Profit and Resource Rent in Fisheries

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ABSTRACT

The difference between the concepts of profit and rent are discussed theoretically and by using aggregated data from the Icelandic and Norwegian fish harvesting industries. The former is a basic indicator for gauging the business performance of firms and industries, and the latter is important for the evaluation of the economic welfare contribution of resources and industries. The importance of distinguishing between profit and rent is greater for fisheries under strict management control, such as those with quotas and licenses, than those with more open access. It was found that profit is lower than rent in both countries. Policy implications are discussed.

Key words: Capitalized rent, invisible resource rent, fishery profit, harvest shares, ITQ, IQ, intra-marginal rent, licenses, limited entry, transitional gains trap.
JEL Codes: Q22, Q28.

INTRODUCTION

In fisheries, as well as in other natural resource-based industries, there is difference between profit and rent. The former is a basic indicator for gauging the business performance of firms, while the latter is for the evaluation of the contribution of resources and industry to economic welfare. Put simply, resource economists are mainly concerned about rent, including pure resource rent and producer surplus (intra-marginal rent [IMR]), in natural resource-based industries, and industry management with the objective of optimizing the sum of rent and consumer surplus. On the other hand, business economists are mainly concerned about the profitability of the firms comprising the industry. Fishery managers, politicians, and the industry may be even more interested in the total income of fishing vessels and crews, thus seeing the opportunity cost of labor as income rather than cost. This is often the case in Nordic fishery discourse (Nielsen, Flaaten, and Waldo 2012) and also in the US and Canada (Holland 2011). Consumer surplus on one hand, and monitoring, control, and enforcement costs on the other, are also positive and negative contributions, respectively, to economic welfare (Manning and Uchida 2016; Schrank, Arnason, and Hannesson 2003). In the academic literature, and in costs and earnings studies, there are not always clear definitions of the profit and rent concepts and their use in actual analyses. This article will mainly discuss and clarify differences and similarities in profit and rent concepts. Recent data from the Norwegian and Icelandic fish harvesting industries is used in the empirical section and proves to be in line with these concepts. References are given to publica-

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tions where misunderstandings between the two concepts have risen, often due to a lack of adequate data to distinguish between the profit and rent concepts (Hannesson 2013; Heen 2014; Heen, Heen, and Leung 2014).

In fisheries managed with a mixture of instruments, such as buyback, licenses, individual quotas (IQs), and vessel group quotas (GQs) that have evolved over time, gauging economic performance development is not straightforward. It has been demonstrated that transferability of free licenses and quotas will gradually reduce initial industry profitability of a governmental buyback or scrapping program (Flaaten, Heen, and Salvanes 1995). Transferable licenses and quotas given for free to fishers may be efficient in reducing the capacity of the fishing fleet, but they are not able to secure future above-normal profitability of the industry. The resource rent generated is made invisible in the accounts of the fishing firms. This may seem as a parallel to the transitional gains trap concept in Tullock (1975), who demonstrated that where a government provides long-term assistance to an industry in which it wishes to improve income levels, gains for favored people tend to be transitional. In some cases, fisheries management seems to have fallen into this type of trap (Nøstbakken 2012; Flaaten, Heen, and Salvanes, 1995). However, while it is true that there are windfall gains to those who were gifted fishing rights, fishers who buy quota and licenses no longer make above normal profit. Tullock's main concern with the transitional gains trap was that it locked in (trapped us in) a system with deadweight losses due to cartel power (e.g., of taxi drivers with medallions). Fisheries are different, as we do not expect to see a deadweight loss associated with them since they are not limiting output to get monopoly rents (at least generally), but to generate resource rent. On the other hand, where above-normal profit is expected, lobby activities to capture this; e.g., to avoid resource taxation and public auction of quota, may take place. This may be characterised as directly unproductive profit-seeking activities (DUP) (Bhagwati 1982).

In this article, we predominantly discuss two hypotheses in order to contribute to the methodology of using accounting data for estimation of rent and profit:

(1) Earnings before tax (EBT) underestimate the natural resource rent in managed fish harvesting industries.
(2) The commonly used business economic indicator return on capital (ROC) underestimates the welfare economic performance of managed fish harvesting industries.

This requires precise definitions of profit and resource rent for a comparison of the differences in magnitude and for a discussion of whether this matters for bioeconomic and policy analyses. The two hypotheses are further discussed below theoretically, and exemplified by aggregate data for the national fish harvesting industries of Iceland and Norway.

In the classical fisheries economic model with one-dimensional homogenous effort and a constant cost per unit of effort, no rent exists in open-access equilibrium (Warming 1911; Gordon 1954). Capital and labor are remunerated according to their opportunity costs, which for the former includes the necessary capital risk premium. A simple change in this model, for example by introducing heterogeneous effort, opens it to the existence of rent, specifically IMR, at open-access equilibrium (Copes 1972). A marginal vessel breaks even and the others may earn IMR, a concept related to producer surplus in microeconomic theory, and conceptually different from the concept of resource rent. Note that disentangling IMR and resource rent may be difficult in actual cases, but at least for open-access fisheries and vessel data it is possible to estimate

IMR (Duy et al. 2012). Pure resource rent does not exist in the open-access regime, but in addition to IMR quasi-(temporary) rent may also exist (Eide 2016). This article, however, focuses on managed fisheries where we expect that some rent exists; this is termed "resource rent" or just rent.[1]

CONCEPTS AND METHODS

Accounting principles for fishing vessel firms are much the same as for other firms. However, since the size and the number of vessels vary significantly, actual bookkeeping practices also vary. In small-scale fisheries globally, and even for larger vessels in developing countries, owners are barely required to keep official accounts. For research purposes, data has to be collected on a case-by-case basis or compiled from different sources.[2] In principle, the accounts of a firm can be itemized, as shown in table 1, where operating revenue from the sale of fish and other marine species is the main source of income for fish harvesting firms. Variable and fixed costs, as well as financial revenues, expenses, and taxes, affect the final result. To avoid misunderstanding, note that purchase of multiannual quotas, be it through auction or other mechanisms, would be long-term investment, similar to purchasing a fishing boat. Depreciation of rights affects operating profit (EBIT in table 1) (as part of the total operating expenses). In addition, financial costs of fishing rights affect profit on ordinary activities before tax (EBT in table 1). Thus, both depreciation and financial costs of fishing rights affect EBT.

