A tale of two quota system

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Abstract

For centuries, agriculture and fisheries have been Iceland's most important economic activities; but, during the past century, the relative importance of these two mainstays of Iceland's economy has dwindled. At the end of the 1970s, both branches found themselves in dire straits, although for different reasons. In agriculture, increased production and misplaced emphasis on exports had led to excess supply; meanwhile, among fisheries, many of the most important fish stocks had been over-fished. Over the ensuing years, the methods used to control production in both these activities were re-examined, and a quota system introduced into both dairy farming and the demersal fisheries. This article traces the events that led to the introduction of these management systems, and analyses the two systems from a property rights perspective.

1. Introduction

For centuries, agriculture and fisheries have been Iceland's most important economic activities; but, during the past century, the relative importance of these two mainstays of Iceland's economy has dwindled. At the end of the 1970s, both branches found themselves in dire straits, although for different reasons. In agriculture, increased production and misplaced emphasis on exports had led to excess supply; meanwhile, among fisheries, many of the most important fish stocks had been over-fished. Over the ensuing years, the methods used to control production in both these activities were re-examined, and a quota system introduced into both dairy farming and the demersal fisheries. This article traces the events that led to the

introduction of these management systems, and analyses the two systems from a property rights perspective.

2. The fisheries

The 1970s represented a major investment period for Icelandic fisheries – both in the harvesting and processing industries. New stern trawlers replaced the aging side trawlers, and the processing capacity of land-based facilities was greatly increased. Iceland expanded her fishing zone to 50 miles in 1972, and to 200 miles three years later. But any joy over gaining complete control over the fisheries was curbed by a black report issued by the Icelandic *Marine Research Institute* (MRI) in 1975, claiming that the cod stock was in a serious state. To counter the waning situation, the government set *total allowable catch* (TAC) quotas in the cod fishery, but these proved difficult to uphold. Consequently, in 1977, the government introduced *individual effort restrictions*, limiting the number of fishing days per year; but again, the system failed miserably. Cod catches usually far exceeded set limits, but the restrictions also led to greater fishing of other demersal species and increased the pressure on species such as haddock, saithe and redfish. The system also proved economically wasteful.

In the early 1980s, biological conditions in the oceans around Iceland deteriorated. Biomass and catches of the main demersal species, particularly cod, dropped sharply; and, in another black report published in 1983, the MRI warned that the cod spawning stock had declined even further. The efforts of Icelandic fishing vessels had risen sharply, and total effort was now similar to what it had been before Iceland extended her fishing zone to 200 miles. In addition, prices on foreign markets had fallen, and most of the harvesting companies were experiencing severe operating losses. The processing industry was doing only slightly better.

In the autumn of 1983, an advisory committee was formed to analyse the state of the fisheries, and to propose new methods to deal with the problems at hand. The general view was that the time had come to abandon effort restrictions and, instead, turn to a quota system. These ideas had gained considerable ground, both among fishermen and vessel operators, not least because of the success of the quota systems in the herring and capelin fisheries that had been put into place in the 1970s. On December 22nd, 1983, the Icelandic parliament passed an amendment to the *Fisheries Act* of 1976, which gave the Minister of Finance discretionary powers to introduce an individual vessel quota system, as well as to restrict entry through licensing. In his speech introducing the bill, the minister emphasized three reasons for the change in policy. First, experience had shown that a more scientific approach to fisheries management was called for. Effort restrictions in a single fishery only served to increase the pressure on other fisheries, so that it would make more sense to adopt a holistic approach and try to manage all the most important fisheries simultaneously. Thus, it would not suffice to set a total allowable catch (TAC) for just the overexploited stocks; rather, TAC also should be set for other species to prevent them from being over-fished. The minister also pointed out that, second, all the relevant parties – fishermen, vessel owners, and the government – had agreed on which management path to follow, and that it would be wise to take advantage of this general agreement. Third, the state of the fish stocks was so depressed that it would be foolish to ignore the recommendations of the MRI.

