Milk quota systems: Considerations of market and welfare effects

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Introduction

Generally, a production quota is a limit imposed on the quantity produced. Milk quotas were often introduced to control the growth of surplus production and budgetary expenditures, to maintain market price support, and to provide price stability for dairy farmers.

The economic theory relating to how quotas impact on markets or, more specifically, on supply, resource allocation and welfare is well established. Typically, the welfare effects of quotas are compared with the free market situation with the standard conclusion that quota systems are inefficient and cause considerable transfers from consumers to producers (for an example, see Veeman 1982). Harvey (1984) argued that in a political-economy context adoption of quotas may result in increased welfare as measured against a status quo policy that generates even greater distortions and misallocation of resources. Guyomard and Mahé (1994) agreed that quotas could be a welfare improving policy instruments, but argued that welfare gains to be expected from the corrective quota instruments are overestimated in a static approach compared to a dynamic approach.

The initial inefficiencies and emergence of quota rent following the milk quota implementation have also been elaborated in the literature (Harvey, 1984; Burrell, 1989; Dawson, 1991; and Colman et al, 1998). This strand of literature illustrates that after a quota imposition, low-cost efficient milk production is impeded at the expense of high-cost inefficient production. When a quota system allows quota to be traded or leased, the efficient producers would lease or buy quota from less efficient producers and the rental price in a competitive market would be bid to a rate equal to the difference between support price and marginal cost – hence the emergence of

quota rent. Dawson (1991) argues that the main criticism of quota systems concerns the tendency for quotas to acquire value.

Although the key concept of quota system is simple – to set a limit on production – the consequences of operating such a system are far reaching and often not foreseen by the quota advocates. The quota system impacts on all facets associated with production, it influences structural changes in agriculture, the structure of the dairy processing sector, welfare of producers and input suppliers (to some extent consumers)[1], the value of assets in agriculture, production risks, the uptake of new technologies and, of course, production levels and trade. A large body of literature exists that have examined the characteristics and effects of quota systems.

This paper is based on work undertaken by the OECD Secretariat in analysing dairy policy reform and trade liberalisation (OECD, 2005). A part of this broad study has also examined the trade and economic effects of milk quotas. This examination of milk quotas can not be compared to the extensive reports investigating milk quota feasibility such as those by Colman et al. (2003) and INRA-Wageningen (2002). Nevertheless, among other things, this paper highlights two important aspects relevant to an evaluation of quota systems which have been sometimes overlooked in the literature and political discussion. Both aspects are discussed in this paper in turn.

First, the paper draws attention to trade-offs that exist among the individual policy tools and given policy objectives. Second, the paper illustrates some important welfare effects of a quota system for owners of farm resources and suppliers of inputs that are not often considered in the literature. Although each part of this paper touches on a different aspect or problem area

[1] Although consumers are typically not affected directly by a quota system, the presence of quota may facilitate a continuation of high price support measures which indeed do influence consumers.

related to quota, the intention is mutual; to stimulate discussion and extend the understanding of the economic impacts of quota systems.

Quota interactions with other policy objectives

The setting of the level of quota represents an important policy decision which interacts with the effects of other policy tools. The impacts on world and domestic dairy markets of changes in the level of quota are conditional on the decision regarding other policy objectives. That is, the quota level has a direct influence on exports and government expenditure on subsidised exports within the objective of holding the supported domestic price unchanged. On the other hand the level of quota determines the cuts in domestic prices required to achieve other objectives such as holding exports or government expenditure on subsidised exports unchanged.

The relationship between the quota and certain policy objectives might be illustrated using a simple diagram. Figure 1 schematically depicts the trade-off between the supported domestic price and the quota level given that the policy objective is to leave government expenditure on subsidised exports unchanged. Consider that at the initial level of the supported domestic price P_S and milk quota Q^* consumption equals quantity Q_{DS} of milk while Q^*-Q_{DS} is exported with export subsidies equal to $(Q^*-Q_{DS})\times(P_S - P_W)$. Holding the supported domestic price constant and increasing the quota to the new level Q_N^* increases taxpayers costs (export subsidies) by $(Q_N^*-Q^*)\times(P_S - P_W)$.[2]

Nevertheless, policy makers can, for a given level of quota, reduce the supported domestic price so that government expenditure (taxpayers' costs) on subsidised exports would not be affected. Figure 1 illustrates that in order to keep government expenditure unchanged, the