Labor cost is a considerable part of the total operating expenses in many fisheries. When the share system is used, actual crew remuneration may vary across vessels, seasons and locations (Thuy, Flaaten, and Kim Anh 2013). Vessels generating above-normal profit may, at the same time, generate above-normal remuneration for their crew members: thus, some resource rent may be hidden in the income of the crew (see the discussion on Iceland, and footnote 11 for why above normal crew income is disregarded for Norway).[3]

Table 1 also includes industry-specific taxes and subsidies. These are included for a comparison of total fishing industry accounts with that of other industries in the national accounts. Note that when accounts are aggregated across the fishing industry as a whole, lease income and lease costs will cancel (or almost cancel) out. This is, of course, not the case for individual firms or group of firms.

ECONOMIC INDICATORS

In addition to calculating profit and rent as absolute figures, they will each also be calculated relative to another economic variable. The numerator of such an indicator includes an earning/profit concept, and the denominator can measure either the economic flow or stock. A number of different indicators could be used in the economic analysis of fishing vessels. As profitability is the focus of this section, we will discuss two financial indicators that are frequently used to measure the profitability of fishing vessels (Anonymous 2015, 2006). The profitability of an industry may vary according to which indicator is chosen, and the choice of indicator is particularly im-

1. Estimating each of the different rent elements in e.g. Figures 4 and 6 of Copes (1972) and Manning and Uchida (2016), respectively, requires more data than available for this article, as far as we can see.

2. Emerging from previous case-by-case research projects, a joint procedure for data collection has gradually been put in place for European fisheries (Anonymous 2006). For a US example of empirical research based on different sources, see Holland (2011). For an example from a developing country where cost and earnings data is usually meager, see Long, Flaaten, and Kim Anh (2008).

3. To the best of our knowledge a theoretical discussion of how different combinations of share and management systems work, as well as the estimation of efficiency and distributional gains within a rent framework, is lacking.

Table 1. Profit and Resource Rent Definitions in Fisheries Based on Costs and Earnings Concepts

Concept*	Explanation
Operating Revenues	Mainly from catch of fish and other marine organisms
+ Income from leasing of fishing rights	Will be matched by a cost item from another fishing firm. Fishing rights include licenses, permits, access rights, user rights, and vessel quotas (VQs, ITQs).
– Total operating expenses	Including fuel, labor costs, insurance, maintenance and depreciation of vessels, and fishing rights.
– Cost of leasing fishing rights	Will usually, but not always, be matched by an income item from another fishing firm. The exception depends on the definition: Is an idle fisher leasing out allotted fishing rights defined as a fishing firm or as something else? If not defined as a fishing firm, there will be a mismatch between lease income and lease costs for the industry as a whole. Such a discrepancy may also appear in profitability surveys when less than the total population is surveyed.
– Cost of auction-purchased annual fishing rights	When vessel owners have to acquire annual rights from the resource owner who could sell or auction time-limited fishing rights (e.g., harvest quotas).
– Industry-specific taxes	Fishery control activities.
+ Industry-specific subsidies	Net = revenue augmenting – cost reducing.
= Operating profit (EBIT)	Earnings before interest and tax.
+ Total financial revenues	Financial income and currency rate gains.
– Total financial expenses	Financial expenses and currency rate losses.
= Profit on ordinary activities before tax (EBT)	The residual for the private firm before tax.
+ Depreciation of fishing rights	Should be included if fishing rights are of limited duration and included in total operating expenses, above. This is usually not the case if they are of unlimited duration.
+ Financial costs of fishing rights	Should be included if total financial expenses include financial expenses of fishing rights.
+ Auction income	For the resource owner from auction of fishing rights.
– Calculated interests on equity	The interest rate should be equal to what the vessels pay on long-term loans, or equal to the interest yield of government bonds plus a risk margin.
= Resource rent unadjusted (RR1)	Resource rent unadjusted for transfer pricing of fish and above normal labor cost.

* In principle, this also applies to small-scale vessels where the "fishing firm" is the owner of the boat and gear.

portant in a comparative analysis of vessel groups or countries when capital structure and technical characteristics differ.

The indicator most commonly used in a profitability analysis of fishing vessels is operating margin (OM) (Anonymous 2015, 2006). OM measures the operating profit; that is, earnings before interest and tax (EBIT), as a percentage of total revenue. The data needed to calculate this indicator is generally, at least in developed countries rich in fisheries, accessible in official statistics. OM also provides a reasonably good picture of the profitability of an industry-sector over time. However, the use of this indicator poses problems in a comparison of vessel groups, industries, and nations varying in capital structure and other economic characteristics.

ROC, equal to return on total assets (ROA), measures earnings before tax (EBT) plus financial expenses as a percentage of the average capital invested. This indicator provides information about the profitability of a project compared to the opportunity cost of the capital. ROC is easy to understand and useful in comparing profitability between different projects, in our case fish-

ing vessels and non-financial companies in two countries. The main difference between OM and ROC is that OM has operating revenue in the denominator, while ROC uses capital. If there were a constant relationship between sales and capital, both indicators would give the same ranking of the profitability of vessels and groups of vessels; however, this is rarely the case. To avoid this problem with the use of OM, economists recommend using capital in the denominator in comparisons of projects and industries.

A general problem in using ROC is determining the value of the total capital or total assets on the balance sheet. Book values often underestimate assets compared with their true market value. This is particularly so if the company has a tax incentive of using a depreciation plan that differs from the actual reduction in the value of the assets. The focus herein is related to how fishing rights are reported in the balance sheet and the implications for calculating the indicators.