The initial allocation of quotas in the demersal fisheries was based upon each vessel's share in total catch of each fishery over the 3 years preceding the introduction of the quota system in 1984. However, special allowances were made for vessels that (1) had been out of operation during part of that period, (2) had entered the fleet after 1981, or (3) had changed hands. Because of the success of the quota system, it was extended for the years 1985-1987, but with

an important new provision. Even though there had been considerable consensus about the introduction of the quota system in 1984, there were some who believed the system was unjust. In order to gain better political support for the quota system, vessels were allowed to choose between catch quotas and effort restrictions. Those choosing the latter then could gain additional quotas by demonstrating high catches during this period. In 1988, Parliament passed a new bill which made the effort quota option less attractive, as vessels under effort restrictions no longer could increase their quota holdings at the expense of those in the quota system.

During the 1980s, the quota system became more and more rooted; and, in 1990, Parliament passed legislation for comprehensive *individually transferable quota* (ITQ) systems, the *Fisheries Management Act*. This legislation abolished the effort quota option, and closed some important loopholes. Whereas the earlier quota system only had applied to vessels above 10 gross registered tons (GRT), the new system applied to all vessels larger than 6 GRT. Smaller boats continued to be exempt from the system, but attempts later were made to set up effort restrictions and quotas. The failure to include all vessels in the quota system right from the start proved to have quite serious consequences, as catches of the small boats usually far exceeded their expected harvests. That loophole was not fully closed until the fishing year 2006-2007, when all small boats were included in a special quota system for vessels under 15 GRT.

The present quota system

In the current fisheries management system, all fisheries are subject to a TAC and are managed on the basis of catch quotas. The quotas are assets of indefinite duration, since the *Fisheries Management Act* does not contain any sunset conditions. As noted above, initial

quotas in the demersal fisheries were allocated on the basis of catches over the three years prior to1984, and the principle of allocating quotas on the basis of fishing history is one of the cornerstones of the *Act*. However, quota holdings of individual vessels have changed considerably since 1984, both because of the effort quota options of 1985-1987, and because of transactions undertaken since.

Each vessel is issued a permanent share in the TAC for every species for which there is a TAC. These permanent quotas may be referred to as *TAC-shares*. The *annual catch entitlement* (ACE) of each vessel then is calculated as the product of the TAC shares and the TAC. Thus, if the TAC for a certain species is set at 100 thousand tons, a ship holding a 1% TAC share will have an ACE of 1000 tons.

This distinction between the TAC-shares and ACE is quite important, as the quota system treats transfers of the two quotas differently. Whereas there are no limits on the transfers of permanent shares, no more than half of the ACE of each vessel may be traded to vessels under different ownership. On the other hand, quota owners are allowed to transfer the ACE between their own vessels at will. Neither the TAC-share nor the ACE may be transferred to non-Icelanders, and the recipient of the transfer must be able to register the quota to a licensed fishing vessel.

The *Fisheries Management Act* stipulates an upper bound on the TAC-shares of individual harvesting companies, which ranges from 12% for cod to 35% for ocean redfish. Individual companies also must not own more than 12% of the total TAC in all species.

3. Agriculture

In the years following the Second World War, shortages of agricultural products were quite common in Iceland, and a substantial share of the domestic consumption of various products was imported, including some milk products like butter. During this post-war period, great emphasis was placed upon improving the production capabilities of domestic agriculture, through various investments in capital goods and land improvements. By 1960, a fairly good balance had been established between domestic supply and demand, but the accent on increased production remained strong. It was widely believed that Icelandic agricultural products could become competitive in foreign markets. Consequently, to encourage exports, primarily of lamb and milk products, a law was passed in 1960 that allowed the government to spend up to 10% of the annual value of agricultural production on export subsidies. Production continued to rise throughout the 1960s and into the 1970s; but, by the end of the 1970s, it became clear that the export drive had been unsuccessful, and that domestic production had to be better aligned with demand. Over the next few years, the government introduced various measures that were intended to limit production to the needs of the domestic market and to curtail exports. However, the government did not relinquish its hold on pricing, and prices for most domestically-produced agricultural products still were determined by government agencies. In 1979, the *Agricultural Production Committee* (APC) stipulated individual production quotas for each sheep and dairy farmer; and, one year later, the APC and the *Farmers Union* agreed that these quotas should take effect for dairy farmers that same year and for sheep farmers in 1981. Unfortunately, however, these attempts to limit production were not fully satisfactory, as the production quotas, in effect, were not limiting. Thus, in 1985, new laws on the production, pricing and sale of agricultural products came into effect, which explicitly stated that production of individual agricultural products could be divided on a regional basis, and within each region between individual farmers. Furthermore,