[2] The level of quota is proportional to taxpayers cost. For example, assuming half of the milk production is consumed domestically, a one percent increase in quota level translates to two percent increase in taxpayers' cost (holding the support price constant).

domestic price has to be reduced to a new level P_N for which the lighter shaded area equals the darker shaded area in the diagram. That is, the export subsidies before and after quota increase must be equal; mathematically expressed $(Q^*-Q_{DS})\times(P_S - P_W) = (Q_N^*-Q_{DN})\times(P_N - P_W)$. Note that under the new price (P_N) consumers will consume a higher quantity ($Q_{DN.}$).[3] A different scenario can be constructed to evaluate the increase of quota with the objective of holding the volume of dairy product exports constant. In the analytical framework of Figure 2 this scenario could be described as follows: "By how much would the price (P_S) have to be lowered to a new level (P_N) so that for a given increase in quota (from Q^* to Q_N^*) the volume of exports remains constant ($Q^*-Q_{DS} = Q_N^*-Q_{DN}$)." Note that in this scenario the darker shaded area in Figure 1 would be smaller than the lighter shaded area, suggesting that government expenditure on exports would be reduced, by how much remains an empirical question.

In order to evaluate numerically the relationship between the quota level and supported domestic prices under specific economic parameters and policy objectives, empirical analysis has been carried out using the *Aglink* model.[4] Following the analytical example of Figure 1, the specific question to be addressed by the first empirical experiment is "how much would domestic prices have to be lowered to accommodate a given increase in milk quota while holding government expenditures on export subsidies constant?" As the level of the quota is exogenous in only one country/region in *Aglink* – the European Union (EU) – the EU module is used to set up the scenario.

[3] It should also be noted that for simplicity the figure represents a small country case which does not have a substantial impact on world markets and prices. For a large country the world price would have to be reduced in the diagram to reflect the impact of increased exports.

[4] *Aglink* is a policy specific, partial equilibrium, dynamic model developed at the OECD. The simulation experiments are conducted using the baseline data of the Agricultural Outlook baseline 2003-2008 published in OECD (2003). The dairy component of this model covers production and consumption of milk and main milk products in major OECD and several non-member economy markets, covering both importers and exporters.

While Figure 1 depicts the analytics in terms of milk price and milk quantities, in reality milk is often priced and traded in the form of dairy products. Thus, theoretically there are a large number of permutations for adjusting individual dairy product exports while holding the overall government expenditure on exports constant. For the sake of transparency, the objective of holding the government expenditures on exports constant is achieved by holding the government expenditures on exports for each dairy product constant at the baseline level.

The results for a 1 percent, 1.5 and 2 percent increase in milk production quota respectively are presented in the first three columns in Table 1 under the heading "Government expenditures constant". The table illustrates, for example, that if the milk quota were to be increased by 1 per cent, then the required stability in export subsidy expenditures would be achieved by a simultaneous reduction in the butter price of more than 3% and an increase in exports of butter by 5.1 percent. [5] The producer price of milk in this scenario would fall by 2.4 percent. World prices for all dairy products would be reduced as a result of increased exports from the European Union, which is a dominant player on world dairy markets. The results for the scenarios show increases in almost linear fashion (Table 1). [6]

The results of the scenario where the policy objective is to increase quota while keeping export volumes fixed are reported in the last three columns of Table 1 under the heading "Volume of exports constant". Comparing the results of the first and second experiment the results for the second show more profound cuts in dairy product and milk producer prices as the internal market clearing is not aided by additional exports. Government expenditures on subsidised exports

[5] Note that export subsidies are limited by the WTO both, in volume and value terms, which prevents any increase over these limits. In this respect the scenario must be viewed as purely illustrative as no account is taken of the respective WTO limits on the volume of subsidised exports.

[6] Note that butter prices would have to be reduced substantially more than those for SMP. These results stem to some extent from the fact that in *Aglink* the EU demand for fat is specified as being less elastic than demand for non-fat solids

would be reduced for all dairy products with the highest reduction seen for butter, again followed by WMP, cheese and SMP.

As the volume of exports is held at the baseline level, the second scenario could be expected to have a negligible impact on world dairy prices. However, as Table 1 indicates, the impact on world dairy prices is non-trivial. This outcome reflects the New Zealand market access quota for butter to the EU market. As a consequence of this special access, the New Zealand butter export price in *Aglink* is partly determined by the world butter price and partly by that on the EU domestic market. As the EU price falls in the *Aglink* scenario, it reduces the rent accruing to New Zealand producers and ultimately reduces the butter prices in New Zealand. Channelling milk from butter to the production of other dairy products increases New Zealand exports of these products and reduces exports of butter. As expected the world butter price increases, while those for other dairy products fall.

