

FACULTY OF ECONOMICS

#### Birgir Þór Runólfsson

# Measuring the Quality of Property Rights: Evolution from Weak to Strong User Rights in the Icelandic

Advantages and Disadvantages of Strong User Rights in Fisheries, Copenhagen, October 16-18, 2023

#### **Economics of Property Rights**



- Economic exchange is usually depicted as the exchange of goods. A research program emerged in the 1960s; property rights theory (Alchian, Coase, Demsetz). That approach depicts economic exchange as exchange of property rights and states that the value of a good depends on the specific design of the relevant property rights. Secure property rights are said to promote efficiency, increase value and economic growth.
- Four components are often identified
  - 1. The right to use a good (usus).
  - 2. The right to modify a good (abusus).
  - 3. The right to enjoy the fruits from the use of a good (usus fructus).
  - 4. The right to transfer property rights of a good to other persons (venditio).
- These are often referred to as a "bundle" of rights.

#### Weak and Strong User Rights



- User rights in fisheries are a sub-part of a much broader topic of the economics of property rights.
- We refer to strong and weak user rights, and for the purpose of differentiating strong from weak user rights, we need a definition and a measure of the strength of user rights.
- Such a measure was suggested by Scott (1988, 1989, 1996, 2008) and more fully defined by Arnason (2000, 2007), who presented a flexible and numerical measure of property rights quality with his so-called Q-measure of property rights quality.
- By strong user rights in fisheries (SURFs), we mean fishing rights that score highly on the quality of property rights, or the property rights quality index (Q-measure).
  - Sole owner rights, individual catch quotas (IQs), individual transferable catch quotas (ITQs), and territorial user rights in fisheries (TURFs) are some examples of strong user rights.
- Weak user rights are fishing rights that score low on the quality of property rights.



#### Scott's six characteristics



- Figure shows Anthony Scott's (2008) six characteristics graphically.
- The arrows represent the dimension of the property right, and do not imply interactions between the characteristics.
- The measured dimensions are not necessarily independent.



#### Arnason's Q-measure of property rights quality



• Value for each attribute can range from 0 to 1

#### Arnason's four attributes



- Security refers to ability of the holder of a property right to withstand challenges to his property right. Best thought of as the probability that the owner will be able to hold on to his property right. Probabilities range from zero to one. A measure of unity means that the owner will hold his property with complete certainty and a measure of zero means that the owner will certainly lose his property.
- **Durability** refers to the time span of the property right. This can range from zero, to infinite duration. Leases are examples of property rights of a finite duration.
- **Exclusivity** refers to the ability of the property rights holder to utilize and manage the property without outside interference. The right of a fisherman to go out fishing has exclusivity reciprocal to the number of other fishermen with the same right. The degree of exclusivity can range from zero corresponding to no exclusivity whatsoever to perfect exclusivity which may be given the measure of unity.
- **Transferability** refers to the ability to transfer the property right to someone else. For scarce (and valuable) resources, this characteristic is economically important because it facilitates the optimal allocation of the resource to competing users/ uses. A feature of transferability is *divisibility*, the ability to subdivide the property right into smaller parts for the purpose of transfer. Perfect transferability implies both no restrictions on transfers and perfect divisibility.

#### How to calculate the Q-index



 $\mathbf{Q} \equiv \mathbf{S}^{\alpha} \cdot \mathbf{E}^{\beta} \cdot \mathbf{D}^{\gamma} \cdot (\mathbf{w}\mathbf{1} + \mathbf{w}\mathbf{2} \cdot \mathbf{T}^{\delta}),$ 

where S denotes security, E exclusivity, D duration and T transferability.  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  are parameters and  $w_1$  and  $w_2$  are weights.

 $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ ,  $w_1$ ,  $w_2 > 0$  and  $w_1 + w_2 = 1$ 

Following Arnason we use the following specifications:  $\alpha = \beta = \gamma = 1/3$ ,  $\delta = 1$  and  $w_1 = 0.6$  and  $w_2 = 0.4$ .