the *Minister of Agriculture* came to an agreement with the *Farmers Association* on the quantity of dairy and sheep products for which the government would pay full (state-determined) prices.[1] Prices for production beyond that limit would be reduced. The first such *'milk production agreement'* was signed that same year, and covered the period 1985-1987, with the share of each farmer in total milk production determined by production over the years 1981-1983. That initial allocation and subsequent transactions still form the basis of today's dairy quota system. Since 1985, four new agreements have been signed, with the current one spanning the years 2005-2012.

Even though quota transfers were allowed in the first milk agreement, quota transactions were very limited. The second agreement banned transfers altogether, but that changed with the third agreement, which came into effect in 1992. That agreement explicitly allowed quota transactions, but the district agricultural associations were allotted first refusal when quotas were to be transferred between districts.

The present milk agreement

According to the present milk production agreement, total milk quotas for each production year – September 1st through August 31st – are determined 3 months prior to the start of the next production year, and take into consideration both domestic production over the previous 12 months, and current stocks. Allowance also is made for projected changes in sales. The allocation to each farmer is based upon his proportional share in the previous years' quota, and upon quota transfers undertaken since the beginning of that quota year.

Rather than guarantee a specific price for each litre of milk, the government has agreed to pay farmers a certain lump sum, each production year, which the producers share among

1 Lög um framleiðslu, sölu og verðlagningu á búvörum nr. 46/1985.

themselves. Most of these payments are linked to production volume. Thus, in 2005-06 – the first year of the current milk production agreement – 97.5% of the payments were linked to production; but this proportion is scheduled to decrease to 80.0% in the final year of the agreement. These payments are allocated to farmers on the basis of their share of the total milk quota. The rest of the government payments are split into components. One part is paid for research and breeding, and the other is inversely linked to the number of cows held by each dairy farmer. Total direct support to dairy farming amounted to 4.0 billion Icelandic kronor (ISK) in 2005-06, but will be almost 6% lower, in real terms, in the last year of the agreement, 2011-12.

At the beginning of each production year, the agricultural price setting board determines the dairy price for each litre of milk of certain prescribed quality, but prices are lower for milk of inferior quality. These prices only are binding for the production quota set by the state. In the production year 2005-06, the total production-linked payments to farmers amounted to 47% of the price of each litre; but this proportion will decline over the next few years, both because support will decrease, and production each year increase. It should be stressed that the state-determined prices are minimum prices, but dairies are free to pay higher prices. On the other hand, this price is not binding for 'excess milk', the amount of milk each farmer produces over and above his quota. In recent years, there has been considerable demand for all excess milk, so that prices have been comparable with the minimum prices.

Quotas in the current agreement are individually transferable, are perfectly divisible, and can be sold freely within or between regions. The district agricultural associations no longer enjoy first refusals, but all transactions must be registered with the *Farmers Association of Iceland*. There is no upper limit on milk quota holdings.

Individual farmers are obliged, at least partly, to utilise their quota every second year, but quota rights are removed if milk production remains completely idle for two years running. It is possible, however, to obtain special permission to put quota usage on hold. In such cases, quota holders must register their idle quotas with the Farmers Association for the reminder of the duration of the present agreement.

