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The Dairy Support System: Who loses and who gains when quotas are tradeable?

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Abstract

Iceland has a tradition of intervening in the domestic agricultural market, including dairy farming. Much of the intervention has consisted of a combination of a minimum support price and subsidies, in addition to import tariffs. An important feature in dairy farming has been the direct payment quotas held by the individual farmers, which are transferable.

Does the quota trade hurt farmers rather than help them? Do those farmers who buy quota lose and those who sell gain? Does flow of capital from continuing farmers to ex-farmers result in the gains from the subsidy only benefitting those farmers that were operating and received direct payment quota when instituted, and then sold out of the system?

We attempt to answer these and related questions here. In doing so, we show that popular arguments about who gains and who loses in quota trades are confused. Contrary to popular claims, economic analysis shows that no one incurs a loss, not those operating in the system, not those who cash out, nor those who buy quota. Not only doesn't anyone lose but in fact most or all gain through trade.

This in general confirms the basic principles of economics and free trade. Gain is the motive for trade; people do not engage in trade if they do not see some gain in doing so. This also confirms that trade increases farmers' wealth. Not only the farmers who receive the initial allocation of quotas gain through trading the quota; farmers buying into dairy farming also gain.

JEL classification: H2, H21, Q1, Q18.

Keywords: Dairy quotas; subsidies in agriculture.

1 Introduction

In Iceland like most developed countries there is a long tradition of government intervention in the domestic agricultural market, both by restricting trade across borders and in the pricing of agricultural products. Despite this intervention by the government, or rather because of it, a problem of overproduction in the industry developed. This applies particularly to the dairy industry and sheep farming. The history of state support for farming in Iceland may be traced back to the 1930s. Over time, the form and extent of this support has been repeatedly altered, sometimes quite radically. In more recent times much of these supports have consisted

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of a combination of guaranteeing a minimum support price and various financial subsidies to farmers, as well as high import tariffs and import restrictions.

An important feature of the dairy support system from 1992 is the direct payment quotas held by the individual farmers.[2] These are direct payments from the state to farmers for production up to a certain pre-decided volume or quota (referred to as "greiðslumark"). The individual farm quotas, designated as percentages of the total production volume entitled to direct payments ("heildargreiðslumark"), were allocated based on previous production of milk. These quotas are also explicitly transferable albeit with certain restrictions. The quotas were not limits on production. However, for production in excess of the quota, farmers only received the price the dairies were willing to pay but no subsidies.[3] An explicit objective with this system was to increase productivity and to raise the level of income for the farmers. Increased productivity can come both through advances in technology and breeding, leading to increased milk yield per cow, both leading to cost reductions. As the farms are heterogeneous the transfer of quotas can lead to further scale economics with larger and fewer farms. The transferability of quotas is therefore of the essence.

It has been argued that quota trade hurts farmers rather than helping them, or more particularly, that those who buy quota do not gain and may possibly lose while those farmers who sell gain (Bjarnadóttir and Kristófersson, 2008a; 2008b).[4] This effect of trading quota, it seems to be argued, appears in the flow of capital from current farmers to ex-farmers (those that sold quota).[5] This then really "traps" the farmers buying the quota, as they are now reliant on continuation of the system even if they "incur losses from it". They are in effect reliant on continuing receiving price subsidies to pay for the quota, as the price they paid in the trade amounted to the net present value of future price subsidies. Therefore, the only farmers who in fact gain from this subsidy quota system are those farmers that were operating and received direct payment quota on issue, and then sold out of the system (Bjarnadóttir and Kristófersson, 2008b:5-6; Bjarnadóttir and Kristófersson, 2008a:33). Another way they describe this "entrapment result", is in reference to the "transitional gains trap" (Tullock, 1975), where it is argued that the government will face great difficulty in abolishing this system as too many farmers have financial interest in its continuation.[6]

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2 Regulations on the dairy support system were changed for 2017 (Regulation no. 1150/2016) with the aim of moving away from the direct payment quota system to a system of direct payments for all production (per liter subsidy).

3 The regulations from 2017 onwards link part of the direct quota payments (54-58%) to production and independent of the quota. This is calculated on a monthly basis, and as long as the total quota is reasonably close to actual production volume this would only have a very small effect on the total price per liter a farmer receives for his milk (likely less than only 1%). There is also a cap on the how much a single dairy farm can receive of the total government support, at 0.7% of the total.

4 They are not the only ones putting this argument forth, as can be seen in the list of references in that paper. The other references discuss trades in quota systems in other countries, which are different from the Icelandic system. We argue that all these have an erroneous argument, but below we only show it in the Icelandic context.

5 This is how the authors describe it in the Icelandic version of the paper, Bjarnadóttir and Kristófersson (2008b, 5). The English language version (Bjarnadóttir and Kristófersson, 2008a, 33) describes this process as the subsidies flowing to former farmers that sold quota and increasing production costs of the current farmers that bought quota.

6 Bjarnadóttir and Kristófersson (2008b, 5-6; 2008a, 33) also describe this "entrapment result" in reference to the "transitional gains trap" (Tullock 1975) and seem to argue that the government will face great difficulty in abolishing this system as too many farmers have financial interest in its continuation. As there often seems to be some confusion as to what the "trap" in the transition refers to, a clarification maybe of help. As it relates to the topic here of agricultural subsidies, it does not refer specifically to the farmers that buy quota being trapped in their investment and relying of necessity on continued subsidies. It rather refers to society (or government) being trapped with having instituted a system that provides a stream of income to a group of individuals or firms, where the recipients will incur "transitional losses" if discontinued. Further, they may have more to lose then society to gain (net) with the abolishment of that system (see Tullock, 1975). This group will therefore resist all changes that decreases this stream of income to them, even if their

We intend to show here that these arguments about who gains and who loses in quota trades are erroneous. We argue that contrary to these, a careful economic analysis shows that no one incurs a loss, not those operating in the system, not those who cash out, nor those who buy quota. Not only doesn't anyone lose but in fact almost all gain through trade. This should be of no surprise, as it is the general result of economic theory that trade results in gain to all participants in that trade. In fact, gain is the motive for trade; people would not engage in trade if they did not see some gain in doing so. Trade therefore generally increases the social surplus (see Debreu, 1959; Varian, 1990). The only exception to this would be if some sort of externalities were present, i.e. a third party not participating in the trade was adversely affected. There is every reason to expect that this applies to all free trade, including trade in direct payments quotas in the dairy sector. In addition, it seems that there is no reason to assume that trade in quota affects third parties adversely.

