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Resource Rent Spillovers to Fishers Remuneration

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Abstract

Icelandic fishers operate on a higher wage rate than they might have attained in another profession. There could be a number of reasons for this. Fishers are more likely to be full-time workers than the average worker in the economy. Fishers are away from home and they experience more occupation-related hazards than the average worker. Part of their higher wage is compensation for such differences. We utilize a database consisting of information gathered from official registry data (tax returns, labour market surveys, education attainment and the national person registry) that has earlier been used to calculate return on education to estimate remuneration gains when a person switches from any occupation to fishing, correcting for individual factors and for factors like working hours. Preliminary results indicate that a person enjoys an hourly wage that is 39 to 50% higher than that they could have earned engaged otherwise (considering explanatory variables such as age, education and sex).

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Keywords: Remuneration contracts, Fishermen wages, Resource rent, Individual transferable quotas.

JEL codes: J33, J41, J52, L70, Q22, Q33

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Introduction

The general rules for remuneration of salary earners in fisheries are relatively similar across countries and across decades (even centuries!). Form of payment has evolved from being in kind to being pecuniary. But there is almost always some link between the value (size) of the catch and remuneration of the crew of a fishing vessel. Direct sharing of catch between owner of equipment and "owner" of labour has prevailed even if relations have developed from slavery and feudalism to present day capitalism even if other rules for remuneration have come into vogue in most other industries. Iceland has seen a fundamental change in her fishery management system from 1985 and onward. The present paper is an attempt to catalogue some of the effects that change has had on remuneration of crews.

The paper is organized in the following manner: First we give examples of sharing (lays) in historical context, then we explain the present day Icelandic arrangement, third we account for some of the effects the introduction of system of Individual Transferable Quotas (ITQs) has had on the lay system. Fourth, we discuss the development of visible (and invisible) resource rent in Icelandic fisheries. Fifth, we try to enumerate to which extent we can find spill-over of resource rent to salary of fishermen. The sixth section concludes.

The Icelandic Sharing Arrangement in historical context

Pay of Icelandic fishers is determined as a share of gross revenue, usually referred to as the "lay system". -Historically, the lay system has its roots in medieval times. A reference to remuneration by shares in Icelandic fisheries is given in one of the Sagas, The *Fóstbræðrasaga*

(Saga of the Sworn Brothers), in a discussion between Olaf II of Norway (995-1030) and his bard (Hreinsson, 1997). The lay system as in use in medieval times in Scandinavia predates the industrial revolution and may well reflect social relations of pre-industrial societies that based their subsistence on hunting. Vilhjálmur Stefánsson wrote in his diary during a stay among Husky inuits in Canada in 1906: "Some [...] are more energetic than others, and accomplish more, but all try and all do something. The fact that one works harder than another worries neither of them…." see (Stefansson, 2001), page 124. An overview of the historic development of the Icelandic system is given in (Matthíasson, 1998). Additional information is given in ("Einurð og samstaða sjómanna skilaði kjarasamningi," n.d.) and in (Valsson, 1990).

Lay systems are used in most fisheries worldwide as noted by (Anderson, 1982; Guillen, Macher, Merzéréaud, Boncoeur, & Guyader, 2015; Matthiasson, 1997; Platteau & Nugent, 1992; Sutinen, 1979; Zoeteweij, Turvey, & Wiseman, 1956),(Christensen, 2010) and (Vestergaard, 2010). Despite almost universal usage of remuneration by shares in fisheries, (McConnell & Price, 2006) and (Guillen et al., 2015) note that fishers are usually assumed to be remunerated by some other rule (fixed wage) in fisheries economic models.

(Davis, Gallman, & Gleiter, 2007) give a detailed account of remuneration of the whalers of New England , possibly in an attempt to satisfy an interest awoken among the general public by Melville's Moby Dick (Melville, 1988). Lance et al. gathered a well of data from the accounting books of whaling enterprises in New England during the 1800s. It is of interest to notice that Lance et al. assume the share of a whaler crew to be about 30% of the "net" defined as gross income minus voyage dependent expenditure under the command of the captain. Gross share-percentage in the range 30%+/-4% is commonly encountered, with a difference of 1 to 10 or more between the captain and a "green-hand".

The New Bedford whalers were not members of a union and did negotiate their shares individually. Able captains and experienced mates were in high demand as the success of a voyage was highly dependent on their skills. Lance et al. note that shares of other crewmembers translated into money payment that were below wage in shore based alternative occupations open to the sailor of a given skill. None the less, the relative wage of individual crew member was and is based on rank, independent of effort brought to the fishing endeavour by each individual.