The Norwegian Directorate of Fisheries, as well as an EU analysis (Anonymous 2006), mainly uses two indicators for measuring the economic performance of the fishing fleet, OM and ROC. Even though there are some limitations to the application of OM, this has been the main indicator used in the profitability surveys of the Norwegian Directorate of Fisheries, and a long-term series is available for this indicator (Anonymous 2015). Iceland has a long history of abnormally high inflation and negative real-interest rates. Despite this, OM and other measures related to total income have been routinely applied both by the National Economic Institute and Statistics Iceland, as the latter assumed the data-collection obligations of the former.[4] Time series data for OM could have been presented for the two countries, but due to this indicator's weaknesses and limitations in comparative analyses, it will not be included in this article.

Referring to table 1, the definition of ROC is: $ROC = \frac{EBT + Financial\ expenses}{Total\ capital}$. The ROC indicator (then in %) is used in this article, but it will be distinguished as cases including and excluding fishing rights. This is the most commonly used indicator and makes comparisons with other industries and nations possible. This article will, therefore, include profit and rent calculations for the 2009–2013 period for Norway and Iceland, and these earning concepts will be included in ROC calculations with and without fishing rights. The economic performance of the fishing industry will be discussed and compared to other industries. The ROC in the five-year period, 2009–2013, is calculated using two approaches. The first method is the common method of including fishing rights, with EBT plus financial expenses in the numerator and total capital in the denominator. The second method, our method, uses EBT plus both financial expenses and depreciation of fishing rights in the numerator and total capital minus the value of fishing rights in the denominator.

After defining profit and resource rent and the economic indicators, we now return to the two research hypotheses discussed in the Introduction. The first compares EBT with resource rent (RR) and claims that EBT underestimates RR. As will be seen for Iceland and Norway, this is the case when interest on, and depreciation of, fishing rights are greater than the interest on equity, the owners capital. From table 1 we have the following:

$$\begin{aligned} RR = {} & EBT + Depreciation\ of\ fishing\ rights \\ & + Financial\ costs\ of\ fishing\ rights - Calculated\ interests\ on\ equity, \end{aligned} \tag{1}$$

4. See Table 1 in https://hagstofa.is/media/49512/hag_160202.pdf.

provided the resource user has not acquired the fishing rights through auction purchases. Purchase of annual quotas from the resource owner, through auction or another way, reduces EBT, and the payment will have to be added to arrive at RR. This implies that RR > EBT when (depreciation and financial costs of fishing rights) > (calculated interest on equity), and the equity is positive.

To test the second research hypothesis, we use the concept ROC, including and excluding fishing rights, ROC^I and ROC^E, respectively. The definitions are:

$$ROC^I = \frac{EBT + Financial\ expenses}{Total\ capital} \tag{2}$$

$$ROC^E = \frac{EBT + Financial\ expenses + Depreciation\ of\ fishing\ rights}{Total\ capital - Value\ of\ fishing\ rights}. \tag{3}$$

ROC^E includes visible and invisible resource rent and is a better indicator for welfare than ROC^I. Comparing expressions (2) and (3) we see that the numerator in (3) is larger than, or equal to, the numerator of (2) and that the denominator of (3) is smaller than, or equal to, the denominator of (2). Thus, the following conclusion holds:

$$ROC^I < ROC^E, \tag{4}$$

when the value of the fishing rights is positive. As will be seen below, for Iceland the numerator of (3) has to be adjusted for the transfer pricing of raw fish (+) and vessel labor cost (+).

FISHERIES AND DATA

NORWAY

The main source of data for Norway is the annual profitability survey from the Norwegian Directorate of Fisheries, which dates back to 1966 (Anonymous 2015). The recent publications by Armstrong et al. (2014) and Gordon and Hannesson (2015), examples of scientific works based on data from the Directorate of Fisheries, give further information on the development of the demersal and pelagic fish fisheries, respectively.

Before 1970, there was free entry into the Norwegian pelagic fish fisheries, with herring, mackerel, capelin, and blue whiting the most important species for the industry. A moratorium on the registration of purse seiners was put in place in 1969, and in 1973, a new licensing system was established (Flaaten, Heen, and Salvanes 1995). The basic principles of the system are still valid, with first cargo capacity and later quota shares as key parameters. Initially, government buyback programs helped reduce the number of purse seine vessels, with the aim of assuring a profitable industry, avoiding biological overfishing, and maintaining reasonable regional fleet distribution. Since the 1980s, larger coastal vessels have gradually secured more fishing rights. In 2013 a fleet of about 180 vessels had 21% of the landed value of pelagic fish, and 73 large purse seiners had 67% (Anonymous 2015). In 2013, the profitability survey included 270 vessels in the pelagic fisheries (Anonymous 2015).

The demersal fisheries were open access up to 1990; however, limited entry for trawlers was introduced as early as 1938. In 1978, a GQs was introduced for the trawlers, but the conventional vessels operated relatively freely until 1989. In this year, a resource crisis led to a number of changes in the fisheries management system with the aim of rebuilding fish stocks. The most important management measure was closing the fisheries and introducing individual vessel

Table 2. Summary of Norwegian and Icelandic Fisheries Statistics (average 2009–2013)

	Number of Vessels	Gross Tonnage (GRT)	Number of Fishermen	Catch (1,000 tons)	Value of Catch (million USD)	Price (USD/kg)
Norway	6,281	307,760	12,530	2,349	2,293	0.99
Iceland	1,650	158,090	3,800	1,231	1,175	0.96

Sources: Norway—The Directorate of Fisheries' annual publications on Norwegian fishing vessels, fishermen, and licenses; Profitability survey on the Norwegian fishing fleet; Economic and biological figures from Norwegian fisheries. Exchange rates from The Bank of Norway. Iceland—Statistics Iceland.

quotas (IVQ) and GQs for all vessel groups. Subsidies to the fishing fleet continued to be reduced, and by the mid-1990s the Norwegian fishing fleet was basically free of subsidies (Isaksen, Hermansen, and Flaaten 2015).