# Hypothesis on relation between property rights quality and economic efficiency

Likely relationship between property rights quality and economic efficiency:

S shape curve.

Increasing Q-measure at low levels, not much change in efficiency (flat slope)

Increasing Q-measure at high levels, not much change in efficiency (flat slope)

Increasing Q-measure "between", great increase in efficiency (steep slope)





#### Strong User Rights



- User Rights are rights to extract
- Strong user rights in fisheries refer to fishing rights that score reasonably highly on property rights quality index with respect to the fishing activity (not necessarily the fish stocks).
- Weak user rights in fisheries therefore refer to fishing rights that score low on the property rights quality index.
- Management of fish stocks and enforcement of fisheries management system is usually the responsibility of government.

#### What strengthens/weakens quality score



- Security
  - 1. Probability of holding (secure) property right
    - a. Good security allows holder to receive payoff of improvements/increased value in the future.
    - b. Uncertain volume/share affects this (time dimension: "decreasing share").
- Durability
  - 1. Duration of right, the longer the better
  - 2. Indefinite duration vs. perpetuity
    - a. Perpetuity requires government to compensate/buy right
    - b. Indefinite duration means rights can be revoked altogether

#### What strengthens/weakens quality score



- Exclusivity (incl. Flexibility )
  - 1. A right to a volume of harvest (or a share of total TAC)
    - a. Uncertain volume or non-fixed share would violate this
  - 2. Number of holders/vessels may matter, fewer=>more exclusivity.
  - 3. To take the harvest in a way he prefers without interference
    - a. Restrictions by regulations would violate this (less flexibility)
      - i. Regulations interfere with management of harvesting
  - 4. Tax on quota restricts receipt of income from harvesting
  - 5. Restrictions on disposal, exporting unprocessed catch, is a restriction (less flexibility)
  - 6. Flexibility, to land above quota, carryover between fishing years, (limited) interchange between species (counting landing of one quota species against unused quota in other species)

#### What strengthens/weakens quality score



• Transferability (incl. Divisibility)

Transferability determines the extent to which a holder may bequeath, trade or sell his interest in a resource

- 1. Restriction on collateral undermines transferability (non-transferability undermines property as right cannot be used as collateral)
- 2. Restrictions on who can hold right limits transfers
  - a. Only Icelanders/Icelandic firms (cap on foreign ownership)
  - b. Only vessels can hold quotas (and government)
- 3. Restriction on consolidation (cap on quota holding) limits transfers
- 4. Requirements of use (harvest) limits transfers
- 5. Restriction/cap on amount of quota on a vessel (no more than vessel can reasonably catch).
- 6. Restrictions on horizontal/vertical rights limits transferability
- 7. Community pre-emption may limit transferability

#### **Open access fisheries**

- Iceland's fisheries were, for all intents and purposes, international and common property fisheries before the extension of the fisheries jurisdiction (EEZ) to 50 miles in 1972 and to 200 miles in 1975.
- Foreign fishing fleets featured prominently on the fishing grounds, taking almost half of the demersal catch.
- The extension of the fisheries jurisdiction all but eliminated foreign participation in the Icelandic fisheries.
- The development of the Icelandic fisheries in the post-war era therefore closely followed the path predicted for an open access fishery, exhibiting increasingly excessive fishing capital and effort compared to reproductive capacity of the fish stocks.
- With the *de facto* recognition of the exclusive 200-mile zone, the situation changed.
- Iceland fought three 'cod wars' with the United Kingdom in 1958-1976, or each time the EEZ was unilaterally extended: to 12 nautical miles in 1958, 50 miles in 1972, and 200 miles in 1975. An agreement eventually concluded each episode and the last of the British trawlers left the Icelandic EEZ by December 1976.