The probability that a potential fishers participates in fishing will be lowered the lower is wage in fishing compared to other lines of activity. By the same token, the higher is the income potential of a fisher compared to other lines of activities the bigger will be the number of would-be fishers. Usually, a situation of large supply of would-be candidates in some line of work will induce adjustment of the wage level, i.e. if the wage level is up for negotiation, either on an individual or a collective level. But, if share parameters are fixed by legislation or hard-to-change historical convention and thus non-negotiable the downward pressure on wage levels of high fishery wages relative to other wages will not be effective. In good times, employers will enjoy a bigger pool of (possibly more productive) applicants. But the wage-level enjoyed by individual fisher will only follow the tune of the net- or gross- revenue of the fishing vessel. A more productive pool of workers might even enhance the wage difference in fishing vis-á-vis other industries as the vessel owners would have to share the proceeds from a potential productivity gain with their employees. Conversely, factors that negatively affect revenue will also affect fishermen salary negatively independently of development of salary-levels elsewhere in the economy. Now, assume that changes in fishery management bring about an increase in resource rent created in a given fishery. (Guillen et al., 2015) points out that a share system

forces the vessel owners participating in that particular fishery to share increases in rent with their crews. Guillen et al. also points out that when the vessel owners were operating under a fixed wage regime the increase in resource rent would accrue to the vessel owners. The reason is that a successful change of a management regime will induce increased volume of catch per unit of effort (measured as number of vessels and/or fishermen). If crews and vessel owners share gross revenue, then pay per fisher will automatically increase. If crews and vessel owners share net revenue, the gain accruing to active crews may increase even faster than in the case of gross-revenue sharing, as unit cost of effort may well be reduced due to changed management regime. Needless to say, management-regime change may well result in reduction in number of active fishermen and active vessels. The share system does not compensate fishermen made redundant while most successive management systems introduced are based on compensation to vessel owners for vessels taken out of active fishing. Increased rents would increase funds flowing to government independent of wage regime. Guillen et al. points out that standard models of fishery economics ignore the working of the share system by assuming a linear relationship between effort and cost independent of volume of catch. They show that a management strategy that maximizes total rent in the fishing industry may not maximize profits under a sharing regime.

The present day Icelandic Sharing Arrangement

For historical and institutional reasons, calculating crew pay is conducted in two phases. The first phase consists of calculating the Split Value (Skiptaverðmæti) which is the part of the (imputed) gross revenue that is split between the vessel owner and the crew. Second important stage is the calculation of the value of the Deck Hand Share (Hásetahlutur). The Split Value is partially defined by Act 13/1998. Definition of the Deck Hand Share is an integral part of every collective agreement.

The Split Value is the part of the total Revenue that is split between the vessel owner and the crew. Complicated (and disputed) rules govern how Split Value (Skiptaverðmæti) is calculated or imputed. Gross-revenue associated with a fishing trip can be defined as $R = \sum_{j=1}^{J} p_j\, x_j$ where x_j is the catch of specie j as weighted at dockside at the end of the trip and p_j is the (imputed) dockside price of specie j at the time of landing for all J species caught during the trip. The calculation of R may seem a simple, everyday task. Size of catch and distribution by species is usually not disputed as the fishermen have a rough idea regarding size of catch. Catch is also weighted at the dock-side by an officially accredited person for administrative purposes, see ("Iceland Responsible Fisheries for the benefit of future generations | Management and control system," n.d.).[1] Dockside price is hardly ever disputed for the part of catch that is auctioned by a public auction-house. The same is not true for price of catch within an integrated firm as will be discussed below. For illustrative purposes assume that a trawler with 15 man

[1] „All catches shall be landed in officially designated landing harbours; Accredited harbour officials weigh the catch by species and record in the central data base; Landed catch is subtracted from the vessel's quota. When quota is used up, the vessel owner must acquire additional quota for the vessel, else fishing must stop; failing that, the vessel loses its fishing license. The Directorate of Fisheries and the Icelandic Coast Guard monitor and control commercial fishing and the landing of catches." From http://www.responsiblefisheries.is/seafood-industry/management-and-control-system/

crew brings 100 tons of catch that brings 10 million kronur as gross revenue. The Split-value share (Skiptaverðshlutfall, *S*) can vary from fishery to fishery and from time to time based on: i) type of activity (lower for shrimp than demersal or pelagic), ii) price of oil (higher Rotterdam-price of oil, lower *S*, see ("Kjör sjómanna ráðast að hluta af olíuverði," n.d.)[2]), and iii) if the vessel is less than 7 years old (*S* increasing with age as new vessels are assumed to be more productive than older ones, see (*Kjarasamningur milli Sjómannasambands Íslands og Landssambands Íslenskra útvegsmanna og samtaka atvinnulífsins*, 2004)[3]). Thus, the Split-Value-Share does reflect input price and capital intensity of the operation. The Split-value share fluctuates around 70%, see also (Sigurðsson, 1986)[4] The value of the crew-revenue share is calculated as (imputed) gross revenue times crew-price share. In our example the crew-revenue share is 7 million kronur.

The deck-hand share is determined by the size of a second parameter, the deck hand share-percentage (d), the Split-value ($S \cdot R$) and the total number of crew (n). The deck-hand share-percentage is variable from vessel-type to vessel-type. It is about 27.9% for ordinary trawlers with a crew of 15[5]. In our example the deck-hand share would be 0.279 (the deck-hand

[2] Introduced in a collective agreement in January 1987, partly a reaction to repeated instances where the Parliament fixed a (lower) percentage in response to adverse development of oil prices, see https://www.mbl.is/greinasafn/grein/379624/.

[3] Introduced in a collective agreement in October 2004, see http://www.sfs.is/Media/kjarasamningur-liu-og-s.a.-vid-sjomannasamband-islands-sem-undirritadur-var-30.oktober-2004.pdf, Split-value percentage lowered by 10 percentage points for vessels less than 7 years old, subject to minimum payment to fishers. To be faced out 2024 to 2031, see http://www.ssi.is/kjaramal/kjarasamningur-milli-ssi-og-sfs/.