2 The dairy support system from 1992

Production quotas were first introduced in Icelandic dairy farming in 1980, with a system that went by the name of "Búmark". Within this system dairy farmers received the full guaranteed minimum support price for production only up to a certain maximum volume, which was based on average production in 1976-8 (Stefánsson, 1998). This system was essentially an individual quota system for price support, where only production within the quota volume was entitled to receive the full minimum price from the dairies. This system led to some reduction in dairy production but not sufficient to enable the payment of the full minimum price for all production. One reason being that despite this attempt to limit production, export subsidies for excess production were retained (Stefánsson, 1998; Kristófersson et al., 2007). Changes were introduced in 1985 when the overall production quota (this time referred to as "fullvirðisréttur") was divided between 25 geographical regions and individual farm quotas revised in accordance with their actual production in 1982-5.

New legislation to overhaul the agricultural support system was introduced in 1992.[7] The new legislation would provide support to dairy farmers mainly by direct payments, by a system of minimum producer prices (farm gate price)[8] and by a milk quota regime.[9] Regulations on production control, subsidies and other aspects of the Icelandic dairy sector are determined in periodic agreements between the government and dairy farmers. An important change was the abolishment of export subsidies. The objective of government intervention in the dairy industry is specified in the agreement, as well as the ways to reach the specified goals. The main objectives have been to improve efficiency through increased dairy farm productivity, to

rate of return with this income is no higher than elsewhere in the economy (only normal rate of return). For more on this see Tullock (1975), McCormick et. al. (1984), Tollison and Wagner (1991), and Shughart (1999). The "trap" in Tullock (1975) is one angle of his work in Tullock (1967), his work with Buchanan (Buchanan and Tullock, 1968) on rent-seeking, and his work with Buchanan on aspects of public choice theory.

7 There was an overhaul of the agricultural support system in 1992. The *Act on the Production, Pricing and Sale of Agricultural Products* (Act No. 46/1985), which applied both to sheep farming and dairy production, was changed (Acts no. 5/1992 and no. 112/1992) and then re-written and re-issued as Act no. 99/1993. The Act lays down that a binding agreement on dairy production must be made with the Farmers Association. Within this framework, policies are determined by renewable multi-year agreements between the government and the Farmer's Association, which provides the general framework for support and production control in covered sectors.

8 The guaranteed minimum support price system was retained. A special Agricultural Pricing Committee sets the minimum producer price (farm gate price) for milk delivered within the production quota. The direct support payments are on top of the minimum farm gate price paid to the farmers by the dairies but only on the volume of their quota. For milk, in excess of the quota limit, farmers only receive a market price that the dairies are willing to pay. This market price was about 50-70% of the farm gate (minimum) price in 2008-2013, but in 2013-2016 it increased to 100%. Since July 2016 it has gone as low as 31% of the farm gate price and as high as 89%, averaging about 62%. Also, from 2017 part of the support payments are paid for excess milk, as mentioned in footnote 3.

9 Additionally, support is also granted for breeding and development work.

ensure acceptable standards of living for farmers, and to lower the price of milk products for consumers.

This new system provided direct support payments to farmers for production up to a certain volume or quota (referred to as "greiðslumark"). The individual farm quotas, designated as a share in the total production volume which is entitled to direct payments ("heildargreiðslumark"), were allocated in a similar way as previously. As before, these quotas did not restrict production.[10]

An important feature of the system was that the direct payment quotas held by the individual farmers became explicitly transferable. This is in accordance with the objectives of the agreement between the government and dairy farmers to increase productivity and raise the average level of income for the farmers. The increased productivity can come either through advances in technology and breeding, leading to cost reductions and increased milk yield per cow, or through scale economics of larger and fewer farms. Tradeable quotas are therefore essential.

From 1992 and up until 2016 transfers of quotas were for the most part without restrictions. However, from 2011 trade of quotas between farms had to take place at an auction market under the auspices of a government agency.[11] But in 1992-2010 farmers could negotiate and trade freely and only had to report their trade (as well as report a trading price) to the authorities. A quota buying farmer, of course, also had an incentive to report the trade to the relevant government agency so as to receive the direct payment following the trade.

A new agreement was negotiated in 2016 and enacted for the period 2017-2026. The new agreement brought changes to the direct payments system with an aim to abolish the quota system and replace it with a system of production subsidies (see Act no. 102/2016 and the 2016 agreement on dairy production). With the changes in regulations in 2017 (Regulation no. 1150/2016) the quotas were no longer freely transferable. Farmers wanting to sell had only the option of "selling" to the government at a pre-announced government price (set at double the present value of the value of the future subsidy payments) and farmers wanting to buy could apply for quota (according to somewhat complicated allocation rules that stipulate eligibility) at that same price. Even though there had been and still was disagreement among the dairy farmers it seems that some farmers were either desperate to sell or convinced that the direct payment system was coming to an end and the new system of direct subsidy for production would replace it in 2021. But the new agreement also stipulated that the dairy farmers would vote on the changes, in 2019, and the result of that election would decide on the continuation of the system. The farmers overwhelmingly opted for a continuation of the older system of direct payment quotas and that called for reinstating quota trade.[12]

In 2019 the government discontinued buying quotas and re-opened the auction market for quotas in 2020 but with a cap on price; double the minimum farmgate price. In 2020 this was then revised to triple the minimum price. There were also other restrictions, such as priority

10 In fact, they do. The regulations issued by the Ministry that are based on Act 99/1993 obligate the dairy producers and processors to export all products in excess of the total volume of the support quota, the Greiðslumark. But the same regulations also provide for possible exemptions from those obligations. See Act no. 99/1993 and the regulations on dairy production each year based on that Act.

11 From December 2010 MAST (the Icelandic Food and Veterinary Authority), would invite written bids and offers that were opened on specific market days (two/three times a year). On the basis of the bids and offers MAST worked out supply and demand schedules and calculated the so-called equilibrium price ("jafnvægisverð"). All lower bids and higher offers were then rejected and the remaining bids and offers became binding contracts.