4. Property rights characteristics

Ownership of property yields the owner the power to manage his resource (like a farmer manages his land), dispose of it (sell, lease or bequeath), and enjoy its yield (crop, rent or royalty income). A rights-holder obtains these three powers of ownership through the collection of the property rights characteristics wrapped up in it. According to Scott (1988, 1996), the most important characteristics are *exclusivity, duration, security* and *transferability*. *Exclusivity* refers to the right to use and manage a resource without outside interference; the more sources of interference, the less exclusive the right. Every kind of property right entails some exclusivity, but the degree may vary. Some rights, such as the right to attend a museum, may entail very limited exclusivity; whereas others, such as buying a book on art, entail almost complete exclusivity. *Duration* refers to the length of time the property right may be enjoyed; or, more precisely, the length of time the holder has the three powers mentioned above. This can range from a very short time (e.g., a one-day car rental) to a much longer time span (e.g., the 99-year lease of land). *Security* (or quality of title) refers to the vulnerability of the property right to challenges by other individuals or to government intervention. Low security leads to uncertainty, and lowers the price that potential buyers would be will to pay for that particular right. *Transferability* refers to the ability of property right holders to transfer their right to someone else. All degrees of transferability are possible. Most leases of

land are transferable, with the permission of the landlord; but many kinds of negotiated landlord-and-tenant arrangements cannot be sublet at all. Authorities also may require the holders of certain property rights to partly utilise that right themselves, rather than sell it or rent it to someone else.

The relationship between these four property rights characteristics is illustrated in Figure 1.

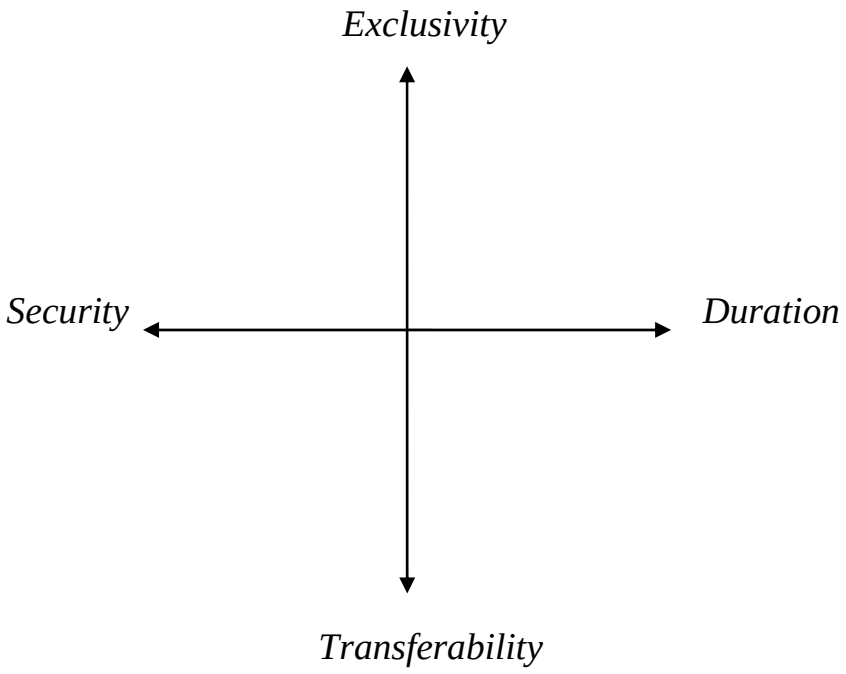

Figure 1: Characteristics of property rights

Each of the four characteristics can be measured on a scale from 0 to 1, with 'zero' meaning that the property right in question holds none of the specified characteristic, and 'one' indicating that the property right holds that characteristic completely. Given this, Arnason (2000) has shown that it is possible to depict perfect property rights (i.e. property rights that hold each characteristic completely) as a rectangle linking the four characteristics. The rectangle, which also may be called the *characteristics footprint* of the property right, is illustrated in Figure 2.