[4] The flow of funds between fishing and fish processing was simplified and reorganized by Act 24/1986. Part of the simplification was the abolition of export fee on fresh and processed fish. The proceeds from that fee had solely been used to finance costs accruing to the fishing firms. The Minimum Fish Price Board (see later) increased the price of fresh fish by 63%. The processors were compensated by the abolition of the export fee. To avoid overcompensation to fishermen due to the abolition of the export fee, the idea of the Split Value Share was introduced in the collective agreement between fishermen and vessel owners in the fall of 1986. A Split Value Share of 70% was assumed to restore the distribution of income between fishermen and vessel-owners already in 1986. See Sigurðsson (1986). https://www.sedlabanki.is/library/Skraarsafn/Fjármálat%C3%ADðindi/Gömul-Fjármálat%C3%ADðindi/Fjármálat%C3%ADðindi%201986%20ágú%20-%20des.pdf

[5] E-mail exchange with Hólmgeir Jónsson, February 2018. The example is valid for about 30% of the trawler fleet, 15 out of 50 (Hjartarson, 2018).

share-percentage) times 7 million kronur (the Split value) divided by 15 (the crew size). For this example, the size of the deck-hand share value is given as:

$$\frac{S \cdot d \cdot R}{n} = \frac{S \cdot d \cdot \sum_{j=1}^{J} p_j x_j}{n} = \frac{0.7 \cdot 0.279 \cdot 10{,}000{,}000}{15} = 130{,}200\ krónur$$

The share accruing to officers is formulated as additional deck hand shares. Thus, a first mate will receive one and half a share and a skipper at least two shares. Total number of shares depends on crew size and number of officers demanding additional share. These "extra shares" can vary from 1 to 3 depending in type of vessel and what gear is in use. Additionally, the vessel owner would have to pay holiday allowance, directly payable to individual fishermen in beginning of May each year, a 10 to 13% surcharge. Hence, to complete our example the crew of 15 would receive 26-27% of the gross value of the catch (assuming 3.2 extra shares and 10-11% in holiday allowance).[6]

Some effects of the ITQ system on lays

Coinciding with the consolidation of the Icelandic ITQ system from 1990 into the first years of the 2000s, the fisheries experienced at least 4 spells of long lasting strikes by fishers, i.e. in 1994, 1995, 1998 and 2001. Before 1991 the Split Value Price was fixed by a semi-governmental Minimum Fish Price Board (abbreviated MFPB) consisting of two participants from vessel owners and two from fishermen unions and four from congregations of processors. In case of tie, government would appoint a chair. Prices announced by the Board were effective

[6] Employer pension fund contribution is directly tied to size of total pay. Employer is also responsible for partial payment of salary in case of sickness and/or work-related injury recovery. Adding 16% or more to the total wage bill, see Sveinn Hjörtur Hjartarson (2018).

in transactions between vessel owners and processors. Act 84/1991 replaced the price-setting function of the MFPB by prices fixed at auction markets or by direct agreement between each crew and each vessel owner. The MFPB fixed a minimum price that was only effective for few small-scale fisheries like lump-sucker fishing. The crews were at an obvious disadvantage bargaining a price of catch as vessel owners were better informed regarding export prices of processed fish and on processors willingness-to-pay for fresh fish.[7] The vessel owners also had more bargaining power as they could shut down the operation of a vessel at any given time leaving the crew with payment just above unemployment insurance, see (Úrverinu, 1997) https://www.mbl.is/greinasafn/grein/368648/. Union spokesmen reported pressure for lower Split Value Price to reflect cost of leasing quota (and various other labour productivity enhancing improvements, see http://timarit.is/view_page_init.jsp?gegnirId=000502432, Ægir 9/1994), which explains the recurrent industrial disputes.

Disputes regarding rules for imputing prices of catch within an integrated or a semi-integrated company was the common denominator for all instances of industrial conflicts. A template for solution was invented by an arbitrator in 1998 (see (Sjávarútvegsráðuneytið, 1998) https://www.stjornarradid.is/efst-a-baugi/frettir/stok-frett/1998/03/04/Skyrsla-nefndar-i-kjaradeilu-sjomanna-og-utvegsmanna-mars-1998/). A special governmental

[7] Only about 16-17% of potential cod-supply is auctioned. The share for auctioned catch is somewhat higher for other species like haddock (33-34%) and Atlantic catfish, see https://www.bbl.is/frettir/samdrattur-i-magni-og-veltu-hja-fiskmorkudum/18731/. A slightly lower percentage for the fishmarkets is reported in Klemensson, Gestsson and Knútsson (2010) https://ir.library.oregonstate.edu/concern/conference_proceedings_or_journals/r207tq39j. They also report a declining share and fewer buyers of fresh fish at auctions. When discussing the proposal that later became Act 84/1991 the Members of Parliament that aired their opinion were more concerned that buyers (processors) would become victims of buyers curse than that owners of intergrated fishing firms would not use armslengths rules when pricing. Integrated firms were less common in 1991 than at the time of writing in 2018. Hence, the MPs judged the proposal based on a static view of the industry structure, see http://www.althingi.is/thingstorf/thingmalalistar-eftir-thingum/ferill/?ltg=115&mnr=63.