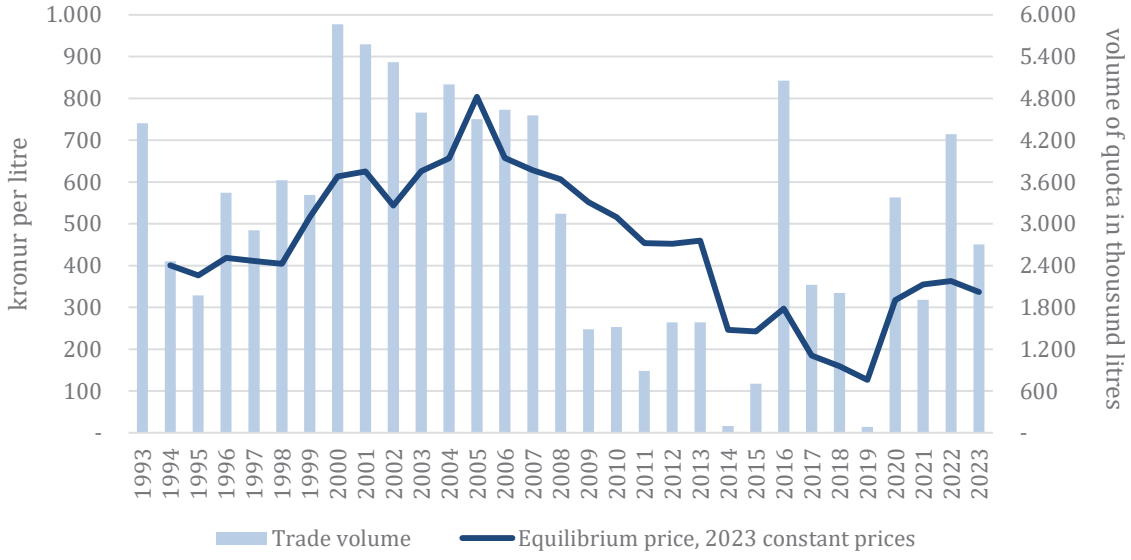
12 The dairy farmers voted in February 2019 and 89% voted for continuation (or against the abolishment) of the quota system (see https://www.visir.is/g/2019190218862/90-prosent-mjolkurframleidenda-vilja-halda-i-kvotakerfid). They then voted in December of 2019 on a new support agreement and 77% approved (see https://www.bondi.is/frettir/kuabaendur-samthykktu-samning?q=K%C3%BAab%C3%A6ndur+sam%C3%BEykktu+samning).

of new entrants and maximum volume for each buyer per auction, and a cap on total quota holding.[13]

There has been much trade in dairy quotas in 1992-2023, on average about 2.7% of the direct payment quota volume each year (see Hagtölur Landbúnaðarins 2010, at bondi.is, MAST at mast.is, Rannís 2001 and *Stöðumat og stefnumótun í mjólkurframleiðslu*, skýrsla til landbúnaðarráðherra, febrúar 2004, at atvinnuvegaraduneyti.is). This average was even higher in 1992-2010 than in 2011-2016, or 3.6% compared to 1.5% in the latter period. In the report *Stöðumat og stefnumótun í mjólkurframleiðslu* (2004:51) trades in quotas in the period 1998-2003 were analyzed specifically. The volume of quotas that were transferred between farms were on average 4.7% of total volume each year during that 6-year period. Additionally, another 4% were transferred on average each year through ownership changes of farms. Of these ownership changes, about a third were between unrelated parties while over 60% were based on the next generation assuming ownership or incorporating the farm business. Based on this information, in addition to that mentioned above, we could infer that about 4% of quotas have changed ownership on average each year in 1992-2023. But, of course, some of this quota has been traded more than once in the period, so we should not assume that all or nearly all the quota has changed hands, although the number of dairy farms has decreased substantially in this period.

From 2011 the annual volume of trade has generally been between one and two million liters or above 1% of the total volume of outstanding direct payment quotas (Figure 1). This suggests considerable rearrangement of the milk production between farms under the direct payment system is continuing, a finding consistent with the reduction in the number of active dairy farms.

Figure 1
Quota trade between farms 1992-2023



Source: Hagtölur landbúnaðarins, Bændasamtökin, Rannís 2001, MAST, Ministry of Food.

As shown in figure 1, there was a severe decline in market activity and trades in 2014- 2015. This may be due to uncertainty about the future of the direct payments system in connection with the general review of the farming support system which got underway in 2014 and may have played a major role in this. This hypothesis is lent certain quantitative support by the fact

13 The cap on total quota holding is 1.2% (the largest quota holder in 2023 had a share of 0.85%). The cap on buying in each market session is 50,000 liters, and 150,000 liters each year. And 5% of quotas at each session are reserved for new entrants into dairy farming.

that the supply (offers to sell) of direct payment quotas during the first market period in 2014 was very high while the demand (bids to buy) was almost non-existent.

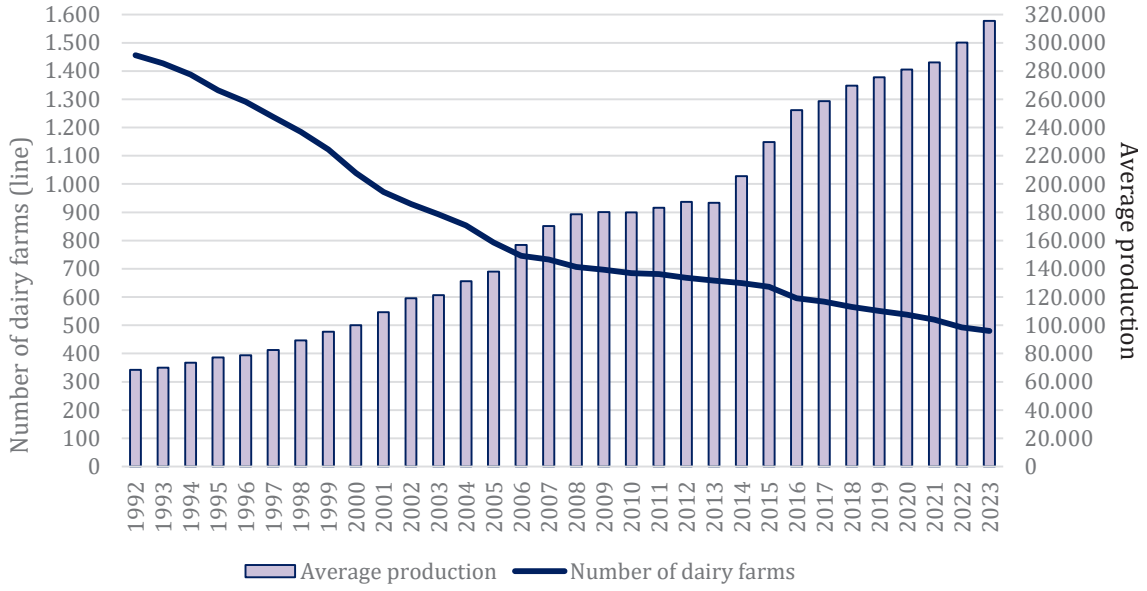
The direct payment quota market recovered somewhat in 2016, apparently partly because of less uncertainty about the future of the system, it would continue little changed until 2021, at least. In addition, it should be noted that activity in the market in 2016 was probably distorted upward by the previous announcement of a provisional halt to direct payment quota trading from 2017 onward. The drop in prices in 2017-2019 is explained by the fact that trade could only take place through the government at fixed prices, as mentioned above.