Welfare effects of a quota system for owners of farm resources and suppliers of inputs

When a quota is set at a level that is above quantity demanded domestically at set support prices, then the quota by itself has no direct consequence for consumers assuming that support prices are held constant. However, the producer welfare impacts of quota policies are not straightforward largely owing to the presence of quota rent. The quota is typically a licence to sell milk at the supported price and as such becomes valuable in its own right. The quota rent (unit value of quota) then reflects the difference between an underlying cost of production and a milk price.

The standard welfare implications of quota imposition suggests that producers would loose if the quantity supplied at current support prices is restricted by a quota level. But would they? The simple analytical framework found in standard textbooks on welfare economics

typically assumes that producer surplus accrues to the owner of relatively fixed assets (typically land, in the case of farmers) under the condition that supplies of variable factors are perfectly elastic. Thus, prices in other markets are assumed fixed or unaffected by intervention in the market of consideration. However, in reality, the supply of inputs is not infinitely elastic. For example, when support price increases it tends to increase price of agricultural inputs as production expansion - under the new support price - increases demand for inputs. Hence, for any support instrument that increases derived demand for purchased farm inputs, the net welfare gain to farmers is likely to be overestimated, using the corresponding producer surplus gain, by the amount of income gains accruing to input suppliers.

The extension of the standard welfare analysis which relaxes the assumption of perfectly elastic supply of inputs is provided in Just et al. al (1982, Chapter 9). In this framework the supply (equilibrium adjustment) curve reflects the induced increases in factor prices (the area below the curve) but also reflects the increases in surplus to all inelastically supplied factors (the area above the supply curve). It follows that the producer surplus is distributed across farmers and other input suppliers. In other words, in the long run the benefits of market price support are shared by farmers' own resources and by input suppliers.

The exact derivation of the equilibrium supply curve is illustrated in Just et al, so that only the consequences for quota systems are considered here. It is not easy to illustrate this phenomenon in a graph so that relatively simple and transparent description is presented. For ease of exposition, it is assumed that 50% of surplus goes to farmers' owned resources and 50% goes to input suppliers. Figure 2 illustrates the hypothetical 50-50 partition of surplus on the basis of farmers' owned resources and purchased input suppliers.

The figure shows that prior to quota imposition farmers would produce Q tonnes of milk at the price P_{S0} with the producer surplus equal to the sum of the areas $a+b+c+x+y+z$. By

construction of the experiment the area $a+b+c$ represents 50% of the total producer surplus and depicts return accruing to farmers' own resources under the assumptions of this simple exercise. The area $x+y+z$ represents the remaining 50% of the total producer surplus and are the returns accruing to input suppliers, again, reflecting the assumption explained in the previous paragraph. If trade in dairy products is fixed such that the domestic price of milk is set to clear the domestic market, then after applying quota of Q^*, a price rise from Ps_0 to Ps_1 is required, and the quota assumes value corresponding to area $a+x+d$ while returns to factors other than quota are reduced to area $b+y$. The quota system results in input suppliers losing an amount equal to area $x+z$. Farmers (to the extent that they hold relatively fixed assets, such as land) loose c but gain x, formerly input suppliers surplus, as part of quota rent.

If domestic demand is determined by a target price, such that trade is determined by excess supply, then assuming the domestic price after application of a quota remains at Ps, quota value will be equal to a+x and return to factors is reduced to b+y at a marginal cost of Pc. Again, input suppliers see their returns reduced by x+z. Farmers lose factor rent a+c but gain a+x as quota rent; x is a transfer from input suppliers to producers because of the quota.[7]

The example above could be also reversed to show that an increase in the quota level allows part of the producer surplus to be recaptured by input suppliers due to rising demand for purchased inputs so that milk producers may loose due to the quota rent erosion. Whether farmer would loose or gain remain an empirical question and very much depend on the share of surplus split between farmer's owned factors of production and suppliers of purchased inputs and the size of the production restriction.[8]

[7] In that case, when domestic demand is less than Q*, exports will need tax payer support given that world price would normally be less than P_{S0}.

[8] The OECD PEM model was used to evaluate the impact of a percentage increase in the EU quota. The analysis shows that the increase in quota quantity is insufficient to compensate for the decline in unit quota rent.