#### Initila management measures fail



- Following the extension of the EEZ to 200 miles, the cod fishery, which is the major demersal fishery, was subjected to an overall catch quota (TAC).
- Initial management measures taken in the demersal fisheries following the EEZ extension were inadequate and did not alter the common property nature of these fisheries.
- Domestic fishers still had to compete for shares in the catch.
- The annual quotas recommended by the marine biologists proved difficult to maintain.
- Effort restrictions, taking the form of limited allowable fishing days for each vessel, were introduced in 1977.
- The demersal fleet continued to grow both through investment in improvements of existing vessels and with new vessels, as entry was still possible.
- The annual allowable number of fishing days for each vessel were, therefore, reduced from year to year.

#### **Evolution of Individual Quotas in Iceland**



- 1975 The herring fishery: Individual vessel quotas
- 1980 The capelin fishery: Individual vessel quotas
- 1984 The demersal fisheries Individual (transferable) vessel quotas
- 1985 The demersal fisheries: Effort quota option expanded
- 1991 A uniform system of individual transferable share quotas in all major fisheries (for all vessels over 6 GRT)
- 2004 Fishing tax introduced
- 2004 Separate ITQ system for "small" vessels
- 2009 Summer "derby" fishery for "small" vessels
- 2010 Large increase in fishing tax
- 2011 Vessels return 5,3% of all quotas each year to government for Summer "derby" fishery, regional quotas, etc.



#### Evolution of quality score in Iceland

	1978	1984	1991	2005	2012	2018	2020
Security	1,0	1,0	0,85	0,9	0,85	0,98	0,98
Exclusivity	0,01	0,6	0,7	0,8	0,7	0,75	0,75
Durability	0,9	0,25	0,8	0,9	0,95	0,95	0,95
Transferability	0	0,9	0,9	0,85	0,8	0,8	0,8

#### **1978 Effort restrictions introduced**



- Security (1,0) (Is it applicable?)
- Durability (0,9) (Is it applicable?)
- Exclusivity (score 0,01)
  - Open access, common pool (only Icelanders)
    - Only restriction is through access to finance (government "monopoly" on banking and loans)
    - Cap on allowable fishing days
    - Gear and area restrictions
- Transferability (score 0)
  - No licensing or user rights
- Q-value 0,12

#### 1984 ITQs introduced in important demersal fisheries

- Vessel quota system for vessels 10 GRT and larger
  - Security (1,0) some uncertainty about volume of quota?
  - Durability (score 0,25) only 1 year, should score be lower? 1/10?
    - 1 year duration
  - Exclusivity (score 0,61)
    - Licensing for larger vessels (access mostly closed), about 667 vessels with quota
    - Small vessels common TAC (amount not share of overall TAC), open access
    - A few large vessels have option to choose effort quota (this became more attractive in 1985-1990)
    - TAC for cod 200 thousand mt (increased to 242 t mt), catch 283 t mt
    - Export of unprocessed catch penalized 25%
  - Transferability (0,73)
    - Within year quota transferable, with some restrictions
    - Quota share not transferable (except with sale of vessel or company)
  - Q-value 0,48





#### **1991 Comprehensive ITQs**

- Vessel quota system for vessels 6 GRT and larger
  - Security (0,85)
  - Durability (score 0,8)
    - Indefinite duration, legislation subject to revision
  - Exclusivity (score 0,6)
    - Small vessels common TAC (amount not share of overall TAC)
    - Small vessels two systems; cod cap and effort quota(fishing days), 1127 vessels
    - TAC for cod 265 thousand mt, catch 274 mt (in 1991/92)
    - Export of unprocessed catch penalized 20%
    - Total number of vessels in ITQ system was 1433 (note more than double that of 1984 allocation), thereof 819 small vessels
  - Transferability (0,91)
    - Harvest 25% every other year
    - Within year quota transferable, with some restrictions
    - Quota shares transferable (some restriction on transfer of vessels)
  - Q-value 0,72

