Two-Tier Pricing and Agenda 2000

Consequences of EU dairy policy reform for Dutch dairy farming

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Les conséquences de la réforme de la politique laitière de l'UE pour le secteur laitier néerlandais

Résumé – Cet article analyse les effets, pour le secteur laitier néerlandais, i) d'un système de double prix, étant donné différents niveaux des prix mondiaux, ii) d'une baisse de 15 % du prix du lait, compensée par un paiement direct et accompagnée d'une augmentation de 1,5 % des quotas, au niveau national (Agenda 2000) et iii) de la suppression des quotas. Notre analyse montre qu'en présence d'un système de double prix et d'un marché libre des quotas, la production de lait de catégorie B (valorisée au prix mondial, inférieure au prix du lait sous quota A) serait positive pour un prix du marché mondial supérieur à 0,31 NG (0,14 euro) par kilogramme. Le profit des producteurs néerlandais évoluerait alors positivement du fait de l'accroissement de la production. En revanche, dans le scénario « Agenda 2000 », les producteurs subissent une perte de profit résultant de la diminution de la rente liée au quota, par suite de la baisse du prix du lait. Le paiement direct par tonne de quota est en effet trop faible pour compenser l'effet négatif de la réduction de la rente du quota. Ces scénarios de réforme de la politique laitière communautaire sont simulés à l'aide d'un modèle micro-économétrique du secteur laitier néerlandais qui détermine les effets des changements de politique envisagés au niveau des producteurs individuels. Les résultats obtenus sont ensuite agrégés (au moyen d'un système de pondérations) au niveau du secteur laitier national.

Mots-clés :
système de double prix, Agenda 2000, production laitière, simulations micro-économiques

Two-Tier Pricing and Agenda 2000. Consequences of EU dairy policy reform for Dutch dairy farming

Summary *– This paper analyses the effects, for Dutch dairy farming, of i) a two-tier milk price system, given different world market prices and ii) a combined 15 % cut in milk prices and a 1.5 % quota increase, compensated by a direct income payment (Agenda 2000) and iii) quota abolition. Our analysis shows that in the two-tier price system, with free quota trade, farmers will produce B-milk if the world market price is higher than NG 0.31/kg (0.14 euro). Profits increase because production increases. Implementing Agenda 2000 results in a profit decrease because quota rents diminish as a result of the cut in milk price support. The proposed direct payment per tonne of quota is too small to offset this fall in profit. A micro-econometric model of Dutch dairy farming is used to calculate the policy effects for individual farmers. These results are then aggregated to the level of the sector as a whole.*

Key-words:
two-tier pricing, Agenda 2000, dairy farming, micro-simulations

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IT is widely acknowledged that dairy policy in the European Union (EU) should be revised. There are three reasons for policy reform. First, EU dairy policy should be compatible with the 1994 GATT (General Agreement on Tariffs and Trade) agreement and the EU may anticipate to the new WTO (World Trade Organisation) round after 2000 (*Agra Europe*, 1996). Under the 1994 GATT-agreement subsidised dairy exports have to be reduced by 21 %, export subsidies have to fall by 36 %, a minimal market access of 5 % has to be established and (fixed) import tariffs have to be reduced by 36 % for dairy products (Hassan, 1996). Second, the enlargement of the EU with Central – and East European countries (CEECS) somewhere after 2000 will put pressure on the export budget of the EU when those countries become net exporters of dairy products. Third, the current, rigid milk quota system is an obstacle for structural adjustments and productivity growth in the EU dairy sector. Support prices are too high in relation to both the level of production and the level of productivity.

Within the EU, alternative systems, which combine lower support prices and more flexibility for the farmer regarding the production level, are examined. The discussion focuses on how farm prices should be brought in line with world market levels, whether and how farmers should be compensated for price reductions, and to what extent quota levels should be adjusted (*Agra Europe*, 1996). A two-tier price system is one of the options (with advocates particularly in France). Similar to the sugar regime, in a two-tier milk price system, A-milk is produced at a supported milk price and farmers are allowed to produce extra B-milk at the lower world market price. The advantage of the two-tier system is that it would enable to export without export subsidies, a prerequisite given the 1994 GATT-agreement, while maintaining a high level of support for dairy farmers. However, there are high monitoring and administration costs involved (*Agra Europe*, 1996). Moreover, it is questionable if the WTO would accept the two-tier price system because it could be considered as unfair competition. Price support to A-milk increases the overall (A-and B-milk) average revenue of milk production (cross-subsidisation), and therefore, in a two-tier system the production of B-milk is indirectly subsidised.