It should be noted that the capture of input suppliers' surplus as quota rent by farmers explains, in part, the high transfer efficiency of quota programs. Transfer efficiency measures the effectiveness of a policy instrument in transferring income to farmers. The definition and discussion on transfer efficiency of agricultural support policies can be found in OECD (1995). In brief, transfer efficiency is defined as the ratio of farm income change to change in program expenditure, in the form of either consumer or taxpayer costs. More generally, removing the ability of producers to react to price changes at the margin allows for related market price support policies to be highly transfer efficient, as this production response is a key determinant of transfer efficiency (OECD 2001). To illustrate the change in transfer efficiency of price support resulting from the imposition of a quota system, consider two alternatives using the setup in Figure 2. The first is an increase in price support (either as MPS or output support payments) from Pc to Ps_0 without quota, and the second an increase from Ps_0 to Ps_1 with quota set at Q*. The first case, increasing price from Pc to Ps_0, without quota, induces a production increase from Q* to Q, with a cost in terms of MPS level or required total payments equal to the area a+c+e+x+z. Of this, the producer gets a+c, the balance lost to input suppliers and deadweight. The ratio (a+c)/(a+c+e+x+z) then defines the transfer efficiency. In the second case, where support applied to raise prices from Ps0 to Ps1 with production fixed by quota at Q*, program cost is equal to area d, and the increase in producer welfare (through quota rent) is also d, yielding a transfer efficiency of 1, the highest possible.[9]

Although quota systems increase the transfer efficiency of support it is important to reiterate that the benefits of quota in terms of producer surplus will be in the long run capitalised

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That is, returns to farm-owned inputs increase but not enough to fully compensate for the reduced value of quota. Indeed, the input suppliers' surplus increases because the price of inputs has increased following the increase in derived demand (See OECD (2005) for more details).

[9] Note, the high transfer efficiency applies at the margin under binding quota.

into the value of quota. If quota is tied to land, the benefits will be capitalised into the value of land.[10] This is indeed a general problem of any increase in farm net returns but the added complexity in quota systems is that the share of benefits flowing to owners of farm resources is magnified at the expense of input suppliers and the rent accruing to quota reduces the surplus accruing to traditional resources.

Conclusions

This paper is based on work undertaken by the OECD Secretariat in examining the trade and economic effects of milk quotas. Two important aspects relevant to an evaluation of quota systems are discussed. First, when evaluating a quota system, it is important to keep in mind that a quota is typically contingent on the existence of another policy, namely market price support, and, in many milk producing countries, that market price support is in turn often contingent on the presence of quota. Simply removing production controls without also eliminating market price support would likely be unsustainable; conversely, in the absence of a policy that raises domestic prices over world prices, there is little rationale for limiting the quantity that domestic producers may offer in the marketplace. Thus, quota interacts with the effects of other policy tools and impacts on markets within a context of specific policy objectives. That is, quota has a direct influence on exports and government expenditures on subsidised exports within the objective of holding the supported domestic price unchanged. The quota level also determines the cuts in domestic prices required to achieve other objectives such as holding exports or government expenditure on subsidised exports unchanged. The actual trade-off between the policy tools is dependant on specific economic parameters.

[10] For further discussion and some empirical evidence on capitalising government program benefits to quota see Oskam and Speijers (1992) and Barichello (1996).

Welfare analysis of such a trade-off must also take into account certain issues related to defining producer surplus. The second part of the paper discussed important welfare implication of operating quota which has been often overlooked in the literature. The simple analytical framework found in standard textbooks on welfare economics typically assumes that producer surplus accrues to the owner of relatively fixed assets under the condition that supplies of variable factors are perfectly elastic. As, in reality, the supply of inputs is not infinitely elastic the producer surplus is shared between farmers and other input suppliers. Thus, provided that part of the primary factors of production are not owned by the farm family and prices for purchase farm inputs are not perfectly elastic (input prices are not fixed) the measured "standard" producer surplus change may understate net benefits to farmers of a quota system. The standard analytical framework does not reflect cost saving due to potentially lower input prices. Nevertheless, this fact may only aggravate the vested interests inherent to a quota and hinder reforms on price support later on.

It is thus important to bear in mind that although quota system increases transfer efficiency of market price support, a quota system is unlikely to be considered as the best policy option. This is due to the inefficiencies that it may create, the cost that it imposes on consumers, the difficulties and costs of administration that may arise for governments, the difficulty in getting the information on the quota level that would match production (or trade) under free trade and the vested interests that it generates. Moreover, quota systems allow a domestic market to be managed only if that market is isolated from external sources of supply. Quota imposition provides gains for initial beneficiaries, but subsequent generations can be locked into a higher cost structure, and the system then perpetuates itself. Thus, the above analysis is here presented from a methodological point of view and by no means intends to defend or recommend quota systems.