Fish Price Resolution Committee (Úrskurðarnefnd sjómanna og útvegsmanna, abbreviated as FPRC) was established. Vessel owners appoint 4 members to the board, fishermen unions appoint another 4 and the Minister of Fisheries appoints a chairperson. The board is assisted by a secretariat (Verðlagsstofa skiptaverðs) responsible for day to day tasks. Crews that do not find the Split-value-price used by their employer satisfactory can relay the case to the board. The board can fix a new Split-value-price which, surprisingly, is not binding for the employer. The board is responsible for collecting information regarding prices on auction market and in transactions within integrated fishing firms for all fish species of relevance. Based on the information collected the FPRC fixes a Split-value-price (usually a pricing rule tying price to length) that is in effect until a new ruling is published, see (Verðlagsstofa skiptaverðs, n.d.) http://www.verdlagsstofa.is/index.php/viemieunarvere.[8] A dispute that started in November 2016 and, after a strike, ended with an agreement in March 2017 indicates that the FPRC did not fully strike a balance that fishermen did find satisfactory. Part of the March-2017-agreement was to increase the Split-value-share by half a percentage point if prices are imputed following the FPRC rule and not a result from arms-lengths exchange at an auction market. Furthermore, the FPRC is authorized to collect and use information regarding development of export prices. Both items reveal that the fishermen unions suspected some form of "information engineering" vis-á-vis the FPRC by the owners of fishing firms.

Demand that crews participated in paying cost of lease of quotas were common shortly after the ITQ system was established (see Guðjón A. Kristjánsson op. cit.). Lease prices could be too high for break-even of a quota-short vessel owner subjected to the collective agreement.

[8] The committe has objectives similar to those of the former MFPB (Minimum Fish Price Board). But with one important difference: Its rulings are not binding.

Crews would then possibly have a choice between unemployment and becoming "co-leasers" of additional quota for the vessel, see (Hæstiréttur, n.d.).[9] Union officers (and crews) protested and maintained that there was no leeway to interpret neither the wording of collective agreements nor the wording of text of the law governing the fixation of the Split-value-price in a manner that allowed a "co-lease" praxis, see (Morgunblaðið, 1994).[10] This was easy enough to state for a union officer. Needless to say, much harder to withstand for crew members facing a choice between employment as crew or finding an alternative job outside of fishing or being unemployed. The conflict between collective interest of the crews and the individual incentives to "cheat" for the individual fisherman or individual crews, probably explains why it has been so hard to find a solution of the problem of fixing the Split-value-price.

In short: The period 1984 to 1991 did see the introduction of ITQs and the abolition of governmental participation in fixing the Split Share Value Price. Both events did weaken the position of fishermen unions and of the crew's vis-á-vis vessel owners at the same time as some

[9] Some of the cases where a crew had agreed with a written contract to co-finance lease of quota were brought to Court. A case in point is one from 1992. A written contract between crew and vessel owner was annulled by both the district court of Reykjanes (July 19th, 1994) and the Supreme Court of Iceland (February 15th, 1994), http://www.asi.is/media/7402/1996.522_(1994.416).pdf.

[10] The main objection by the fishermen and the fishermen unions was the fact that a vessel owner leasing out their quotas did not share the proceeds with the crew of the vessel that the quota was leased from. They pointed out the asymmetry and the unfairness associated with fishermen sharing costs of leasing in but not sharing gains of leasing out, Hólmgeir Jónsson e-mail communication 16.3.2018 (2018). Furthermore, the officials of fishermen unions as well as the common members did understand the „race-to-the-bottom" mechanism involved in accepting fishermen participation in cost of quota leasing: Vessel owners, that we shall label vessel owners A, that could force their crews to pay part of the lease-price would be at an advantage compared to vessel owners that did not have their crews participate (which will be labelled vessel owners B). Vessel owners A would then be able to bid higher lease price per kilo of quota than vessel owners B. Thus, the probability that a lease vessel was of type A increased helped by the market mechanism. The only way to stop this race to the bottom was to outlaw crew participation in quota leasing. The view that officials of fishermen unions were concerned about race to the bottom finds support in the fact that they initiate a change in the Fishery Management Act that restricts the possibility for a single unit (vessel) to lease-out and lease-in during one year, see https://www.mbl.is/frettir/innlent/1994/05/14/moguleikar_a_framsali_fiskveidikvota_threngdir_i_ny/, see also Hólmgeir Jónsson Fiskifréttir, 6. Des. 1996 – 46. Tbl 14 árg. Bls. 5 and Fiskifréttir 7. Febrúar 1997 5. Tbl. 15 árg. Bls. 5 Obviously, the profit maximizing strategy for a vessel owner in a system where fishermen participate in leasing in quota is to lease out all allotted quota and then lease all fished quota in. Thus, fishermen pay would be lowered considerably, cet.par. The most extreme form of this option is closed in May of 1994.

fishing operators did see their costs inflated due to cost of leasing quotas or due to cost of servicing debt related to procured quotas. Fishermen unions and fishermen have, for the last 30 years, tried to regain their former position and strength, as can be seen from the recurrent conflicts and strikes that have shaken the sector. Put differently: The vessel owners have used considerable firepower for the last 30 years to reduce the crew's share of income and rents. The intensity of the struggle suggests that considerable values are at stake. The vessel owners seem to be of the opinion that unaltered lay rules would transfer too much of the value added in the industry to the crews. Hence, the research question asked in this paper: To what extent have crews been able to obtain a part of the resource rent? Put differently: To what extent are crews in the Icelandic fishing fleet paid in excess of wages they would earn in alternative employment?