Since the mid-1990s, various schemes have been introduced to reduce the number of vessels in demersal fisheries through the transfer of fishing rights and quotas. The trawler fleet quotas were allowed to be transferred from one vessel to another if one was taken permanently out of Norwegian fisheries. These quota rights were time limited, but in 2005, they became permanent. The quotas were again made time limited in 2007. The time limitation is 25 years. In 2003, a similar program was introduced for coastal vessels over 15 meters, and in 2007 for vessels over 11 meters. From 2007, these transferred quotas were made time limited. The time limitation is 20 years. Twenty percent of the transferred quota was deducted and returned to the common quota pool of the vessel group. No transferability was allowed between vessel groups, and there were restrictions on transferability between regions (counties). (For a more comprehensive discussion of cod fisheries management, see Armstrong et al. 2014).

In Norway, the number of vessels and fishers declined steadily over several decades. A summary of the statistics on vessels, employment, catches, gross tonnage (GRT), price, and value of catches is given in table 2 (2009–2013 averages). The total number of vessels in the fisheries was about 6,300 in 2013, compared with 6,500 and 26,500[5] for 2009 and 1980, respectively. The total number of fishers has also declined steadily over the last few decades, from 34,800 in 1980 to about 12,500 in 2013. Of the latter, about 80% had fishing as their main occupation.

A problem with using the profitability survey time series is that both the calculation principles and the categorization of vessel groups by size and gear has changed over time. The last major revision of profitability studies was made in 2008.[6] According to the Directorate of Fisheries, the perspective was changed from a welfare economic viewpoint to accounting principles in business economics. The main change from the 2008 survey is that fishing rights are specified in the balance sheet, and the depreciation of time-limited fishing rights is specified in the profit and loss account (Anonymous 2010). The fact that the value and depreciation of fishing rights are specified in the surveys enables us to calculate the RR in the fisheries.

5. This includes 18,280 open boats.

6. Over time, accounting principles may change for different reasons, including changes in tax laws, international agreements (e.g., EU regulations), industrial structure, politics, and policy needs. It is not obvious to the authors why changes in the Norwegian and Icelandic profitability surveys took place when they did. Nor is it clear how fisheries management and regulations have affected accounting methods and statistics.

To be included in the profitability surveys, vessels have to meet some specific minimum levels in regard to size, income, and number of days at sea (Anonymous 2015). Based on these minimum levels, the average number of vessels included in the profitability studies for 2009–2013 is 1,610 and average employment is 8,230, which corresponds to about 65% of the total fisheries employment in table 2. However, the catch of these vessels amounted to 93% of the total fish landings for these years. While the number of vessels and fishers has declined year by year, as have the catches from 2010 to 2013, prices of fish and thus the value of the catches shows greater variation. Due to a price increase of about 75%, the value of catches was nearly 60% higher in 2011, the year with greatest value, compared to 2009.

ICELAND

The main source of data for Iceland is the Profitability in Fishing and Fish Processing Survey, now published yearly by Statistics Iceland, continuing work initially carried out by the National Economic Institute. Statistics Iceland utilizes tax returns, providing a comprehensive database, and the financial statements provided by firms as a supplement to their tax returns. Statistics Iceland also has access to registry data on industry and the basic technical and economic characteristics of firms.

The current ITQ system in the Icelandic fisheries is based on the Fisheries Management Act of 1990 and subsequent amendments. At present, the ITQ system applies to 25 different fisheries, which represent about 98% of landed value.[7] Initial quota shares were allocated to vessels, and vessels only, based on their catch history in the previous three years.

Based on stock assessment and scientific advice, the Ministry of Fisheries and Agriculture determines the total allowable catch (TAC) for the next fishing year, which commences September 1st. A valid fishing license is needed to participate in the fisheries. Two main types of licenses now exist—quota licenses and hook quota licenses—with the latter open only to boats smaller than 15 GRT using bottom longlines and hand lines.

A third type of license is the coastal license. Small vessels, operated by an active owner, using hand lines only, can, during the months of June, July, and August, fish almost freely. The only restriction is a ceiling (GQ) for the catch of cod, which increased from 3,995 tons in 2009 to 8,600 tons in 2015. The coastal license was one of many attempts to alleviate adverse effects, both psychological and economic, of the collapse of the financial sector in Iceland in 2008. The coastal license fits badly into the overall management system due to its derby-style characteristics.

In the ITQ system, a clear distinction is made between two types of quotas: TAC shares (permanent quotas) and annual catch entitlements (ACE). The ACE of each vessel is the product of its TAC share and TAC for each species. All quotas are denominated in cod-equivalent terms, as the cod fishery is by far the most important.[8] There is an upper limit of TAC share holdings for each harvester and the related firms or individuals, varying from 12% for cod to 35% for redfish. The combined TAC shares of each firm in all fisheries must also not exceed 12% of the total value of the TAC, measured in cod equivalents. The corresponding ceiling in the hook quota system is 5%.

7. This description is based on Arnason (2005) and Matthíasson and Agnarsson (2010).

8. The cod equivalents are based on the ex-vessel price of a kilo of fish of a given species relative to the ex-vessel price of a kilo of cod. Thus, holding a given amount of cod equivalents of cod, say, can provide more added value than holding the same amount of cod equivalents of haddock or saithe, for example.

There is considerable flexibility in the two quota systems. Catches may exceed ACE in some of the demersal fisheries, provided quotas are larger than catches in others. This, however, does not apply to the cod fishery. Up to 20% of quota holdings in most fisheries can be transferred between fishing years. Finally, should catches exceed quotas in any fishing year, the quota allocation of the subsequent year is simply reduced correspondingly. Overfishing may range between 3 and 5%, depending on the fishery.

Average and summary statistics (2009–2013) for vessels, employment, catches, GRT, price, and value of catches for Iceland are given in table 2. The total number of vessels participating in the fisheries was 1,696 in 2013, compared to 1,582 and 1,449 for 2009 and 1981, respectively. Contrary to this increase, the total number of fishers declined over the last few decades, from 6,037 in 1980 to about 3,000 in 2013. The statistics do not distinguish between degrees of employment, but from anecdotal knowledge, the vast majority involve full-time employment.