#### 2005 All fishing under ITQs, but 2 systems



- Vessel quota system for all vessels
  - Security (0,9)
  - Durability (score 0,9)
    - Indefinite duration
  - Exclusivity (score 0,83)
    - Small vessels in separate ITQs (TAC share of overall TAC), system phased in 2001-2006 (17,5% of cod TAC)
    - Catch in line with TAC for cod (2005/06)
    - All species under ITQs
    - Fishing tax, special tax on quotas based on overall historical profitability (2 1/2 years back)
    - Total number of vessels in ITQ system 477, down by about 2/3 since 1991, but increase in size and power.
  - Transferability (0,9)
    - Within year quota transferable, with some restrictions
    - Quota shares transferable (some restriction on transfer of vessels)
    - Harvest 50% every other year
    - Restriction/cap on amount of quota on a vessel (no more than vessel can reasonably catch).
    - Restriction on consolidation (cap on quota holding) limits transfers
  - Q-value 0,84

#### 2012 Increased fishing tax, Summer derby fishery



- Vessel quota system for all vessels
  - Security (0,85)
  - Durability (score 0,95)
    - Indefinite duration
  - Exclusivity (score 0,73)
    - Small vessels in separate ITQs (TAC share of overall TAC)
    - All species under ITQs, except Summer "derby" fishery
    - Almost 100% of TAC is allocated but vessels have to return 5,3% of quotas to gov't for "derby" fishery, regional quotas, etc. (exception in mackerel, monkfish)
    - Increase in fishing tax (250-300%), based on overall historical profitability (2 1/2 years back)
    - Total number of vessels in ITQ system 261, down by about 4/5 since 1991
    - Number of vessels in "small" vessel ITQ 342, down by 50%. But additional 230 only in Summer fishery.
  - Transferability (0,87)
    - Within year quota transferable, with some restrictions
    - Quota shares transferable (some restriction on transfer of vessels)
    - Harvest 50% every year
    - Restriction/cap on amount of quota on a vessel (no more than vessel can reasonably catch).
    - Restriction on consolidation (cap on quota holding) limits transfers
  - Q-value 0,80

#### 2018 fishing tax at higest level (total)



- Vessel quota system for all vessels
  - Security (0,95)
  - Durability (score 0,95)
    - Indefinite duration
  - Exclusivity (score 0,67)
    - Small vessels in separate ITQs (TAC share of overall TAC)
    - All species under ITQs, except Summer "derby" fishery
    - Almost 100% of TAC is allocated but vessels have to return 5,3% of quotas to gov't for "derby" fishery, regional quotas, etc.
    - Fishing tax at new high, still based on overall historical profitability (2 1/2 years back)
    - Total number of vessels in ITQ system 224 down by about 85% since 1991
    - Number of vessels in "small" vessel ITQ 316 down by 50%. But about 100 additional only in Summer fishery.
  - Transferability (0,87)
    - Within year quota transferable, with some restrictions
    - Quota shares transferable (some restriction on transfer of vessels)
    - Harvest 50% every year
    - Restriction/cap on amount of quota on a vessel (no more than vessel can reasonably catch).
    - Restriction on consolidation (cap on quota holding) limits transfers
  - Q-value 0,80

#### 2020 ITQ system for larger vessles and smaller vessels, + summer derby

- Vessel quota system for all vessels
  - Security (0,95)
  - Durability (score 0,95)
    - Indefinite duration
    - Within year quota transferable, with some restrictions
    - Quota shares transferable (some restriction on transfer of vessels)
  - Exclusivity (score 0,83)
    - Small vessels in separate ITQs (TAC share of overall TAC)
    - Catch in line with TAC for cod (2019/2020)
    - All species under ITQs
    - Fishing tax, special tax on quotas based on profitability 1 1/2 years back.
    - Total number of vessels in ITQ system 178, down by about 87% since 1991, but increase in size and power
  - Transferability (0,87)
    - Harvest 50% every year
    - Restriction/cap on amount of quota on a vessel (no more than vessel can reasonably catch).
    - Restriction on consolidation (cap on quota holding) limits transfers
  - Q-value 0,86