Resource rent

Calculating the resource rent when harnessing a non-renewable resource (mining) implies deducing the value of all inputs in their best alternative use from the value of the mined product. Assuming a final reserve of the non-renewable resource and fixed product and alternative-use prices, the annual amount of rent will diminish as density of the resource in the mine is reduced and remaining time of gainful economic exploitation shortens. Resource rent when harnessing a renewable resource is also calculated as the difference of income from the harnessed product and value of inputs in their best alternative use. Resource rent in renewable resource harvesting can be a steady stream of income if the growth potential of the resource is left intact by the harvester. A renewable resource can also be harvested at rates faster or slower than intrinsic growth. In the former case, the renewable resource is utilized as if it was non-renewable. The flow of resource rent from a renewable resource can continue unabated for considerable time.

A key to correctly estimate the resource rent in any form is to have a good measure of value of outputs and inputs in their best alternative use. Use of transfer pricing is widespread in Icelandic fisheries as shown above. Fishers are not remunerated according to value of labour input in alternative use, catch is sometimes valued at a market, but more often by bureaucratic means. Both caveats will taint official data as that of the Statistics Iceland recorded in table XX. Hence, vessel operating surplus will give a deflated estimate of rent if compensation of fishers is higher than in best alternative occupation. The problem will be compounded if price of catch as reported to Statistics Iceland is lower than best alternative ex-vessel price of fish. Assume absence of rents in processing, if transfer prices did reflect value in best alternative use. I.e. assume processing to be an ordinary zero-economic profit activity. Then, in the presence of distorted transfer prices, the operating surplus in fishing and processing is a better estimate of resource rent in the sector than the operating surplus in fishing alone. Both estimates ignore the effect of overcompensation for fishers. That is taken into account in Flaaten et al. (2017). Their conclusion is that a third of the resource rent in 2013 actually surfaced as operation surplus in the fishing operation, a third transferred to fish processing and a third captured by fishermen. A pricing of fresh fish that would have eliminated the resource rent flow from fishing to processing would have increased the fishers' share of the rent by 1/9; from 3/9 to 4/9.

Table 1 Operating accounts of fish and fish processing 2008-2016

Operating accounts of fish and fishprocessing 2008-2016							
Imputed cost of capital equipment, millions of kronur							
	Fishing	Fishprocessing	Fishing fee	Fishing industry and public purse	Value added in	"Profit" in fishing indursty as % of value added	"Visible" rent as percentage of value added
2008	17.316	15.864	- 270	32.910	100.052	33,2%	32,9%
2009	20.633	24.543	1.015	46.191	132.273	34,2%	34,9%
2010	21.881	21.661	2.265	45.807	137.548	31,7%	33,3%
2011	27.942	31.598	3.893	63.433	156.356	38,1%	40,6%
2012	25.411	31.790	9.836	67.038	161.176	35,5%	41,6%
2013	16.358	32.593	9.724	58.674	157.738	31,0%	37,2%
2014	13.482	22.799	8.121	44.402	138.069	26,3%	32,2%
2015	24.024	21.995	7.410	53.429	157.443	29,2%	33,9%
2016	17.240	14.467	7.852	39.560			

Source: Statistics Iceland, Financial accounts of fishing and fish processing and national accounts.

Table 1 shows that the extra profits in fishing and fish processing amounts to 30 to 60 billion kronur in running prices. Adding the fishing fee increases “visible” rent to 33 to 67 billion kronur. Compare that to total value added in fishing and fish processing of 157 billion kronur in 2015. The visible rent (as observable from the reports of Statistics Iceland) runs from 26% to 28% of value added in the industry 32 to 42% of value added if the fishing fee is counted in during the period 2008 to 2015. Note that the fishing fee is treated as a cost and not as a tax in EBITA calculations presented by Statistics Iceland. Thus, Statistics Iceland is reflecting the fact that the fishing fee is a cost-recovery instrument, partly at least.

Size of resource rent spillover to fishers

Guillen et al. (2015) attempt to measure the size of resource rent accruing to employees in the Nephrops Fishery in the Bay of Biscay. They consider different management strategy with open access as the base strategy against which other strategies are measured. A fixed wage as opposed to share wage is calculated by estimating the wage accruing to fishers under the base strategy; open access. Thus, they assume implicitly that the best alternative use of labour in Bay of Biscay is in an unregulated Nephrops Fishery. Our strategy for measuring the wage in best alternative use is very different as will be explained below.

According to Statistics Iceland the average cost per man-hour in fisheries was higher, even considerably higher than in any other industry except for aviation. Cost per man hour is 85% higher than in all other activities in the economy. Cost per employed is more than 2.5 times higher than cost per employed elsewhere in the economy. See table 2.