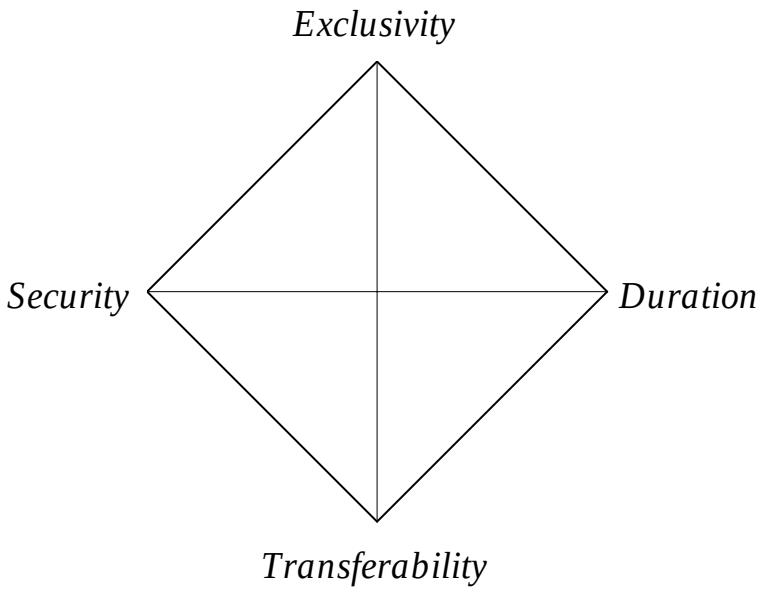

Figure 2: A perfect property right

Once values have been assigned to each characteristic, it is possible to compare the characteristic of the property right in question with those of a perfect property right. As an example, consider a property right with perfect security and exclusivity, but of limited duration and with incomplete transferability. Thus, we assign both security and exclusivity the value 1.0, duration the value 0.4, and transferability the value 0.8. The characteristic footprint of that property right is shown as the dashed line in Figure 3.

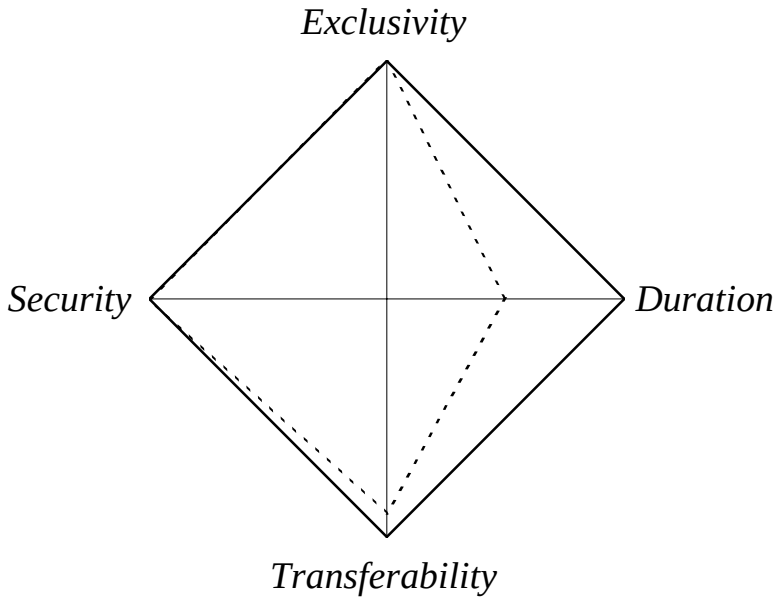

Figure 3: Footprint of a property right

Since each characteristic is assigned a value within the interval [0,1], it is possible to construct an aggregate numerical measure of property rights for that same interval. A value of zero thus would indicate a completely worthless property right, while a value of unity implies a perfect property right. Arnason (2000) has suggested one such index, the *Q-measure*, which he defines as

$$(1) \qquad Q = S^{\alpha} E^{\beta} D^{\gamma} (w_1 + w_2 T^{\delta})$$

$$\alpha, \beta, \gamma, \delta, w_1, w_2 > 0 \text{ and } w_1 + w_2 = 1.$$

Here, S denotes security, E exclusivity, D duration, and T transferability; α, β, γ, and δ are parameters that represent the elasticity of the Q-measure with respect to each characteristic; and w_1 and w_2 are weights. The term w_1 can be regarded as the maximum value of Q, given

that there is no transferability. As defined here, the first three characteristics – security, exclusivity and duration – are essential; i.e. a value of zero for any of those characteristics will yield in a Q-value of zero. Transferability, on the other hand, is not necessary for a positive Q-value; but the impact of non-transferability depends upon the weight w_1.