RESULTS

The data and results for Iceland and Norway for the concepts introduced and discussed in table 1, are compared in table 3 for 2013. Leasing fishing rights is excluded due to a lack of data and since lease income, in principle, should balance lease costs in the total fisheries of each country. Government auction of fishing rights has not been used in either of the two countries, but may be of importance in other cases. Industry-specific taxes and subsidies are also excluded since they are negligible in these two countries today. However, subsidies were quite important for Norway until about three decades ago. Nowadays the exemptions of environmental taxes, notably fuel taxes, remain (Isaksen, Hermansen, and Flaaten 2015), but since this is the case for most fishing nations, it has not been corrected in the context of table 3.

Table 3. Fishery Rent in Iceland and Norway (2013)

	Iceland		Norway	
Concept	Millions USD	Operating Revenue (%)	Millions USD	Operating Revenue (%)
Operating revenue	1,289	100	2,002	100
– Total operating expenses	–1,030	80	–1,596	80
– Depreciation of real capital	–76	6	–185	9
= Operating profit (EBIT)	183	14	221	11
+ Total financial revenues	0	0	48	2
– Total financial expenses	–153	12	–218	11
= Profit on ordinary activities before tax (EBT)	30	2	43	2
+ Depreciation of fishing rights	0	0	71	4
+ Financial costs of fishing rights	100	8	104	5
– Calculated interests on equity	–19	–1	–65	–3
= Resource rent unadjusted **(RR1)**	111	9	153	8
+ Adjustment for transfer pricing of raw fish	126	10	0	0
+ Adjustment for labor cost above opportunity cost	115	9	0	0
Resource rent (RR)	353	27	153	8

Sources: Profitability survey on the Norwegian fishing fleet (Anonymous 2015); Statistics Iceland; exchange rates from The Central Bank of Norway and The Central Bank of Iceland.

The RR1s of the two countries in table 3 are much the same: 9 and 8% of landed value for Iceland and Norway, respectively. However, when adjusting for the transfer prices of raw fish and labor costs above opportunity costs for Iceland, the RR amounts to as much as 27% of the operating revenue of the fishing fleet. Thus, these two characteristics are very important, but invisible, parts of the RR of the Icelandic fishing industry.

A comparison of the data in the different steps in table 3 might enable us to identify other causes of the difference in the RR. Operating expenses account for 80% of the operating revenue for both countries; however, the depreciation of real capital differs, at 6% of total revenue in Iceland and 9% in Norway. This difference is partly due to the profitability survey's vessel population for Norway, which is somewhat skewed with more large vessels than the total population, including vessels above 8.0 m only. On average, these vessels have a higher book value and depreciation per vessel than the Icelandic vessels. The net financial costs are 12% in Iceland and 9% in Norway, mainly due to the higher value of fishing rights in Iceland. Subsequently, the profit on ordinary activities before tax (EBT) as a percentage of operating revenue is 2% in both Iceland and Norway.

Depreciation of fishing rights is zero in Iceland, but 4% in Norway because fishing rights in Iceland are mainly time-unlimited rights, while a large part of Norwegian fishing rights is time limited, as discussed above. The financial costs of fishing rights are higher in Iceland than in Norway, however. Overall, the capital costs of fishing rights (depreciation and financial costs) are 8% in Iceland and 9% in Norway. Calculated interest on equity is 1.4% of total revenue in Iceland compared to 3% in Norway. RR1 is a bit higher in Iceland (9%) than in Norway (8%).

The following two steps in the calculation of RR in table 3 create a great difference in the RR on the bottom line and spill over to tables 4 and 5. The first step is an adjustment for the transfer pricing of raw fish, which in Iceland accounts for 10% of the operating revenue, on average. Vertically integrated fish processing companies do not pay market price for (all of) the fish and thus some of the RR may be found hidden in the accounts of the processing companies.[9] Our adjustment assumes that if all transactions were at arm's-length, then the equilibrium price would be somewhere in between the observed market price and the internally registered price. Such adjustments are not necessary for prices in Norway due to the industry structure and legal system for the first-hand sale of fish. The second step is adjustment for labor cost in Iceland, which counts for 9% of the operating revenue (table 3). Labor cost per worker was about twice as high in 2013 in fish harvesting compared to the economy as a whole. There are a number of reasons for this. Fishers are more likely to be full-time workers than the average worker. Further, they are away from home and experience more occupation-related hazards than the average worker. Part of their higher wage is compensation for such differences.

Work in progress by Statistics Iceland, initiated for this article, indicates that a person engaged in fishing earns an hourly wage that is 39 to 50% higher than they (considering explanatory variables such as age, education, and sex) could have earned engaged otherwise.[10] This is

9. The amendment to Act 74/2012, which was confirmed July 10th 2015 (after the completion of this project), fixes the basis for the catch fee in Icelandic fisheries. The Act prescribes that the base for catch fee levied on fishing firms should include 78% of profit on ordinary activities before tax (EBT) in land-based freezing firms and 5% of EBT of others processing demersal species. Also included in the tax base is a quarter of 22% of EBT in meal and oil processing and 25% of EBT in freezing of pelagic species (capelin and herring). Effectively, the tax authorities are trying to counter the taxational effects of transfer pricing.

10. This research uses both one-way and two-way fixed-effect regressions on data obained from the Icelandic longitudinal income database (Baum 2006, 220). Variation in the logarithm of hourly wages is explained by commonly used explanatory variables in addition to a binary variable taking the value 1 if the individual is engaged in fishing that year, 0 otherwise. The total

based on the methodology developed by Mincer (1958, 1974). The database consists of information gathered from official registry data (such as tax returns, labor market surveys, industrial statistics, education attainment, and the national registry). This database is kept and maintained by Statistics Iceland and has previously been used to estimate returns on education. As there seems to be more demand for positions for fishers in Iceland than there are positions, and based on the noted research and arguments, we conclude that 50% of the difference between wages in the fisheries and other industries is really RR accrued by the fishers due to the lay system, well-unionized labor, and unexplained social and institutional reasons. In Norway, however, the general view is that the remuneration of fishers, on average, is the same as their opportunity cost[11] (Nielsen, Flaaten, and Waldo 2012, 77–78 and footnote 11). Thus, there is no adjustment for this in the Norwegian case. The two adjustments for Iceland are the causes of the great differences in the bottom line RR in both absolute figures and as a percentage of operating revenue. For 2013, the RR in Iceland[12] accounted for 27% of the operating revenue compared to only 8% in Norway.