In 2011-2013, the equilibrium price (at current price level) for direct payment quotas was fairly constant at close to 450 kr./liter (about six to seven times the direct payments).[14] However, it dropped considerably in 2014 and was then around 250 kr./liter in 2014-2016.[15] It may be noted that these direct payment quota prices (of five to six times the direct payments) suggest either inordinately high discount rates of between 14 and 20% or the expectation that the system of direct payments will end in the near future (next 4 to 8 years) or both.[16]

Analysis suggests that the market price for direct payment quotas should, among other things, depend on current and expected marginal profits of producing milk.[17] Unfortunately, however, very little information about the profitability of dairy farming, let alone its marginal profits is available.

Figure 2

The number of dairy farms and their average production 1992-2023



Sources: Regulations on "greiðslumark mjólkur á lögbýlum og greiðslur til bænda", Auðhumla, SAM ("Samband afurðastöðva í mjólkuriðnaði") yearly reports.

14 These prices are at 2023 price level.

15 There is good correlation between the equilibrium quota price and the per litre subsidy, or 0.70 for the period 1993-2023 and 0.82 for the period 2000-2023. Another factor influencing the quota price is the price that the dairy pays for milk in excess of quota. By law the dairy only has to pay the minimum price for milk that is within the quota of each farmer. Usually, the price for the excess milk is much lower. But, from about mid-year 2013 to mid-year 2016 the dairies paid the full minimum price for all milk. This probably explains the drop in trade volume as well as quota price in that period. There was also an increase in the total quota in this same period, around 20%.

16 A change in the tax law may also have had an effect on the price also. From 2011 farmer can no longer use tax depreciation for (new) quota investments, but in 1992-2010 tax law allowed depreciation over a 5-year period.

17 A simple equation for quota price in equilibrium is $v=(p_0+s-C_q)/r$ where p_0 is the base price offered by the milk processor, s the subsidy, C_q the marginal cost of producing more and r the rate of discount possibly including the risk of the direct payments system being discontinued.

Quota trade in 2017-2018 were at levels similar or higher than in 2009-2015 but fell in 2019 when no trade was allowed for most of that year.[18] Trade then resumed at higher volumes in 2020-2023 (see figure 1).

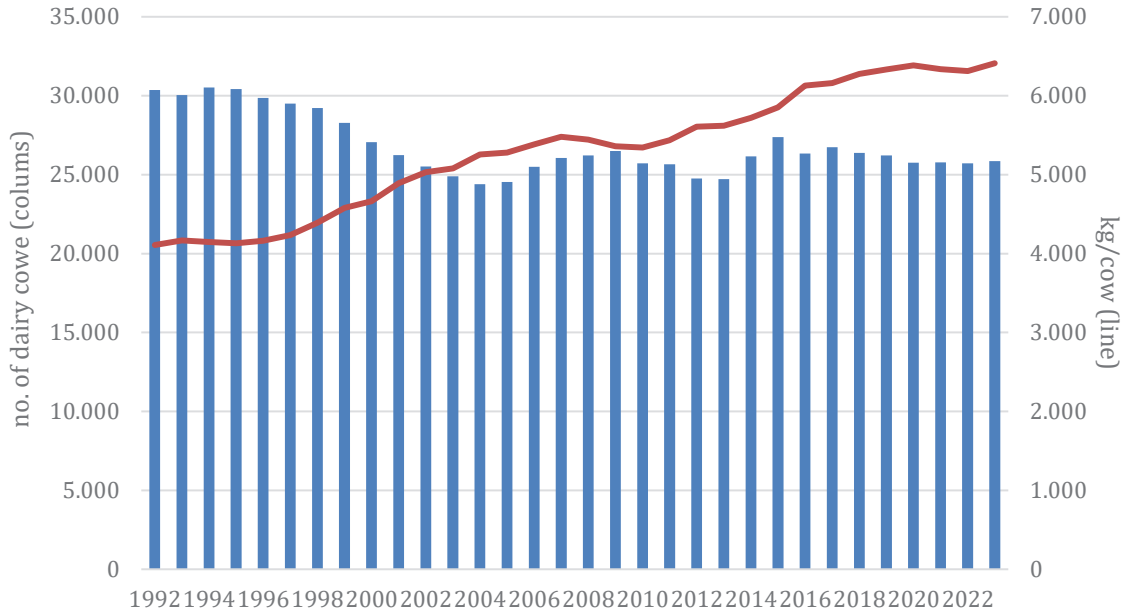
There is considerable evidence of increased productivity in dairy production under the direct payments system at least since 1992.[19] First, the number of farms has fallen and the average production per farm has increased substantially (see figure 2).

This suggests that technically available returns to scale in dairy production are being exploited to a greater extent than before. Second, the total real price per unit of milk production received by the farmers (see figure 4 below real price per liter to farmers) has declined considerably since 2005 while at the same time, dairy farmers' net income has, if anything, improved. This also suggests improvement in productivity.

Figure 2 indicates the development in the number of dairy farms since 2005 as well as their average production. In 2005, the number of milk farms was 793 but were more than 1500 in 1991, a decrease of close to 50%. In 2016 the number of farms had dropped to 596, and down to 480 in 2023. This is a decrease of more than 2/3 since 1992. Over the period 2005-2023, the average milk production per farm has increased from 138 thousand liters to 315 thousand liters per year or by almost 130%. The increase in milk production per farm was almost 270% in the period 1992-2016, and for the whole period 360%. This clearly represents a very considerable increase in labor productivity.[20]

Figure 3

Average milk yield per cow in kg and number of cows in 1992-2023



Source: Félag Kúabænda á Suðurlandi (Búnaðarsamband Suðurlands, https://www.bssl.is/), RML, Satistics Iceland.