Table 2: Comparison of salary per employee in fisheries and in other industries

	Compensation of employees (gross) 2015, MKr	Total number of working hours per week, 2015, '000 hours	Number of employees	Hourly salary gross, 2015, Kr/hour	Salary per employee, Mkr	Excess hourly rate, fishery %	Excess salary per employee in fishery, %
Fishery	58365	185	3300	6057	17,7		
A - Agriculture, forestry and fishing	67177,0	368	6800	3511	9,9	73%	79%
C - Manufacturing	150413,8	709,9	16900	4075	8,9	49%	99%
C:10-12 - Manufacturing food,	65757,4	275	6500	4598	10,1	32%	75%
C:10.2 - Processing and preserving of fish, crustaceans and	35503,7	141,9	3200	4812	11,1	26%	59%
C:24 - Manufacture of basic metals	18838,0	92,5	2200	3916	8,6	55%	107%
D - Electricity, gas, steam and air	11699,3	57,8	1300	3893	9,0	56%	97%
E - Water supply; sewerage, waste management and	7825,9	37,7	900	3992	8,7	52%	103%
F - Construction	61397,5	467,5	10400	2526	5,9	140%	200%
G - Wholesale and retail trade; repair of motor vehicles and	125726,4	787,6	21600	3070	5,8	97%	204%
storage	93278,9	431,9	10100	4153	9,2	46%	92%
H:51 - Air transport	34344,5	80,6	1900	8194	18,1	-26%	-2%
I - Accommodation and food service	51695,0	353,8	10000	2810	5,2	116%	242%
J - Information and communication	62710,7	337,4	8700	3574	7,2	69%	145%
K - Financial and insurance activities	61675,4	236,6	5900	5013	10,5	21%	69%
activities	6859,0	33,5	800	3937	8,6	54%	106%
M-N - Various specialiced activities	100986,2	602,7	15200	3222	6,6	88%	166%
M - Professional, scientific and	62536,0	411,9	10200	2920	6,1	107%	188%
N - Administrative and support service	38450,1	190,8	5000	3875	7,7	56%	130%
N:79 - Travel agency, tour operator and other reservation	13790,7	67,1	1600	3952	8,6	53%	105%
O-Q - Public admin., Education and	313670,3	1618	45300	3728	6,9	62%	155%
O - Public administration and defence; compulsory	89576,8	273,8	6700	6292	13,4	-4%	32%
P - Education	103642,1	720,8	20100	2765	5,2	119%	243%
Q - Human health and social work activities	120451,5	623,4	18400	3716	6,5	63%	170%
R - Arts, entertainment and	16234,7	182,3	5900	1713	2,8	254%	543%
activities	21230,7	147	4100	2777	5,2	118%	242%
All other than fishery	1096780	6455	161300	3267	6,8	85%	160%

Nielsen et al. (2017) focus on income of small-scale fishers in Denmark, Norway, Sweden and Iceland. They also report average income accruing to fishermen in those countries. Table YY gives an overview of their findings.

Table 3: Annual yearly income for fishers (fishery salary in parentheses), EUR, 2012				
Country/Group	Sweden	Denmark	Norway	Iceland
Average wage in the economy	41,000	34,100	35,800	37,000
Average wage fishing	31,000 (20,100)	56,500 (38.800)	51,500	90,300 (85,500)
Costal fisheries	28,100 (25,500)	49,100 (46,600)	50,000-60,000	47,400 (44,400)

Source: Nielsen et al. (2017).

Table3 reveals that salary of Icelandic fishermen is more than twice the national average (salary of costal fishers is closer to the national average, though). The table also reveals that Icelandic fishermen are very well paid compared to their colleagues in the other Nordic countries. Some of the difference between the general wage level and the wage accruing to fishermen may be a compensation for inconvenience attached to fishing compared to other lines of activity. The inconvenience attached to being a fisher in Iceland is conceivably similar to the inconvenience of being a fisher in the other Nordic counties. Hence, if Danish and Norwegian fishermen are compensated for inconvenience of fishing, it can be deducted that Icelandic fishermen are overpaid. It should be noted however that the real value of fishery salary was exceptionally high in the year 2012.

Fishing entails longer hours and less convenience than a factory or an office job requiring compensation as alluded to above. Fishing used to be very hard, physical work. Machines, equipment and routines have eliminated the hardest tasks, but fishing is still more physically demanding than average work on shore. Work hazard is also more pronounced at sea than in most jobs on land, see Jensen et al. (2014, https://journals.viamedica.pl/international_maritime_health/article/view/38805). They point out that fatality has decreased substantially during last decades but is 25-50 times higher than the average in on-shore activities. We can thus expect self-selection into fishing based on