NORWAY

Table 4 provides the average economic performance of the Norwegian fishing vessels surveyed, using the indicators discussed above: profit (EBT), RR, and ROC. ROC is reported both by including fishing rights (ROC^I) and excluding fishing rights (ROC^E), for reasons discussed above. ROC for all Norwegian non-financial stock companies is included for comparison.

The EBT for the five-year period is 198 million USD, on average, and within the range of 43 and 405 million USD. The RR is 287 million USD, on average, reaching a maximum in 2011 of 506 million USD and a minimum in 2013 of 154 million USD. The financial costs of fishing licenses were calculated based on the book value of fishing licenses and permits, and the average interest rate actually paid for long-term and current liabilities. Calculated interest on equity is based on the book value of equity and the previous average interest rate paid for long-term and current liabilities.

RR is higher than profit for all years—45% higher, on average, ROC^I is 6.6%, on average, compared to ROC^E of 12.0%, a difference of 5.4 percentage points. RR and ROC^E are considerably higher than EBT and ROC^I, respectively, for each year and for 2009–2013, on average. Compared with the ROC for non-financial Norwegian companies, we see that ROC^E produced a higher yield, 12% compared to 9.2% for non-financial companies. This underlines the sugges-

dataset covers the period 1998 to 2012. The database consists of information gathered from several official registers, and the number of fishers in the database is in line with observations from labor market surveys and other surveys (E. Sigurðsson, economist, Statistics Iceland, personal communication, August, 2016).

11. This is also the view of the authors. In 2013 near-shore vessels below 11.0 m, on average, had an annual remuneration of the crew (including the owner) of NOK 380,000. Purse seiners, the most profitable fleet segment, on average had NOK 1,199,000 (including captain, mate, and chief engineer), both measured for full-time equivalents (Anonymous 2015). In the on-shore private sector, unskilled laborers, on average, made NOK 354,000, and skilled laborers with a lower college/university degree made NOK 564,000 per year. A survey among vessel owners (N = 219) in Norway (2007) found that none of the purse seiners had experienced recruitment problems, whereas in coastal "jigging" 12% had experienced such problems. On average, 71% of all vessels had not experienced recruitment problems (Sønvisen, Johnsen, and Vik 2011). A corresponding survey for 2015 found that 70% of all vessels (N = 741) had not experienced recruitment problems, whereas 20% had (J. P. Johnsen, professor, The Norwegian College of Fishery Science, University of Tromso, personal communication, August 2016). To the best of our knowledge, no fishing vessels have been unable to fish their quotas due to lack of crew.

12. In Iceland, fishing rent is a potential tax base. Fishery rent estimates corresponded to 5–10% of government tax revenues in 2011, but up to 20% if rent generated in the fish processing industry is included (Matthíasson 2012). This is relatively lower for Norway, which has important oil and gas sectors.

Table 4. Profit, Rent, and ROC in Norwegian Fisheries and Non-financial Companies (2009–2013)

	Profit and ROC (including fishing rights)		Rent and ROC (excluding fishing rights)		Norwegian Non-financial Companies
	Profit (EBT)	ROC^I	Rent (RR)	ROC^E	ROC
	(Millions USD)	(%)	(Millions USD)	(%)	(%)
2009	160	6.6	238	11.7	9.0
2010	198	7.1	272	12.1	9.7
2011	405	9.5	506	16.9	9.2
2012	184	5.8	263	10.5	10.2
2013	43	3.8	154	8.7	8.1
Average 2009–2013	198	6.6	287	12.0	9.2

Sources: Own calculations; data from the Norwegian Directorate of Fisheries and Statistics Norway.

tion, above, that there is positive RR in the Norwegian fishing industry. ROC for non-financial companies also includes oil- and gas-related industries. However, there is an industry-specific resource tax for the oil and gas industries that is deducted from revenue before ROC is computed. There is no similar resource tax for the fishing industry in Norway. As expected, ROC^E is higher for the fishing industry compared to the average non-financial companies. Profit and ROC^I are, as expected, lower than rent and ROC^E.

ICELAND

Table 5 shows profit (EBT), ROC, and RR in the Icelandic fisheries. As for the Norwegian fisheries, ROC is reported both including (ROC^I) and excluding (ROC^E) fishing rights. ROC for all Icelandic non-financial stock companies is reported for 2009–2011.

Profit for the five-year period is 46 million USD, on average, within the range of –11 and 98 million USD. RR is 391 million USD, on average, reaching a maximum in 2011 of 468 million USD and a minimum in 2009 of 331 million USD. RR is substantially higher than profit for all years, 8.5 times higher, on average, and ROC^I is 6.5%, on average, compared to the ROC^E of 23.4%, a difference of 16.9 percentage points. RR and ROC^E are considerably higher than profit

Table 5. Profit, Rent, and ROC in Icelandic Fisheries and Non-Financial Companies (2009–2013)

	Profit and ROC (including fishing rights)		Rent and ROC (exclusive of fishing rights)		Icelandic Non-financial Companies
	Profit (EBT)	ROC^I	Rent (RR)	ROC^E	ROC*
	(Millions USD)	(%)	(Millions USD)	(%)	(%)
2009	–11	6.0	331	21.0	6.3
2010	31	6.6	374	22.4	8.2
2011	98	7.4	468	24.5	8.1
2012	82	7.2	431	27.0	n.a.
2013	30	5.1	353	22.0	n.a.
Average 2009–2013	46	6.5	391	23.4	n.a.