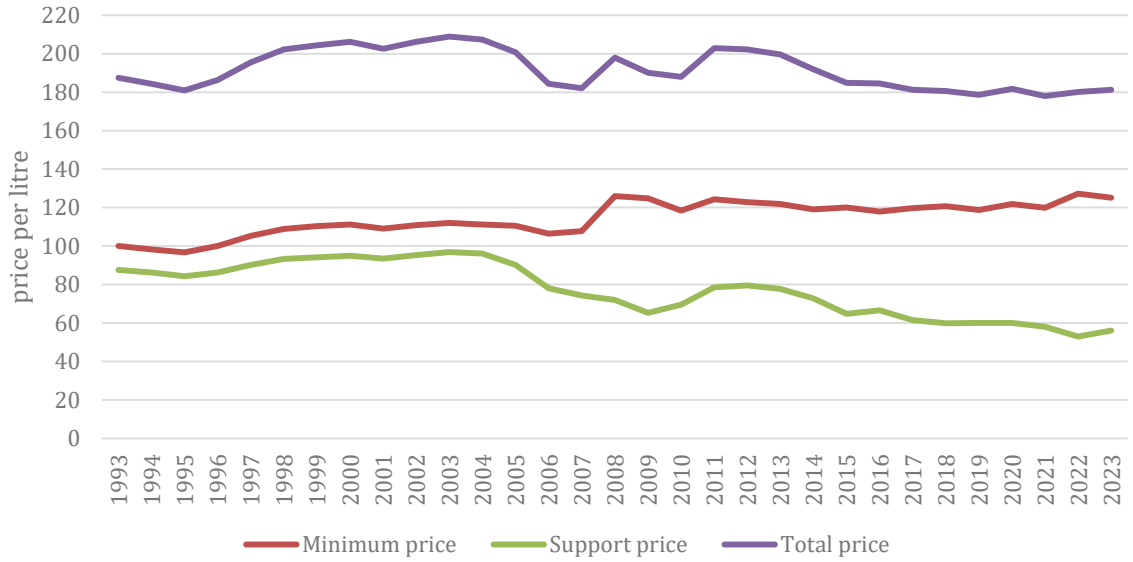
18 As mentioned above, with changes in regulations in 2017 quotas were no longer freely transferable and farmers wanting to sell had to sell to the government at a pre-announced government price (set at double the present value of the value of the future subsidy payments) and farmers wanting to buy could apply for quota (according to somewhat complicated allocation rules that stipulate eligibility) at that same price.

19 Actually, available production statistics (Auðhumla, https://audhumla.is/, and ársskýrslur SAM) indicate a considerable growth in production per farm since 1980, when the average production was about 48,000 liters per farm. This growth, however, became much more rapid from 1992 onwards (as seen in figure 2), after the system of direct payment was adopted.

20 That is labor productivity. Total factor productivity increase may have been rather less, however, as there has been a very considerable increase in the use of capital (machinery) and other inputs over the same period.

Since the introduction of tradeable direct payment quotas there have also been great improvements in milk yield per cow, as can be seen in figure 3. In 1992 yield per cow averaged 4,108 kg but started to increase at an increasing pace in 1997. In 2023 the average yield was above 6000 kg, at 6,411 per cow. This is a 60% increase in milk yield over these 30 years. About 3/5 of this increased yield occurred in the 10 years between 1997 and 2007. The most productive cows yield about 14,000 kg per year and the most productive farms have a average yield of nearly 9,000 kg per year (see www.rml.is).[21]

Figure 4
Calculated real price (2023) per litre of production received by dairy farmers



Sources: SAM ("Samband afurðastöðva í mjólkuriðnaði") yearly reports.

As explained above, the total price received by dairy farmers for their production consists of the minimum price paid to them by the dairies and the direct payments received from the state.[22] The evolution of these prices in real terms (2023 prices), is illustrated in figure 4. As is evident from the figure, the total price has declined considerably or by 6% since 1992 and almost 16% since 2003. Since apparently dairy farmers' net income has not declined during this period, this decline in the real price is indicative of at least the commensurate annual growth in total factor productivity of dairy farming since 1992.

Interestingly, the fall in the real price received by dairy farmers is explained solely by the fall in the real value of the direct payments per liter of production. These payments have fallen by more than 2/5 since 1992 (actually since 2003), while the real value of the minimum price has increased by 1/5.

21 The milk yield from cows in Iceland are still low relative to yields in countries in northern Europe and North America, where the yield is 50-60% higher.

22 The minimum price here is the price that is actually paid to dairy farmers who sell to SAM milk product producers. This farmgate price is always a little higher (1-5%) than the minimum price set by the official price committee (Verðlagsnefnd), the difference being the "quality" (fat, protein) of the milk. Further, the support price (the subsidy) here is the one that SAM publishes and is calculated on the basis of the total government financial support to dairy farming. This support price here is therefore a little higher than the direct quota payments per liter. In 2023 it was a little less than 40 krónur.

3 Increasing efficiencies with tradeable quotas

We have argued in Ragnarsdóttir et.al. (2017) that the Icelandic system of direct payments to farmers is in many ways well-suited to improve their living standards without creating additional social costs in terms of resource misallocation. This system of direct payments only distorts production if the direct payment quota is set above the level that farmers would choose without it. This is explained in some detail in Ragnarsdottir et al. (2017). The essential reason is that the subsidy is only up to a certain volume of production, namely the direct subsidy quota. Production beyond that level does not receive any subsidy. It immediately follows that if farmers in the absence of a subsidy chose to produce at or beyond the direct subsidy quota, the subsidy will not affect their level of production. The distortion in the Icelandic dairy production, in excess of the socially optimal level of production, are therefore caused by the minimum price rather than the direct payments system.[23]

We now turn our attention to the theoretical arguments behind the efficiency enhancing quota trade. Let us begin our analysis by imagining two dairy farmers who are operating at a period when a dairy quota regime is instituted. When the quota is allocated both farmers receive an equal amount of quota.[24] On the graph in figure 5 this is shown as q^1 and q^2 on the horizontal axis. But we also assume here that the farms, or farmers, differ in their ability and this is reflected in the difference in marginal cost curves, MC^1 and MC^2, in the graph. These differences may reflect differences in productivity, economies of scale (with current facilities), or different opportunities the farmers face (difference in opportunity cost).