5. Characteristics of the Icelandic quota systems

Open-access in fisheries leads to the *'tragedy of the commons'* (Hardin, 1968). Because nobody owns the fish and/or fishing grounds, each fisherman will catch as much as he wants, without thinking much about the future or the effects his action has upon the behaviour of others. There is no incentive for the fisherman to hold back, as someone else surely will take his place and catch the fish otherwise destined for his net or hook.

An ITQ system in a fishery attempts to solve the ownership problem by allocating quotas to individuals, who are then free to dispose of them as they see fit; e.g., either sell them or use them. In order to introduce an ITQ system, it is necessary to establish a TAC that is both economically and biologically meaningful. That TAC then is divided into a number of individual catch limits, called *quotas*, and allocated to participants in that particular fishery. As defined here, quotas really are percentage shares, which can be translated into kilograms or tonnes once the TAC has been determined. However, it also would be possible to define the quotas in volume units, right from the start.

As noted by Hannesson (2006), an ITQ is the right to catch a specific quantity of fish from a given stock within a given time period. Once these rights have been established and the fishery turned from a commons into a closed club, it becomes possible to manage the fishery in a more sustainable and economical manner.

The ITQ system in the Icelandic demersal fisheries is a very good example of attempts to correct a market failure – overexploitation of a natural resource – by creating utilisation rights. However, these rights or quotas, as defined in the *Fisheries Management Act*, are imperfect property rights. To see this, let us consider the four characteristics mentioned above - security, exclusivity, duration and transferability - and try to determine values in the [0,1] interval for each characteristic. Consider first, security. Owners of quotas today have obtained their quotas either through initial allocation or purchases from other quota holders. The quotas represent legal assets and must be regarded as secure as any other asset held by companies or individuals. A score of '1' thus would seem quite appropriate. Similar reasoning can be applied to exclusivity. A quota holder has the right to harvest his share without interference from other fishermen, but it is possible that the management authorities may infringe upon that right through various regulations. Nonetheless, this characteristic also is deemed perfect, and assigned a value of one. We then come to other two, more troublesome characteristics. Although the *Fisheries Management Act* contains no duration limits, harvesters have been very hesitant to regard their quota rights as permanent. Many people in Iceland regard the ITQ system as unjust, and politicians often try to play on these sentiments, in particular shortly before elections. Legal experts have claimed that the government can reclaim allocated quotas, but might have to pay out damages instead (Auðlindanefnd, 2000). For our purposes, we therefore assign a value of less than unity to the duration characteristic, say 0.8. Finally, as mentioned above, there are some limits on transferability of the annual catch entitlement, but hardly any on the TAC-shares. Even though these limitations are not serious, they result in a characteristic value of less than unity, say 0.9.

In a market without externalities, the forces of supply and demand, over time, will create an equilibrium that is socially optimal. If the market is out of equilibrium, prices will adjust until supply equals demand, thus eliminating excess supply and demand. In the case of excess supply, this means that some producers probably will exit the market, or all producers will curtail their production. When the government chooses to interfere by, for instance, setting non-equilibrium prices or determining quotas, the market no longer yields an efficient outcome. The government intervention, thus, constitutes a market failure, and will lead to deadweight loss and decreased economic welfare. However, in some cases, governments are reluctant to yield the floor to market forces. This especially is true in agriculture, where government intervention has a long history, and has been justified for a number of reasons (Pennings et al., 1996).