* Data for 2012 and 2013 were not yet available from Statistics Iceland at the time of this project.
Sources: Own calculations; data from Statistics Iceland.

and ROC^I, respectively, for each year and for the average of 2009–2013. Table 5 includes ROC for Icelandic non-financial companies, but only for the years 2009–2011. Comparing ROC^E and ROC for non-financial companies, we see that ROC^E is substantially higher for all three years, three times higher than for Icelandic non-financial companies.[13] ROC^I for each of three years is lower than ROC for non-financial companies, on average, by about 1 percentage point.

DISCUSSION

The results shown in tables 4 and 5 demonstrate that the common measure of profit EBT underestimates RR for both countries. For these two important fishing countries, the 2009–2013 data thus supports (does not refute) the first hypothesis of this article:

EBT underestimate the natural resource rent in managed fish harvesting industries.

ROC^E is also higher than ROC^I, which is in line with the theoretical discussion above. The numerator is higher and the denominator lower for the former than the latter. The difference in the ROC measured by ROC^E and ROC^I is 5.4 percentage points for Norway and 16.9 for Iceland, on average. Thus, the second hypothesis also holds:

The commonly used business economic indicator ROC underestimates the welfare economic performance of managed fish harvesting industries.

Compared to the ROC of non-financial Norwegian companies of 9.2 percent, ROC^I is 2.6 percentage points lower, and ROC^E 2.8 percentage points higher. This demonstrates that the economic performance of Norwegian fishing vessels is higher than the average non-financial Norwegian company. This may come as a surprise to those who have based economic performance analysis purely on business economic indicators, such as OM and ROC^I. However, it is not a surprise for economists aware of the possibility of invisible RR in closed fisheries managed with licenses and other rights (Flaaten, Heen, and Salvanes 1995; Asche, Bjørndal, and Gordon 2009).

At the aggregate level for both countries (including all fishing vessels in the profitability surveys), RR is higher than EBT for each year and on average in the 2009–2013 period. Comparing the results between Norway and Iceland, we note that the two countries have the same ROC^I, on average, but Iceland has the highest ROC^E. Iceland has the most rationalized fishing industry (Nielsen, Flaaten, and Waldo 2012), and we, therefore, expect the highest ROC^E. However, Norway and Iceland have about the same profitability as gauged by the common business economic indicators above. This was expected, as the ROCs for non-financial firms are much the same in these countries. Preliminary work by the authors indicates differences between vessel groups in Norway. Since the value of fishing rights is low, EBT is larger than rent for the small-scale fishing vessels in the demersal fisheries, including the interest on and depreciation of these rights. The interest on equity exceeds the interest on and depreciation of fishing rights. Small-scale fishing vessels (< 11 m) have not been included in the structural programs allowing for transferable fishing rights; therefore, the book value of fishing rights is very limited.

13. Fishing companies are included in the non-financial sector, and the real difference between fisheries and other non-financial firms is, therefore, greater than shown in this table. Compared to Norway, this is more prevalent for Iceland where fisheries are a greater part of the economy, relatively speaking.

Estimates of vessel value when licenses are in use include license value, unless they are specified in the accounts. This thus includes some of the invisible rent as a rental cost for vessels, unless handled explicitly. This was the case in Norway from the early 1970s, when licenses were introduced, until 2008 (Flaaten, Heen, and Salvanes 1995; Anonymous 2010) and in the first decade of the Canadian sablefish fishery (Grafton 1995). For analysis of investment behavior and capacity adjustment, it is important to distinguish between investment in real capital and immaterial capital, such as fish quotas and fishing licenses (Nøstbakken, Thébaud, and Sørensen 2011). Some studies have intentionally distinguished between the two types of capital, but without full success (Anonymous 2006, 304). If the business costs of immaterial capital are included in the bioeconomic analysis of a fishery, the predicted open-access and optimal-managed industry will both be distorted.

An additional and very important question is whether it matters for industry profitability and investment behavior if licenses and quotas are granted free of charge to the first generation of holders of such rights. This was investigated for Norwegian purse seiners and the answer is positive: ". . . efficiency gains from introducing tradable quotas are not realized immediately if the initial quota allocation is based on grandfathering" (Nøstbakken 2012).

Does it matter if the concepts of profit and rent are mixed up and the data does not distinguish between real and immaterial capital costs? Yes, it does, for at least two reasons. First, in analyses of weak regulated fisheries (some limited entry and quota restrictions), real economic performance will be underestimated when immaterial costs, which include depreciation and financial costs of fishing rights, are included as costs. Industry representatives and analysts may conclude that the need for further policy reform is greater than it actually is. In particular, the former may even be eager to ask for government intervention to provide short-term relief, such as subsidies (Sumaila et al. 2010). Second, analysts may get their results partly skewed, exaggerating the description of the present rent loss situation in the industry, and overestimate the optimal reduction in fishing capacity and the necessary investment in fish stock.

Estimating rents, including IMR, based on company accounts, can only tell us something about what the rent is, given the structure of the industry and the abundance of fish at the time. However, it tells us nothing about what the potential rent might be. For this, we need models to analyze what happens for hypothetical structures of the fishing fleet and abundance of fish stocks. It is also likely that the costs of monitoring, control, and enforcement will increase in actual fisheries under rent generation management, and such costs should be deducted from the (gross) resource rent discussed herein (Schrank, Arnason, and Hannesson 2003).

In the well-known FAO and World Bank "Sunken Billions" report (Arnason, Kelleher, and Willmann 2009), capital and other costs for the main analysis were mainly based on the "Economic Assessment of European Fisheries" (Anonymous 2006), which includes some capitalized RR. "The value of fishing rights has not been included explicitly. In some cases it may be implicitly in the value of the vessel" (Anonymous 2006, 304). Both Iceland and Norway were included in this European economic assessment, and in those years the actual agencies did not publish data that distinguished fully between real and immaterial capital costs (Anonymous 2010; Matthíasson and Agnarsson 2010; Matthíasson 2012). Thus, capital costs may have been exaggerated. "Icelandic cod demersal multi-gear, multi-species" in 2005 had a potential "rent loss" corresponding to 55% of landed value of fish (Arnason, Kelleher, and Willmann 2009, Table 4.3, 43). Norway was not included in this table. However, the corresponding table in an advanced edition of the "Sunken Billions" states that "Norwegian trawl" in 1998 had a similar loss of 439%

of landed value (Arnason, Kelleher, and Willmann 2008, Table 19, 58). The latter, in particular, seems very high and may have been be distorted for unknown reasons; including the way capital costs have been calculated, as discussed above.