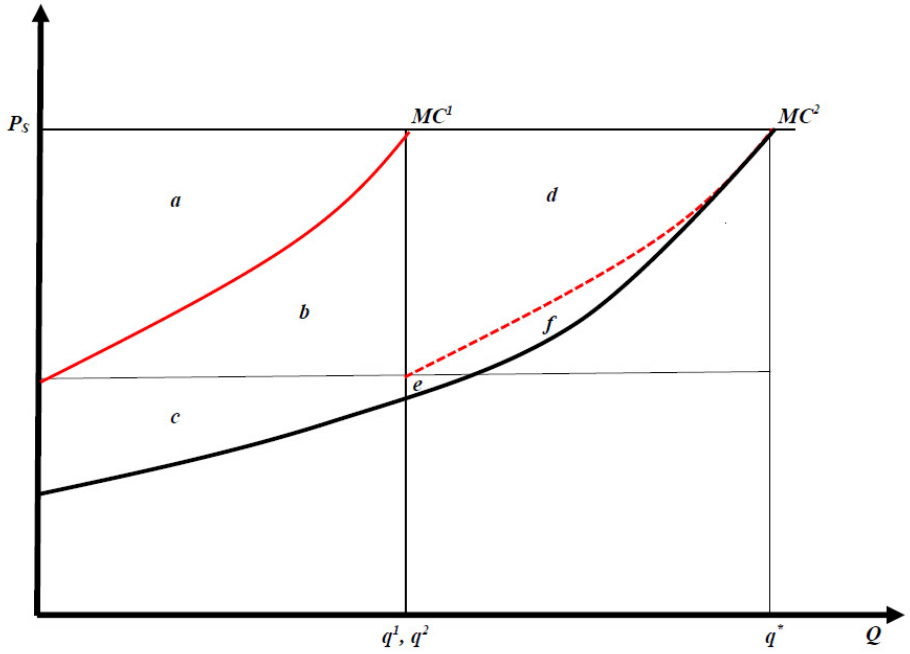
At this volume of quota farmer 1 could expect to receive a rent that reflects the difference between the P_S and MC^1, or area a. Farmer 2, on the other hand, can expect to receive a rent that reflects the difference between P_S and MC^2, or area $a+b+c$, when he produces his full quota at q^2. So, the gains to farmer 2 are larger by $a+b+c-a$ or $b+c$, as he is comparatively better at dairy farming.

But from the graph we can also see that were farmer 2 able to double his production to q^*, a volume that equals $q^1 + q^2$, he would receive an additional rent equal to areas $d+e+f$ (the difference between P_S and MC^2 from q^2 to q^*). Also note that area d (below P_S and the dotted line) is equal in size to area a. Farmer 1 is therefore receiving less rent from producing volume q^1 than farmer 2 would receive in increased rent if he increased his production by volume q^1. In fact, farmer 2 could offer to produce farmers' 1 quota, pay rent equal to area a to farmer 1, and yet receive areas $e+f$ in additional rent. This tells us that there are gains in trading quota between these two farmers. With trade farmer 2 w1ould produce all the milk ($q^1 + q^2$) and farmer 1 would produce no milk.

23 Although Tullock (1975) warned of the "transitional gains trap" that society could get itself into with the establishment of trade restrictions and subsidies that benefitted certain groups of people and would therefore be difficult or impossible to abolish, because of the opposition of those groups, he also asked why society (almost) always chose those methods of delivering those income transfers in the most inefficient ways (see Tullock, 1986). Tullock (1986) would possibly have approved of the Icelandic direct payment system, if he had to choose between it and some other system of production restrictions and subsidies.

24 Note that there was already a quota system in place, the fullvirðisréttur, as described in section 2 above. The greiðslumark replaced the older system, and now the quotas were freely transferable and instead of just a guaranteed minimum price there was now a (lower) minimum price plus a direct support payment (per liter).

Figure 5
Beneficial trade between two dairy farmers



It may be noted that depending on the base price (i.e. the milk price before the subsidy) one or both farmers may initially produce above the direct subsidy quota. If that is the case, it is highly likely that this excess production and, therefore, the total production of milk will be reduced following the trade. This will bring milk production closer to the policy objective represented by the total quota.

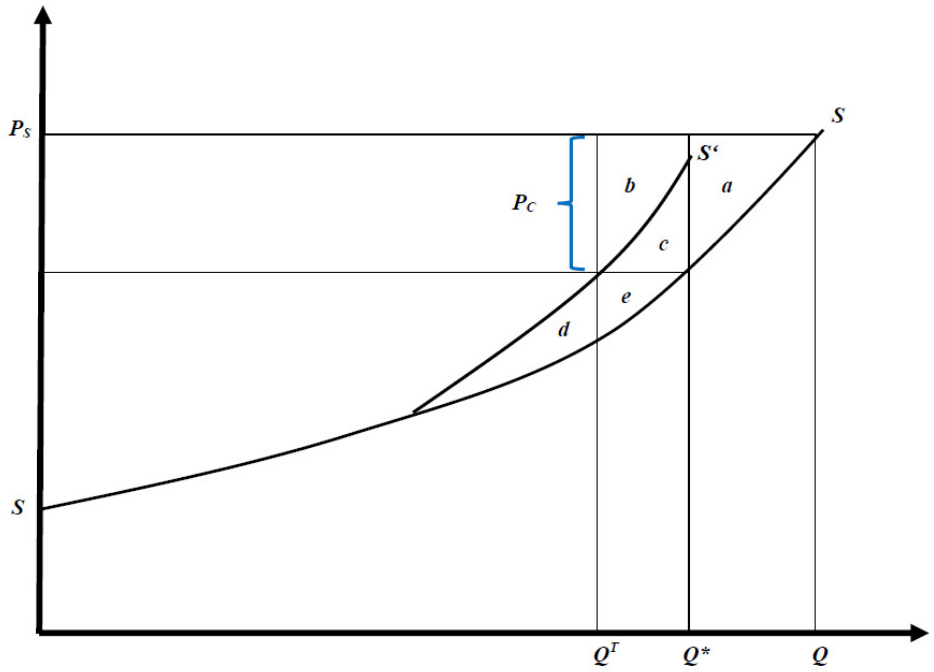
Let us now look at the dairy farming sector as a whole. Figure 6 describes the supply conditions in the market for milk, where *SS* shows the market supply, which is of course the horizontal summation of the individual supply (or relevant parts of the *MC*) curves of the individual dairy farms. At price P_S the farmers are willing to supply quantity *Q*.[25] We assume here that farmers are heterogeneous in their producing abilities. Let us now assume that the government imposes a production limit at Q^*. With an equiproportional production (quota) reduction total production will decrease from *Q* to *Q**, the supply curve *SS* reverts to the intra-supply curve *SS'*. If quota trade is not allowed there will be a loss in producer surplus defined by the area *a+c+d+e*, of which *a* is result from the decrease in total production and *c+d+e* from the efficiency differentials between farmers.