characteristics that are relatively scarce and that are valuable in some land-based activities (relatively low level of risk-aversion). Furthermore, the composition of the work force (age, sex, education, experience) may differ from the composition in land-based activities. Hence, some wage differential has its "natural" cause that is also valuable outside of fishing. Thus, we can expect that an average fisherman will find work that demands skills or risk attitude that is different from skills and risk-attitude demanded for an average job in the economy. Our quest is much like attempts to measure the gender wage gap, see (Hagstofa Íslands, 2010) https://hagstofa.is/media/49846/launamunur_kynjanna_lokaskyrsla_februar_2010.pdf. In accordance with the definition of rent we search for a measurement of remuneration accruing to fishers in excess of what that person would receive in best alternative occupation. Being a fisherman is a life-long occupation for some, while others are fishermen for long or short spells of time. The ICELID database is maintained by Statistics Iceland. We used a version of the database covering all individuals age 16 years and older, sending in tax return in Iceland during the period 1998 to 2012. The dataset is incomplete in the sense that occupation is self-reported by employer when reporting to the tax authorities. The tax authorities do not audit that information. The information may be lacking or the standards for occupation may be non-uniformly applied by different rapporteur's. Industry is reported at firm/conglomerate level, not at the level of individual operation. Occupation is classified according to ÍSTARF95 (based on ISCO-88). Hence, as integrated fishing firms employ both fishermen (which should be coded as 64.XX according to ÍSTARF95) and Employers specialized in fish-processing (should be coded as 10.20 according to ÍSTARF95). If the main activity of the integrated firm is fishing it will be coded as a fishing-firm according to ÍSAT2008(based on Nace Rev.2) (and the previous versions

of that standard). If the main activity of the integrated firm is fish-processing it will be coded as such according to the standard even if some of its employees are fishermen.

We added a new variable to the database. The variable represents the level of confidence for that a particular job record is that for an individual working as a fisherman. A job record with several high indications of being that for an individual working as a fisherman is therefore close to the value 1, while a record with several high indications of being a for an individual working as something other than a fisherman is close to the value 0. The most relevant information used for coding the variable includes the ÍSAT2008 classification of the firm and the ÍSTARF95 classification of the individual's vocation for each particular job record. In addition to the information within each record we used information from adjacent records for each individual (modelled based on data observed from survey data for the probability of individuals retaining the same vocation between periods). Using priors based on information from survey and census data (such as proportion of fishermen by age groups, gender, residence, and education) does add to the variability (it is used as a starting point for each record), but due to the relative small fraction of individuals working as fishermen it is mostly overwhelmed by the evidence from observations. It does however provide a good reference for the aggregate number of fishermen in order to verify the new variable. Hence, non-fishermen will hardly be coded as fishermen, while some fishermen will not be adequately coded. Assume that fishermen are paid a higher salary than non-fishermen. Then the bias introduced by our coding convention will lower measured difference between pay of fishermen compared to non-fishermen.

The dependent variable in the analysis is the logarithm of the real wage rate. Explanatory variables used in the analysis are; an indicator variable for whether the job record is that for an individual working as a fisherman, the age of the individual, the age of the individual squared

and divided by 100, an indicator variable for whether the individuals highest level of education is upper secondary or post-secondary (non-tertiary), an indicator variable whether the individuals highest level of education is tertiary, an indicator variable for whether the individual is a resident in the capital area, an indicator variable for whether the individual is married or cohabiting, the number of children aged up to 7 years old residing in his household, the number of children aged between 7 and 15 residing in his household, an indicator variable for whether the individuals nationality is something other than Icelandic, an indicator variable for whether the individual has disabilities, and an indicator variable for each year in the study.

Our estimation strategy is to run; (i) OLS against Fixed-Effects to account for latent individual specific effects, (ii) a Mincer type equation against an extended variant of the equation to assess the robustness of the results with available variables, and (iii) the scope of observation inclusion; including observations where we are confident of the record being of a fisherman or not against having more strict confidence criterion in order to assess the influence of uncertainty in the variable of interest (indicator for working as a fisherman). The combination of three alternations, with two variants each, yields eight estimations in total.

The results are reported in table 4 to 5. Table 4 assumes a narrow definition of fisher (high value of the Fisher variable). Table 5 assumes a more laxed definition. Marginal effects are reported in table 6.

Table 4. Parameter estimates for the wage equation using the ordinary least squares, logarithm of wage rate as dependent variable, and standard errors appear in parenthesis.

Variables	Broad scope		Narrow scope		Broad scope		Narrow scope	
Intercept	6.714	(0.003)	6.720	(0.003)	6.575	(0.003)	6.582	(0.003)
Fisherman	0.398	(0.002)	0.427	(0.003)	0.431	(0.002)	0.473	(0.003)
Age	0.043	(0.000)	0.042	(0.000)	0.039	(0.000)	0.039	(0.000)

Age^2 / 100	-0.044	(0.000)	-0.044	(0.000)	-0.041	(0.000)	-0.040	(0.000)
Upper secondary education	0.148	(0.001)	0.146	(0.001)	0.130	(0.001)	0.129	(0.001)
Tertiary education	0.332	(0.001)	0.333	(0.001)	0.301	(0.001)	0.304	(0.001)
Capital area					0.065	(0.001)	0.063	(0.001)
Married / Cohabiting					0.037	(0.001)	0.037	(0.001)
Children < 7 years					-0.002	(0.001)	-0.003	(0.001)
Children 7 - 15 years					0.005	(0.000)	0.005	(0.001)
Non-Icelandic					-0.116	(0.002)	-0.109	(0.002)
Disabilities					-0.230	(0.002)	-0.228	(0.002)
Year = 1999					0.059	(0.002)	0.058	(0.002)
Year = 2000					0.105	(0.002)	0.104	(0.002)
Year = 2001					0.149	(0.002)	0.147	(0.002)
Year = 2002					0.161	(0.002)	0.159	(0.002)
Year = 2003					0.188	(0.002)	0.186	(0.002)
Year = 2004					0.214	(0.002)	0.212	(0.002)
Year = 2005					0.258	(0.002)	0.255	(0.002)
Year = 2006					0.269	(0.002)	0.267	(0.002)
Year = 2007					0.281	(0.002)	0.279	(0.002)
Year = 2008					0.241	(0.002)	0.232	(0.002)
Year = 2009					0.149	(0.002)	0.144	(0.002)
Year = 2010					0.100	(0.002)	0.093	(0.002)
Year = 2011					0.125	(0.002)	0.117	(0.002)
Year = 2012					0.135	(0.002)	0.133	(0.002)
Observations	1,168,828		1,136,966		1,168,828		1,136,966	
R-squared	0.22		0.22		0.27		0.27	