The European Commission's options for reform are reflected in the Agenda 2000 agreement. The agreement (*Agra Europe*, 1999a) contains a 15 % cut in dairy, *i.e.* butter and skimmed milk powder, intervention prices over the period 2005/2006-2007/2008 in order to improve competitiveness of EU dairy farming. As a result, the possibilities to sell dairy products are broadened. Moreover, the agreement contains a 2.4 %

increase in total EU milk quotas until 2007/2008 (1.5 % for the Netherlands) which also has a price reducing effect. Compensation for the price decrease is given on a flat rate basis per tonne of quota. The complex proposal to compensate by a « virtual » dairy cow premium, based on an assumed average yield of 5,800 kg per cow (*Agra Europe*, 1998), has therefore been scrapped. It is questionable if the Agenda 2000 agreement meets the needs of the new trade round. The elimination of export subsidies is not ensured and compensatory payments are not production-neutral. Therefore, the Agenda 2000 agreement is not fully WTO-compatible. Moreover, the enlargement issues are not explicitly considered (*Agra Europe*, 1999b).

The purpose of this paper is to analyse the effects for dairy farmers of i) a two-tier milk price system, ii) the Agenda 2000 reform regarding dairy, and iii) quota abolition. Dutch dairy farming is considered to be one of the most efficient within the EU. Therefore, the effects on production of the two-tier price system and the Agenda 2000 agreement for the Dutch dairy sector will give an indication of the possible effects on EU production. The effects are analysed using a micro-econometric simulation model of Dutch dairy farms and they are calculated for individual farms and for the industry as a whole. The model used is from Boots, Oude Lansink and Peerlings (1997). However, changes were made in order to simulate both the two-tier milk price system as the Agenda 2000 reform. Our theoretical model of the two-tier system is similar to the framework of Bureau *et al.* (1997) regarding the EU sugar sector, with A- and B-quotas and the possibility to produce C-sugar.

MODEL, DATA AND ESTIMATION

In order to analyse a two-tier milk price system, a model of output supply and input demand for dairy farmers is developed (Boots, Oude Lansink and Peerlings, 1997). Farmers are assumed to be short-run profit maximisers and price-takers in all input and output markets. In the short run, volumes of fixed inputs and the state of technology are assumed to be fixed and there is no exit and entry of farms. It is assumed that each farmer has access to the same production technology; farm-specific features (e.g. the quality of land and management) are modelled using fixed effects.

The outputs distinguished are milk (q_0), which is subject to supply constraints, and a composite of other outputs (q_1). Purchased feed (q_2), dairy cattle (q_3) and a composite of other inputs (q_4) are used as variable

inputs. Netput prices v_0 to v_4 and quasi-fixed inputs labour (z_1), land (z_2), buildings (z_3) and machinery (z_4) are assumed given. The model also includes a time trend (z_5) representing technology and a dummy (z_6) allowing for a change in technology due to the introduction of milk quotas in 1984. Furthermore, there are dummies (z_7 and z_8) included to distinguish between three regions.

A restricted profit function is defined as the cost of producing the constrained output q_0 (Moschini, 1988). The properties of the restricted profit function are equivalent to those of the regular profit function. However, it is possible that restricted profit is negative. The symmetric normalised quadratic (SNQ) is used as the empirical specification (Kohli, 1993; Oude Lansink and Thijssen, 1998) of restricted profit at the farm level.

From the restricted profit function, the netput equations (q_i, i = 1,..,4) for each farm are derived using Hotelling's lemma. The intercepts of the netput equations represent farm-specificity. The model is completed by the milk supply function, which is only valid in the pre-quota period (1973/1974-1983/1984). In the post-quota period (1984/1985-1992/1993), milk supply is exogenously given for the individual farm and the milk supply equation does not apply. In that case, the marginal costs of producing at the quota level are relevant.