The quota system in Icelandic dairy farming provides a prime example of a government-initiated market failure mechanism. The current milk production agreement provides quota holders with two different kinds of rights: a production right and the right to receive a certain proportion of the direct payments allocated to dairy farmers. These rights are both completely secure and exclusive, and have a high degree of transferability; there certainly are far fewer restrictions on quota transfers in dairy farming than in demersal fisheries. However, since the agreements cover a specific number of years, the duration of the rights is much shorter than in the fisheries. These characteristics could yield the following values for the four characteristics: security = 1.0, exclusivity = 1.0, duration = 0.5 and transferability = 0.99.

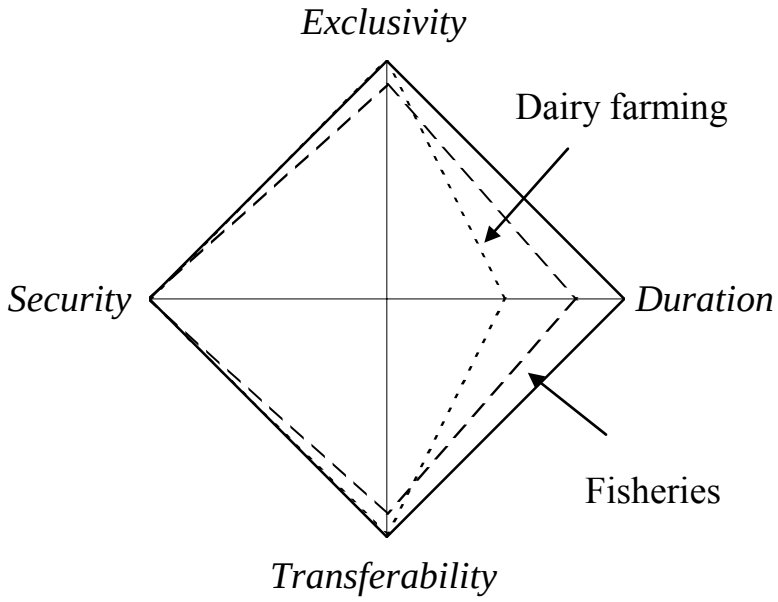

Figure 4: The quality of property rights in the demersal fisheries and dairy farming

The characteristics footprints of property rights in the two quota systems are illustrated in Figure 4. The figure clearly reveals the effect that the relatively-short duration of property rights in the dairy quota system has on the quality of rights. It should be noted that, whereas the quality of property rights in the demersal fisheries can be assumed to remain unchanged, unless the government decides to change the management system, the same does not hold for the dairy quota system. Each milk agreement spans a certain number of years; and, as the agreement draws closer to its end, the short duration becomes more and more important for the quality of the property right. This especially holds true if there are reasons to believe that the government will change its policy and cease to support dairy farming as wholeheartedly as it has in the past. There is, however, nothing to suggest such a paradigm shift.

6. Conclusions

In the mid 1980s, quota systems were introduced in the Icelandic fisheries and agriculture, but for completely different reasons. The ITQ system in the demersal fisheries was set up to solve the externality problem that follows from open-access fisheries, a dilemma with which effort restrictions had been unable to cope. In contrast, the quota system in dairy farming represents a market failure in itself. Here, production far exceeded domestic demand; but, rather than allowing market forces to bring equilibrium about through price adjustments, the government stepped in. This, of course, is a similar strategy to that followed by most governments in the industrialised world.

The characteristics of the property rights embodied in the two quota systems are somewhat disparate. Both rights can be said to be fully secure and exclusive, but they differ in the degree of transferability and duration. There are minor restrictions on transferability in the dairy quota system, but transfers of the annual catch entitlement in the demersal quota system are quite serious. On the other hand, the TAC-shares in the fisheries are freely transferable. The *Fisheries Management Act* contains no duration limits; nonetheless, quota holders have been very reluctant to view their rights as permanent. On the other hand, the milk production agreements span a specified number of years, so that property rights are not as strong as in the demersal fisheries. History has shown, though, that dairy farmers should not have much to fear when the current agreements runs out, as it is highly unlikely that the government will abandon its agricultural support policy, even though it may change shape.

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