Table 5. Parameter estimates for the wage equation using the fixed effects model, logarithm of wage rate as dependent variable, and standard errors appear in parenthesis.

Variables	Broad scope		Narrow scope		Broad scope		Narrow scope	
Intercept	6.327		6.336		6.362		6.374	(0.000)
Fisherman	0.329	(0.004)	0.380	(0.005)	0.343	(0.003)	0.404	(0.005)
Age	0.052	(0.000)	0.051	(0.000)	0.048	(0.000)	0.047	(0.000)
Age^2 / 100	-0.040	(0.000)	-0.040	(0.000)	-0.039	(0.000)	-0.038	(0.000)

Upper secondary education	0.007	(0.002)	0.007	(0.002)	-0.006	(0.001)	-0.006	(0.001)
Tertiary education	0.179	(0.002)	0.181	(0.002)	0.172	(0.002)	0.174	(0.002)
Capital area					0.012	(0.001)	0.012	(0.001)
Married / Cohabiting					0.002	(0.001)	0.002	(0.001)
Children < 7 years					-0.020	(0.001)	-0.021	(0.001)
Children 7 - 15 years					-0.005	(0.001)	-0.005	(0.001)
Non-Icelandic					-0.032	(0.003)	-0.031	(0.003)
Disabilities					-0.043	(0.003)	-0.042	(0.003)
Year = 1999					0.038	(0.001)	0.039	(0.001)
Year = 2000					0.059	(0.001)	0.059	(0.001)
Year = 2001					0.097	(0.001)	0.096	(0.001)
Year = 2002					0.111	(0.001)	0.111	(0.001)
Year = 2003					0.126	(0.001)	0.126	(0.001)
Year = 2004					0.143	(0.001)	0.143	(0.001)
Year = 2005					0.180	(0.001)	0.181	(0.001)
Year = 2006					0.190	(0.001)	0.190	(0.001)
Year = 2007					0.198	(0.001)	0.198	(0.001)
Year = 2008					0.165	(0.001)	0.166	(0.001)
Year = 2009					0.062	(0.001)	0.063	(0.001)
Year = 2010					-0.009	(0.001)	-0.011	(0.002)
Year = 2011					0.003	(0.002)	0.001	(0.002)
Year = 2012								
Observations	1,164,097		1,132,350		1,164,097		1,132,350	
Individuals	200,212		196,959		200,212		196,959	
R-squared (full model)	0.74		0.74		0.76		0.76	
R-squared (projected)	0.14		0.14		0.22		0.22	

Table 6. Marginal effects (as percentages) of the indicator variable for fisherman.

	Restricted equation		Extended equation	
	Broad scope	Narrow scope	Broad scope	Narrow scope
Ordinary least squares	53.3%	48.9%	60.5%	53.9%

Fixed effects model	46.2%	38.9%	49.8%	40.9%

According to table 6a person that has been working outside of fisheries, but has the characteristics necessary to work as fisher will increase his/her hourly wage by 40 to 60% by becoming fisher, or a fisher that quits will find his or her income reduced by 30 to 40%. We may conclude that half of the wage differential observed in labour cost data reported above is due to differences in characteristics as observed through the database. The rest of the difference is due to characteristics that are not observed through the database. Some of the difference can still be caused by fishery-specific characteristics that are not included in the database. Judging from the comparison between fisherman income in Iceland and in the other Nordic countries indicates a ceiling of 30-50% on payment for fishery-specific attributes in Norway and Denmark. Hence, a cautious estimate is that about half of the excess payment received by Icelandic fishermen is due to the existence of the resource rent in the fishery they participate in.

Individual vessel owners have on several occasions tried to reduce the share of revenue accruing to crews. Crews have been surprisingly successful in withstanding those attempts. We will not try to explain why that is so. We will however point out two facts: First, initial effect of introducing more effective fishery management system is reduction in cost per unit of effort rather than increase in catch volume (Hannesson2007, n.d.). Thus, the cost savings induced by the introduction of the ITQ system in Iceland were bound to accrue to the group of vessel owners. As crews remuneration is based on gross revenue, only small part of cost-of-effort savings did accrue to them. Secondly, it can serve the vessel owners well to avoid conspicuous accumulation of resource rent income on the books of the fishing firms as majority of Icelandic

voters have been in favour of higher fishing fees for the last 30 years. Paying crews salary well in excess of the salary they could earn in alternative employment may prove to be a cost-effective way of fighting back against that siege.

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