The netput equations and the milk supply function, with additional error terms, are estimated on a panel data set [1] of 9 365 observations on specialised dairy farms over the period 1973/1974-1992/1993. The data are described in Boots, Oude Lansink and Peerlings (1997). The data for the average farm in 1992/1993 are presented in Table 1.

The milk supply equation is included during estimation in the pre-quota period. In the pre-quota period, the quantity of milk can be related to the error term and an instrumental variable estimator must be applied. Error terms may be correlated across equations. Therefore, 3SLS is an appropriate estimation technique (Judge *et al.*, 1988, p. 655). A detailed discussion on the estimation procedure and results can be found in Boots, Oude Lansink and Peerlings (1997). The Hessian of prices is positive semi-definite, a necessary condition for farmers to be short-run profit maximisers.

[1] The willingness of the Agricultural Economics Research Institute (LEI-DLO) in The Hague to make the data available is gratefully acknowledged.

THEORETICAL FRAMEWORK OF A TWO-TIER PRICE SYSTEM

The estimated model of the previous section is used to simulate the effects of the two-tier price system for individual Dutch dairy farms and the sector as a whole. In the theoretical model a distinction between a two-tier system with and without quota transfers is made. When trade in A-quotas is allowed, it is assumed that there are no quota trade restrictions. The theory behind the two-tier system is described in this section (see also Bureau *et al.*, 1997). It shows that the estimated model, wherein no distinction is made between A- and B-milk, can be used to simulate a two-tier milk price system.

No quota trade

In a two-tier price system, a fixed amount of A-milk ($\breve{q}_{Ah}$) at the farm level (denoted by h) is produced at a given supported price (v_A). Farmers are free to produce milk beyond their A-quota (q_{Bh}), but they will receive the lower world market price (v_B) for this B-milk. Thus, the milk price 0 is now partitioned into v_A and v_B, such that $v_A > v_B$, and $q_{0h} = q_{Ah} + q_{Bh}$. Therefore, given the world price for milk, and given the level of A-quota, the farmer chooses his B-production where profits are maximised:

$$\pi_h(\mathbf{v}, z_{kh}) = \max_{q_{Ah}, q_{Bh}} \{v_A\, q_{Ah} + v_B\, q_{Bh} + g_h(v_i, q_{0h}, z_{kh})\}$$

$$\text{s.t.} \qquad q_{Ah} \leq \breve{q}_{Ah}$$

$$q_{Bh} \geq 0 \qquad (1)$$

Here, $\mathbf{v}$ is a vector of prices consisting of v_A, v_B and v_i, $g_h(.)$ is restricted profit. The maximisation problem is restated as the Lagrangian:

$$L(\mathbf{v}, \breve{q}_{Ah}, z_{kh}) = v_A\, q_{Ah} + v_B\, q_{Bh} + g_h(v_i, q_{0h}, z_{kh}) - r_{Ah}(q_{Ah} - \breve{q}_{Ah}) + r_{Bh}\, q_{Bh} \qquad (2)$$

where, r_{Ah} and r_{Bh} are farm-specific Lagrange multipliers corresponding to the constraints in (1). They represent the extra profit of the farm when the constraint is relaxed by one unit. Therefore, they are also referred to as the shadow price of the constraint (Chiang, 1984, p. 727). Thus, r_{Ah} and r_{Bh} represent the value of A-quota and B-milk respectively. Using the definition of marginal production costs, $-\dfrac{\partial g_h(.)}{\partial q_{0h}} = s_{0h}$, the Kuhn-Tucker conditions for an optimum are:

$$v_A - s_{0h} = r_{Ah} \qquad ; r_{Ah}(\check{q}_{Ah} - q_{Ah}) = 0 \tag{3a}$$

$$v_B - s_{0h} = r_{Bh} \qquad ; r_{Bh}\, q_{Bh} = 0 \tag{3b}$$

The farm's shadow price of A-quota (r_{Ah}) equals the difference between the market price of A-milk and the farm's marginal cost of total production, and – r_{Bh} is equal to the difference between the price of B-milk and marginal cost. If both constraints in (1) are indeed binding (r_{Ah}, $r_{Bh} > 0$), the optimal production of A-milk equals the quota level and there is no B-milk produced ($q^*_{Ah} = \check{q}_{Ah}$ and $q^*_{Bh} = 0$, optima are denoted by an asterisk). Thus, the optimal total production level equals the quota level. If only the quota constraint is binding ($r_{Ah} > 0$ and $r_{Bh} = 0$), optimal A-milk production equals the quota level and the optimal total milk production is found by solving (3b) ($q^*_{Ah} = \check{q}_{Ah}$ and $q^*_{Bh} = q^*_{0h} - \check{q}_{Ah}$). If only the second constraint is binding ($r_{Ah} = 0$ and $r_{Bh} > 0$), there is no B-milk produced and total milk production is found by solving (3a) ($q^*_{Bh} = 0$ and $q^*_{0h} = q^*_{Ah}$). Since it is assumed that $v_A > v_B$, it cannot be that both constraints are not binding.

Free quota trade

If the exchange of A-quota is allowed within a two-tier system, a farmer may choose to expand milk production beyond his initial A-quota ($\check{q}_{Ah}$), either by producing B-milk at the low world price v_B, or by buying extra A-quota at its market price (r_A^T)[2]. However, a farmer may also want to sell part of his A-quota, expanding B-milk production instead. The following profit maximising problem holds:

$$\pi_h(\mathbf{v}, \check{q}_{Ah}, z_{kh}, r_A^T) = \max_{q_{Ah}, q_{Bh}} \{v_A\, q_{Ah} + v_B\, q_{Bh} + g_h(v_i, q_{0h}, z_{kh}) - r_A^T(q_{Ah} - \check{q}_{Ah})\}$$
$$s.t. \qquad q_{Bh} \geq 0 \tag{4}$$

The corresponding Lagrangian is:

$$L(\mathbf{v}, \check{q}_{Ah}, z_{kh}, r_A^T) = v_A\, q_{Ah} + v_B\, q_{Bh} + g_h(v_i, q_{0h}, z_{kh}) - r_A^T(q_{Ah} - \check{q}_{Ah}) + r_{Bh}\, q_{Bh} \tag{5}$$

Again, r_{Bh} is the farm-specific Lagrange multiplier corresponding to the constraint that B-milk production cannot be negative. The conditions for an optimum are:

[2] r_A^T is the rental price of quota user rights which is not the same as the price of buying quota ownership rights.

$$v_A - s_{0h} = r_A^T \tag{6a}$$

$$v_B - s_{0h} = -r_{Bh} \qquad ; r_{Bh} q_{Bh} = 0 \tag{6b}$$

Equation (6a) implies that the farm's marginal cost of total milk production equals the difference between the market prices of A-milk and A-quota. If the constraint is binding ($r_{Bh} > 0$), there is no B-milk produced ($q^*_{Bh} = 0$). The optimal milk production and market price of quota ($q^*_{0h} = q^*_{Ah}$ and r_A^{T*}) are found where the aggregate A-quota level ($\breve{Q}_A$) is given by $\sum_{h=1}^{H} q^*_{0h} = \breve{Q}_A$ and the marginal costs are equal across farms $s_{0h} = s_{0f}$ $(h, f = 1,..,H)$. The market price of quota (r_A^{T*}) is the price at which there is no excess demand or supply of quota. If the constraint is not binding ($r_{Bh} = 0$), the market price of quota equals the difference between the price of A-milk and the world price ($r_A^{T*} = v_A - v_B$). Optimal milk production (q^*_{0h}) can be found by solving (6a) or (6b). The composition of q^*_{0h} (*i.e.* the share of A and B milk in it) is indeterminate, but it makes no difference for the profit level of the farm.

POLICY SIMULATIONS AND RESULTS

The policy simulations are elaborated in this section. First, the effects of the two-tier system are determined. Then, the effects of the Agenda 2000 reform, wherein quota is 1.5 % higher and milk prices are 15 % lower, are calculated. Finally, the effects of abolishing quotas are simulated.

Note that long-term effects of dairy policy changes cannot be simulated, because of the short-run character of the model. Moreover, input and output prices are held constant, which could be unrealistic if there were large changes in total milk production. Furthermore, the model does not include consumer demand and budget costs, therefore, welfare analysis is not possible. Finally, manure legislation in the Netherlands could be restrictive if farmers want to increase their milk production. This is not incorporated in the policy simulations.