With quota trade we can identify the potential trade of quota as the area marked by the difference between P_S and *SS* at Q^* and a horizontal line from there to the *SS'* curve, or the rectangle *b+c*. The horizontal line marking the lower bound of this area therefore defines P_C the price of a quota unit in this situation. The amount of quota trade could therefore be up to the amount Q^TQ^* on the horizontal axis and the total selling price would be *b+c*, of which b represents compensation to sellers for the loss of (future) income (to fixed resources) and c is their net gain. Buyers of the quota gain the right to generate the extra income *b+c+d+e* at an opportunity cost of *b+c*. Their net gain is therefore *d+e*. The industry as a whole gains *c+d+e* in efficiency.[26]

25 P_S is the sum of the minimum guaranteed price and support payment price up to the volume Q*. For excess production in excess of the quota (greiðslumark) of each farmer and in excess of Q* (heildargreiðslumark), farmers are paid a price that is lower than the minimum price, as explained in footnote 8. To simplify the presentation in the graphs in Figures 5 and 6, we do not show the lower price that dairy farmers receive for excess milk, in producing beyond their quota.

26 Figure 6, as well as some of its interpretation, is reproduced from Burrell (1989). A similar graph

Figure 6
Total quota and the efficiency enhancing quota trade in the dairy farming market



With quota trade we can identify the potential trade of quota as the area marked by the difference between P_S and SS at Q^* and a horizontal line from there to the SS' curve, or the rectangle $b+c$.[27] The horizontal line marking the lower bound of this area therefore defines P_C the price of a quota unit in this situation. The amount of quota trade could therefore be up to the amount Q^TQ^* on the horizontal axis and the total selling price would be $b+c$, of which b represents compensation to sellers for the loss of (future) income (to fixed resources) and c is their net gain. Buyers of the quota gain the right to generate the extra income $b+c+d+e$ at an opportunity cost of $b+c$. Their net gain is therefore $d+e$. The industry as a whole gains $c+d+e$ in efficiency.

As some quota selling farmers will leave the industry (which likely will occur, although it may take some time) it may seem that the amount $b+c$ is leaving with them. But this conclusion would be incorrect. Area b was their share in future income which they could have moved out of the industry anyhow, so nothing of this area is leaving specifically because of the quota trade. Area c, which represents a part of the increased efficiency resulting from the quota trade, is achieved by decreasing costs, such as acquiring factors of production and supplies from outside the industry. In that view area c may now go to farmers leaving the industry instead of going to outside suppliers. But from the perspective of the industry there is no difference here resulting from the quota trade, c moved out before and may continue to do so after the trade. So, $b+c$ is not a (new) net loss to the industry.

In addition, we should keep track of the net gain accruing to the buyers of quota, areas $d+e$, as areas $b+c$ "pay their own way".

On top of the efficiency gains shown on the graph, one could expect that there may be further lowering of cost as continuing farms increase in size and production. Such efficiency gains would then result in SS shifting down, at least partly (the portion under areas $d+e$).

And further in addition, farmers may not only differ in their abilities to produce but could also have differences in time preferences (discounting the future at different rates), which may also create potential trade in quotas.

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is also reproduced in OECD (2005).

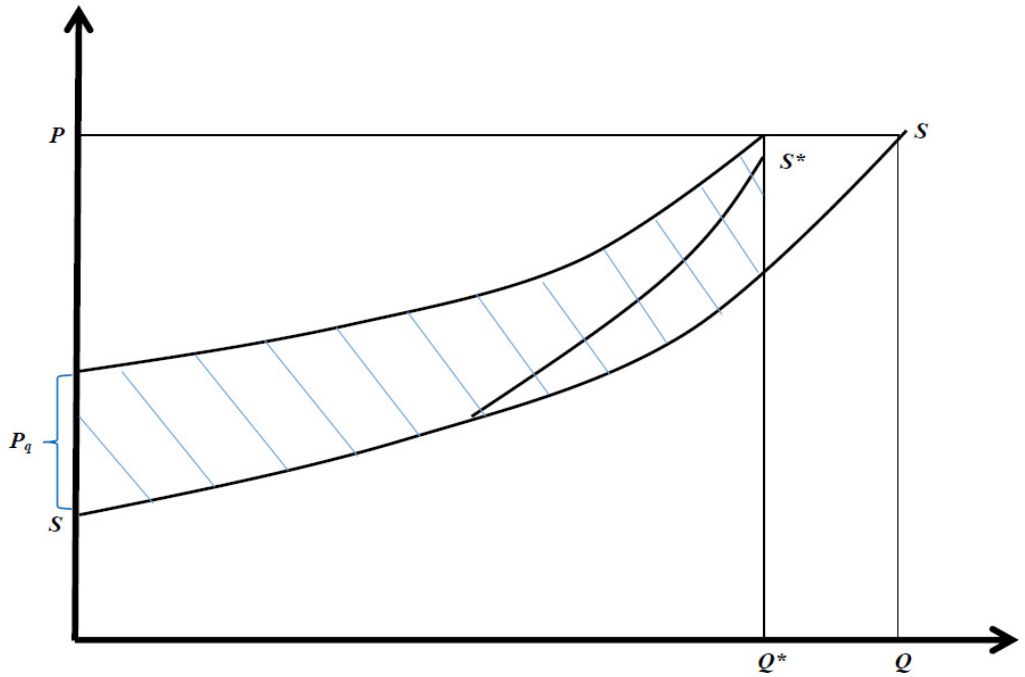
27 Again, P_S is the combined minimum guaranteed price and support payment price. Milk produced in excess of Q* receives a lower price than the minimum price.

The quota trade therefore increases efficiency in the dairy sector, as the more efficient farmers produce a larger share through acquired quota. The increased efficiency enlarges the surplus, which then is divided between those farmers that continue dairy farming and those who trade their quota, both gain and society gains.

