased salary share implies an improved production efficiency, although the reduction is not proportional to the large decrease in the number of fishermen. This is probably linked to Norwegian fishermen being paid through a share system. The crew are generally allocated a fixed share of the catch value. This share is somewhat reduced when a vessel acquires an ITQ and influenced by crew and vessel type and size, but not proportional to the number of fishermen. The reduction in number of fishermen is also compensated by increased operating days and annual working hours for the remaining fishermen. A vessel with a single quota may only be operated parts of the year, whereas a vessel with a doubled quota should have considerably more days at sea.

Since cod is used as a special case study, a brief discussion of species composition in Norwegian fisheries is necessary. In terms of catch value, cod has been the most important species in the last decades. The value share of cod out of the total Norwegian catch was about 32.6% in 2015, up from 26.2% in 1983. Herring and mackerel are the two other most important species. In the last two decades, cod, herring, and mackerel jointly accounted for a substantial share of the total Norwegian catch, i.e. 43.4% on average in the last 5 years and 35.5% in the 2000s.

Fig. 1 plots the number of vessels versus the total catch quantity of the overall Norwegian fishing fleet from 1983 to 2015. While vessel numbers clearly exhibit a downward trend, the total catch volume shows a high level of fluctuations. However, the reduction in the number of vessels is much higher than the decline in catch volume, indicating an increase in fishing capacity and utilization per vessel. The strong reduction in the total number of vessels during the last decades is also echoed in the development of cod trawlers, as the number of active cod trawlers reduced from 131 in 1998 to only 37 in 2015.

Unlike the consistent decline in vessel numbers, the ROS and ROA values are more volatile, as shown in Fig. 2. The average ROS is 2.93% in the 1983–2015 period. The value of ROS is negative in 12 out of the total 33 sample years, with most of the negative ROS occurring in earlier years. Although this indicator has shown a positive trend during the last decade, it still maintained a high variance. After a peak in 2011

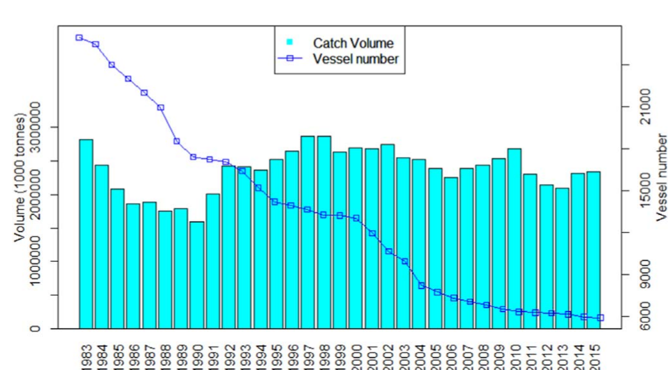

Fig. 1. Numbers of fishing vessels and catch volume of the Norwegian fishing fleet.