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TABLES

Table 1. Impacts of quota increases on key variables (average changes from baseline for the EU)

		Government expenditures constant			Volume of exports constant		
Variable	**Product**	%change	%change	%change	%change	%change	%change
Quantity	**Milk**	**1.0**	**1.5**	**2.0**	**1.0**	**1.5**	**2.0**
Domestic Prices	Butter	-3.1	-4.6	-6.0	-4.9	-7.3	-9.7
	Cheese	-1.4	-2.0	-2.7	-1.9	-2.8	-3.7
	SMP	-0.9	-1.4	-1.9	-0.2	-0.3	-0.4
	WMP	-1.2	-1.8	-2.4	-2.1	-3.1	-4.1
	Milk	-2.4	-3.6	-4.7	-3.0	-4.4	-5.9
Subsidized Exports (Volume)	Butter	5.1	7.8	10.5	0	0	0
	Cheese	2.3	3.5	4.6	0	0	0
	SMP	4.5	6.8	9.2	0	0	0
	WMP	2.7	4.0	5.4	0	0	0
Government Expenditures on Subs. Exports	Butter	0	0	0	-8.7	-12.9	-17.0
	Cheese	0	0	0	-3.4	-5.0	-6.7
	SMP	0	0	0	-0.7	-1.0	-1.4
	WMP	0	0	0	-6.6	-9.8	-12.9
World Prices	Butter	-0.6	-0.9	-1.2	0.3	0.4	0.5
	Cheese	-0.3	-0.4	-0.6	-0.1	-0.1	-0.2
	SMP	-0.1	-0.2	-0.2	0.0	-0.1	-0.1
	WMP	-0.6	-0.9	-1.2	-0.2	-0.2	-0.3

FIGURES

Figure 1. Interaction between quota level, domestic price, exports and government expenditures

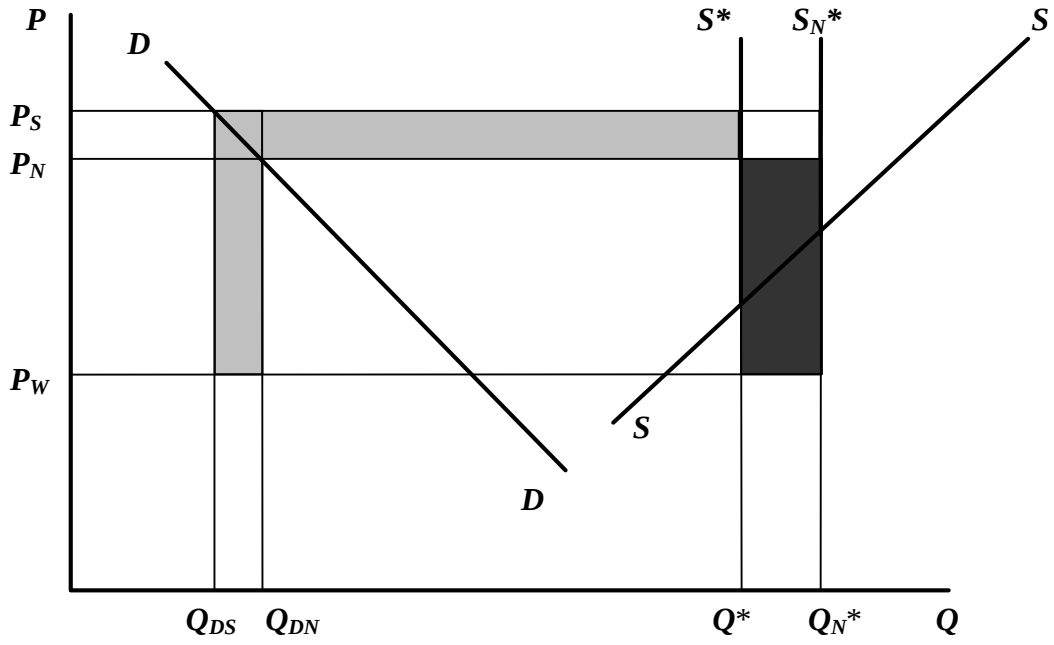

Figure 2. Quota imposition favours farm owners at the expense of input suppliers