4 The cost of acquiring quota

When quota trade is allowed the more efficient farmers will acquire more quota and increase their share of the total, and other less efficient farmers will decrease their share. This will of course make dairy farming more concentrated, as would be expected if more efficiency is the aim. This is in effect a "buying out" of some excessive resources in the industry and they leave.[28] So it would seem, that the remaining resources are now receiving more income per unit. But the total income is the same (Q^T x P_s). Relative scarcity of the required resources or factors in dairy farming is what changes with the imposition of a quota system with a production limit. Now a quota is required, and it is scare because of the production limit (or in the Icelandic case, the direct payments limit). Other factors, such as farmland and farmers become less scarce and that lowers their price, while the factors which are becoming scarcer increase in value.[29]

Figure 7
The opportunity cost of owning quota



28 When a quota system with a (total) production limit is put in place it usually requires farmers to decrease total production. If quotas are tradable, they acquire value, as they both become required and scarce resources, but a fixed resource in farming, such as farmland, decreases in value as it is now in excess supply. See Burrell (1989).

29 It should be obvious that as long as there are requirements, such as quotas, land, or other factors, for producing or receiving (payments) supports these factors will gain value. Newcomers will therefore pay a price to enter a restricted/subsidized industry, such as agriculture. So, quotas are not the right culprit when complaint about "price" being a hindrance for newcomers to enter; restrictions/subsidies are.

Tradeable quotas acquire value at the expense of other factors.[30] This is illustrated in figure 7. The shaded area represents the aggregate opportunity cost of using quota and must be covered out of income. This opportunity cost is a cost faced by all dairy farmers that operate after the tradable quota system is established, not just those who buy or lease quotas. A farmer who buys (or leases) his quota, in part or fully, surely not only faces the cost of acquiring the quota but further may enter into obligations, such as financing the newly acquired quota with a loan from his bank. Such financial arrangements, the installment and interest payments on the loan, often become the visible part of the quota trade and is then mistaken as showing the "cost" of the quota. But the repayment of the loan with interest is not the relevant cost here and in fact they do not represent the cost of the quota acquirement in any way.[31] The relevant cost of the quota, at the time of purchase, is the expected value of the alternative investment for the quota; the value of the foregone alternative.

Imagine a farmer who has managed to put some money aside in recent years. He now has a sizeable amount in his savings account at his local bank. The farmer is now deciding on whether to keep this money (asset) in the savings account, which accumulates an interest rate of 6% per annum, or whether to invest his savings in dairy quota (at the going price per liter), which looking at all reasonable calculations should return a (riskless) rate in excess (or just above) 6%. In acquiring the dairy quota, the farmer therefore faces the cost of foregoing the savings account with its interest income.[32] Just across the highway from this farmer there is another farmer contemplating a similar choice, except that he has no accumulated savings in the bank. But the local bank manager has looked at his calculations on the investment return and offered to finance the acquisition of the quota with a loan that carries an interest rate of 6%. As his expected (riskless) return is more than 6% he too will invest in quota. Both farmers here buy quota and both farmers face the exact same cost. The only difference is regarding financing the acquisition of the quotas, one farmer finances with a loan from the bank while the other is self-financed.[33] This different arrangement of financing however does not affect their costs in any way.[34]

A third farmer who receives an allocation of quota at the start of the system and does no trading in quota still faces the same cost as the two farmers above. By producing milk and thereby using his own quota and foregoing the sale or leasing of the quota he is in effect facing the same opportunity cost as the other farmers. This third farmer could sell (or lease) all his

30 This decrease in value of farmland or other dairy farming specialized capital really challenges the view that the value of the tradeable quotas is somehow creating a windfall. This "windfall" is only really a change in relative prices of the farm related assets, as long as the total support price per liter stays the same. In the Icelandic case, and in fact, most other countries that have used tradable quotas, the real support price per liter has decreased over the years.

31 What is often referred to as the "interest cost" of acquiring ("buying") quota is more properly the interest expense of an investment and should be evaluated along with other expenses and against the revenues of the same investment project. The net return of that investment, revenues minus expenses, is then the relevant cost in comparing this investment to another. A further point to consider is that there may be institutional incentives in place, such as tax treatment of interest, that encourage farmers, and business in general, to use debt finance rather than equity finance.

32 To keep the example simple, we assume there are no other investment options. Further, we of course assume that the two investment choices are being evaluated over a certain common time period, such as 10, 20 or 30 years.

33 Another way to look at the method of self-financing is to assume that this farmer will repay himself by putting a certain amount each month into his savings account and rebuilding his savings with accumulated interest within a given time period (the assumed evaluated investment period).
It may be noted that Modigliani and Miller (1958) pointed out long time ago that with perfect capital markets the method of financing did not affect the value of the company.

34 Further, the often referred to "outflow" of capital (the stream of subsidies payments) as quota buying farmers pay down their loans is not a net outflow. Rather, these farmers first receive an "inflow" of capital, when they incurred the debt to finance the quota, and then later they have an "outflow" to pay down the debt. On net, there is no outflow of capital, and as for the interest payments, they are a part of the borrowed capital.

quota (at the going price per liter) and put the proceeds into a savings account at his local bank and receive 6% interest on the savings amount. The height of shaded area in figure 7 shows this same opportunity cost per liter, P_q, that every farmer producing milk and receiving payments in proportion to his quota faces.

The whole of the shaded area therefore shows the aggregate opportunity cost that the farmers as group face. This total value of the quota arises as the quota becomes a requirement for receiving price supports, whether they are in the form of a minimum guaranteed price or subsidies, or a combination thereof as in Iceland. These same price supports were tied to some other required asset before the tradeable quota system was put in place and raised the value of those assets then. But even though the total income in dairy farming is the same as before, the total value of the quotas could be larger than this imputed value of the other assets before. Or, in other words, the decrease in value of these previously required factor could fall less in value than is the total value of all the tradeable quotas, and that is because of the increasing efficiency in dairy farming after trade in quota begins. In time this increase in efficiency may not be the only effect on the increase in quota values (real price of quota per liter) as other changes resulting from introduction of quotas will also provide incentives to increase the income from a given volume of milk.

5 Conclusion

Although it is one of the basic principles of economics that the free trade of goods and services creates benefits to all parties involved in that trade, as they would not otherwise engage in it, and that such trade in general benefits the whole of society, some have suggested that this somehow does not apply to the trade of dairy quotas. We have in the above explained why those doubts are unfounded.

We have shown here that these arguments about who gains and who loses in quota trades are confused. Our analysis shows that no one incurs a loss, not those operating in the system, not those who cash out, nor those who buy quota. Not only doesn't anyone lose but in fact most or all gain through trade. This is of course of no surprise, as it is the general result of economic theory that trade results in gain to all participants in that trade. In fact, gain is the motive for trade; people would not engage in trade if they did not see some gain in doing so.

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