Policies for generating RR have both efficiency and distributional implications, though economists are traditionally more concerned about the former. The life of a manager within a Gordon–Schafer model is quite simple: effort and harvest control are equally efficient at leading to rent maximization and perfect adaptation; however, introducing extensions such as uncertainty, multiple cohorts, multiple species, a heterogeneous fleet, imperfect fish markets, seasonal variations, and economic analysis and management become complex and difficult to handle. It is outside the scope of this article to provide a review of all these issues discussed theoretically and empirically in the literature. However, for a recent overview of investment behavior and capacity adjustment in fisheries, see Nøstbakken, Thébaud, and Sørensen (2011), and for an analysis empirically investigating the basics for perfect adaptation and ITQs, see Nøstbakken (2012), who demonstrates that actual behavior is not always as efficient as assumed in simpler bioeconomic models. The type of taxation may impact investment in immaterial assets and investment (real capital) behavior. The more general literature on natural resources also handles such issues outside the theoretical perfect adaptation literature, including unproductive rent seeking (see Bhagwati 1982; Sachs and Warner 1999; Torvik 2002). Rent, actual and potential, in resource industries may spur unproductive rent-seeking activities. Even if the profit of a fishing fleet may be low, we have seen, above, that rent may be high.

DISTRIBUTION OF RENT

RR may be generated in fisheries through different types of policy instruments that are effective at reducing effort and increasing fish stocks. Instruments include buyback, auctions, licenses, quotas, and taxes. Rent capture through taxation and resource rental may generate different re-

Table 6. Distribution of the Resource Rent

Concept	Explanation
Resource rent (RR)	See table 1.
+ Former quota/license holders (vessel owners)	Rent accrues to previous rights holders if they sold their grandfathered rights (licenses, quotas) "profitably" (cf., Norway, above).
+ Part to present and future quota and license holders	Rent accrues to the present holders if they only or mainly grandfathered their rights, or bought "cheaply." Community quotas may keep the rent locally.*
+ Crew members' part	Well-organized and/or unionized labor may manage to be paid above their opportunity cost (cf., Iceland, above).
+ Processers' part through transfer pricing of raw fish	Vertically integrated firms may have an incentive to move revenue from the vessels to the processing plants because of the share system in the fleet (cf., Iceland, above).
+ Financial institutions	Sellers of rights may deposit their financial surpluses in banks that lend to buyers of rights. This is of importance if the banks are oligopolies in a thin capital market.
+ Auctions	Revenues accrue to the government, or other legitimate resource owners.
+ Resource taxes	Special taxes for the fishing industries (similar to petroleum and hydropower industries).
+ Company taxes	Regular taxes for all industries.

* See discussion in Charles (2001).

sults whether levied on profit, rent, or gross value of landings (Grafton 1995). Policymakers and politicians are, in general, rarely concerned with only the size of the pie, but also its distribution—within a generation and between generations. For example, Iceland and New Zealand are among the leading countries using ITQs, but without allowing full international transferability. In fact, Iceland does not allow foreign nationals to hold quota rights at all (Flaaten 2010). Table 6 gives a brief overview of possible rent distribution among the main groups of recipients in fisheries.

When resource owners wish to capture rent in rights-based fisheries through resource taxes, there are several ways of doing so, including quota rental charge, profit charge, lump sum charge, and *ad valorem* royalty charge based on quota holding and output price (Grafton 1995). Export taxes could also be used (Flaaten and Schulz 2010). When interests are deductible from EBIT, this reduces the net profit and the profit tax more for those who have debt financing compared with equity financing of vessels (Flaaten, Heen, and Salvanes 1995; Grafton 1995). Both the resource tax system and the debt-to-equity rate of the firm may thus affect efficiency and rent distribution.

CONCLUSION

This article theoretically discussed why EBT in regulated fisheries usually underestimates RR. The use of data from the two important North Atlantic fishing nations, Iceland and Norway, has strengthened the arguments and illustrated differences in the profit and rent concepts found in the literature.

In the long term, we expect that the ROC, including fishing rights, would be at the level of the opportunity cost of capital with the same risk. For both Iceland and Norway, ROC^I are lower than ROC for the national non-financial companies. Disregarding differences in risk, this would imply that the willingness to invest in fishing vessels would marginally decline, and the prices of fishing rights would fall over time. The investment drivers are not independent of the design of the fishing rights system, including the initial allocation of rights, as discussed in Nøstbakken (2012).

The grandfathering of fishing rights could also be called the political fisheries business cycle, as a kind of parallel to the macroeconomic concept of *the political business cycle* (Nordhaus 1975). Current government representatives may want to please their constituencies and the industry by granting rights from privatization (arbitrarily) to the present generation of fishers, or—to limit them to even fewer fishers—to the vessel owners. Initially, this increases business economic performance through ROC, but gradually this performance is eroded through the transferability of rights, implying differences in ROC^E and ROC^I as demonstrated for Norway and Iceland in Tables 4 and 5, respectively.

We have argued why it may matter if profit and rent concepts are confused. The underestimation of economic performance is one argument. Another important argument is that analysts searching for management improvements may have their point of departure partly skewed, exaggerating the description of the present rent loss situation in the industry and the need for a reduction of fishing capacity and stock increases. This is due to the inclusion of rent elements in fishing costs. Depreciation and the financial costs of fishing rights may be business economic costs; nevertheless, they are important elements of RR. This is, however, not an argument against the rationalization of fisheries, but a warning against the wrong use of concepts and data, which may have unwanted effects on efficiency and distributional outcome.

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