#### TAC and catch, cod 1976-2021





#### Small-vessel cod catch and share in total cod catch





Cod catch Share of total cod catch



#### Number of fishing vessels in ITQ systems 1991-2020



#### Fishing tax and other fees on fishing 1993-2020





### OF ICELAND

#### Evolution of quality score in Iceland

	1978	1984	1991	2005	2018	2020
Security	1,0	1,0	0,9	0,9	0,98	0,9
Exclusivity	0,01	0,6	0,6	0,8	0,75	0,82
Durability	0,9	0,2	0,8	0,9	0,95	0,9
Transferability	0	0,9	0,91	0,85	0,8	0,82
Q-value	0,12	0,48	0,73	0,81	0,82	0,82

#### **Evolution of the Q-score in Iceland**



	1978- 1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994- 1998	1999- 2002	2003	2004	2005	2006	2007- 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Security	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	0,85	0,85	0,85	0,9	0,9	0,9	0,9	0,9	0,95	0,95	0,85	0,85	0,85	0,85	0,9	0,98	0,98	0,95	0,98	0,98	0,98	0,98
Exclusivity	0,01	0,6	0,55	0,5	0,5	0,5	0,45	0,4	0,7	0,7	0,7	0,65	0,65	0,7	0,7	0,8	0,8	0,85	0,8	0,75	0,7	0,7	0,65	0,7	0,75	0,75	0,75	0,75	0,75	0,75
Durability	0.9	0.25	0.25	0.4	0.4	0.5	0.5	0.5	0.8	0.8	0.85	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Transferability	0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Hansterasiney	Ū	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,05	0,05	0,03	0,05	0,05	0,05	0,05	0,05	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
	0,12	0,51	0,50	0,56	0,56	0,60	0,58	0,56	0,75	0,75	0,76	0,78	0,76	0,78	0,78	0,81	0,83	0,85	0,78	0,77	0,76	0,76	0,76	0,80	0,82	0,81	0,82	0,82	0,82	0,82

Q-Index 1978-2020



#### Scoring sub-attributes of the Q-value



 $\mathbf{Q} = \mathbf{S}^{\alpha} \cdot \mathbf{E}^{\beta} \cdot \mathbf{D}^{\gamma} \cdot (\mathbf{w}_1 + \mathbf{w}_2 \cdot \mathbf{T}^{\delta}), \ \mathbf{0} \le \mathbf{Q} \ge \mathbf{1}$ 

Scoring S and D without sub-attributes

Scoring *E* and *T* by sub-attributes

 $\mathbf{E} = \mathbf{a}^{\alpha} \cdot \mathbf{b}^{\beta} \cdot \mathbf{c}^{\varepsilon} \cdot \mathbf{d}^{\delta} \cdot \mathbf{e}^{\gamma} \cdot \mathbf{f}^{\eta}$ 

Where  $\alpha = \beta = \varepsilon = 1/4$ ,  $\delta = \gamma = 1/16$ , and  $\eta = 1/8$ 

 $\mathsf{T} = \mathsf{g}^{\alpha} \cdot \mathbf{h}^{\beta} \cdot \mathbf{i}^{\varepsilon} \cdot \mathbf{j}^{\delta} \cdot \mathbf{k}^{\gamma} \cdot \mathbf{h}^{\eta} \cdot \mathbf{m}^{\rho}$ 

Where  $\alpha$ =3/10,  $\beta$ =2/10, and  $\varepsilon$ = $\delta$ = $\gamma$ = $\eta$ = $\rho$ =1/10

#### Scoring sub-attributes of *E* in the Q-value



 $E = a^{\alpha} \cdot b^{\beta} \cdot c^{\varepsilon} \cdot d^{\delta} \cdot e^{\gamma} \cdot f^{\eta}, \text{ where } \alpha = \beta = \varepsilon = 1/4, \ \delta = \gamma = 1/16, \text{ and } \eta = 1/8$ 

- $a \rightarrow \mbox{ total share of catch of TAC species in current fishing ear }$
- $b \rightarrow \mbox{ number of vessels active in current fishing year }$
- $\mathsf{c} \to \mathsf{tax}$  on quota (inverse score)
- $d \rightarrow$  restrictions of disposal, exporting unprocessed catch (inverse score)
- $e \rightarrow restrictions$  on fishing days, season, gear, etc.
- $f \rightarrow$  flexibility, swap between species, fishing over quota/carryover between fishing years

#### Scoring sub-attributes of T in the Q-value

 $T = g^{\alpha} \cdot h^{\beta} \cdot i^{\varepsilon} \cdot j^{\delta} \cdot k^{\gamma} \cdot l^{\eta} \cdot m^{\rho}, \text{ where } \alpha = 3/10, \beta = 2/10, \text{ and } \varepsilon = \delta = \gamma = \eta = \rho = 1/10$ 

- g  $\rightarrow$  transferability of vessel, share, divisibility of share
- $h \rightarrow$  transferability of annual quota, divisibility of annual quota
- i  $\rightarrow$  restrictions on using share as collateral (inverse)
- $j \rightarrow$  restrictions on who can hold quota, Icelandic, vessels, government (inverse)
- $k \ \rightarrow$  restrictions on consolidation, cap on quota holding (inverse)
- $I \rightarrow$  requirements on use (harvest), restrictions/cap on quota on vessel (inverse)
- $m \rightarrow$  community/union pre-emption right to block transfer (inverse)



#### Q index and scores by attributes



	1978- 1983	1984	1985	1986	1987	1988- 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002- 2003	2004	2005	2006	2007	2008	2009	2010- 2011	2012	2013	2014	2015	2016- 2017	2018	2019	2020
Security	1,0	1,0	1	1	1	1	1	0,85	0,85	0,85	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,95	0,95	0,95	0,85	0,85	0,85	0,9	0,95	0,95	0,95	0,95	0,95	0,95
Exclusivity	0.01	0.61	0 57	0.48	0 50	0 51	0 50	0.60	0.66	0.66	0.66	0 71	0 72	0 74	0 74	0 74	0 74	0.76	0.77	0.78	0.83	0.84	0.86	0.88	0.85	0.82	0 73	0 74	0 74	0.83	0 77	0.67	0.80	0.83
Durahility	0.9	0.25	0.25	0.4	0.4	0.5	0.5	0.8	0.8	0.85	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.85	0.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
	0,5	0,25	0,25	0,4	0,4	0,5	0,5	0,8	0,8	0,85	0,9	0,9	0,9	0,9	0,9	0,5	0,5	0,5	0,9	0,9	0,5	0,5	0,5	0,5	0,85	0,85	0,95	0,55	0,95	0,95	0,35	0,33	0,95	0,95
Iransferability	0	0,73	0,73	0,73	0,73	0,73	0,73	0,91	0,91	0,91	0,91	0,91	0,91	0,93	0,89	0,90	0,89	0,89	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,87	0,87	0,87	0,87	0,87	0,87	0,87	0,87	0,87
	0,12	0,48	0,47	0,52 1,0	0,52	0,57	0,56	0,72	0,74	0,76	0,78	0,80	0,81	0,82	0,81	0,81	0,80	0,81	0,82	0,82	0,84	0,86	0,87	0,87	0,81	0,80	0,80	0,82	0,83	0,86	0,84	0,80	0,85	0,86
				0,9																														
				0,8																						$\sim$	$\sim$							
				0.7																														
				0.6																														
				0.5						/																								
				0.4				Γ																										
				0,4																														
				0,5																														
				0,2				<b>J</b>																										

#### Q-index compared with sub-attributes scores





Q index Q index based on sub-attributes

#### Correlates with value of quotas





#### Correlates with profits







# Thanks!

# Total fish catch, landed value and export value of fish products 1993-2022 (constant prices 2022)





Cod

## Total cod catch, landed value and export value of cod products 1993-2021 (constant prices 2022)





Cod catch Export value at 2022 Ikr