The simulations describe the effects on farm profits, input demand and output supply, especially milk production, and the shadow prices of fixed inputs. Profits are calculated as the value of the netputs. If profits decrease as a result of the simulation, compensating payments, necessary to offset this profit loss, per hectare and per tonne of quota are calculated. Here we use the initial quota in 1992/1993 as the base for compensating payments. This implies that the level of compensation does not influence

production decisions. Prices of the other output and variable inputs and the amount of fixed inputs at the farm level are kept constant throughout all simulations. In the simulation model, the effects are determined for all individual farms in the sample for 1992/1993, representing 27 515 farms in the sector. These farms represent a total initial quota of 10 590 million kilograms, which is 95 % of the national quota in 1992. For ease of presentation, simulation results are presented for the average farm as percentage changes compared with the base simulation. The base simulation and the other simulations and their results are discussed now.

Base simulation

The base simulation (see Table 1) represents the situation where quotas are transferable in a competitive market and every farm trades up to the point where the marginal costs of production are equal for all farms. The calculated market price of quota equals NG 0.39/kg. So the base simulation does not represent the actual situation but represents the situation where all efficiency gains from quota trade are realised.

Table 1. **Data and base simulation for the average specialised dairy farm in 1992/1993 (total no. of farms: 27 515)**

	Price index (1980/1981=1.00)	Dimension	Data	Base simulation	
				Quantity[a]	Shadow price (1992/93 NG)
Milk output	1.17	Kilogram *1000	384.868	-	0.311
Other output	1.05	Guilders *1000 (1980/81 prices)	78.477	87.917	-
Purchased feed	0.82	Guilders *1000 (1980/81 prices)	71.090	61.901	-
Dairy cattle	1.12	Guilders *1000 (1980/81 prices)	4.020	3.493	-
Other input	1.14	Guilders *1000 (1980/81 prices)	74.909	70.086	-
Profits	-	Guilders *1000	205.151	228.697	
Labour	-	Hours	3916	-	7.676
Land	-	Hectares	31.117	-	1629
Buildings	-	Inventory value, guilders *1000 (1980/1981 prices)	245.363	-	0.036
Machinery	-	Inventory value, guilders *1000 (1980/1981 prices)	197.110	-	0.086

[a] The base simulation represents the situation in which quotas are tradable in a competitive market.

Two-tier price system

In a two-tier price system, policy makers can use several instruments: i) allow for quota trade, ii) set the level of A-quota, and iii) set the level of A-prices. To keep the presentation clear we assume that the price of A-milk is fixed at 0.70 guilders (NG) per kilogram[3] which is also the price of milk in the base simulation. Further, we assume farm level A-quotas to be the same as in the base simulation. One could argue that quotas should be reduced in a two-tier system, because maintaining the present level of quota would imply that the 1994 GATT-agreement conditions would not be fulfilled. The simulations do not account for quota reductions in order to avoid that the effects of the two-tier system are confused with the effects of quota reduction. The main unknown variable is the price for B-milk (world market price[4]). Therefore, simulations are presented for a range of prices for B-milk.

Table 2. Effects of a two-tier price system at different levels of the price of B-milk if quotas are transferable[a] (percentage changes compared to base simulation)

Price of B-milk	Netput quantities					Profit	Shadow prices			
(1992/1993 NG/kg)	Milk output	Other output	Purchased feed	Dairy cattle	Other input		Labour	Land	Buildings	Machinery
$v_B \leq 0.311$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.35	3.17	-0.68	6.00	5.10	0.18	0.10	5.16	8.95	51.91	37.61
0.40	7.18	-1.79	13.95	11.96	0.70	0.52	11.67	20.26	117.47	85.12
0.45	11.68	-3.36	23.37	20.23	1.69	1.38	19.00	32.98	191.24	138.56
0.50	15.69	-5.05	32.17	28.07	2.92	2.49	25.52	44.28	256.80	186.07

[a] A-quotas are the same as in the base simulation and the price of A-milk is NG 0.70/kg.

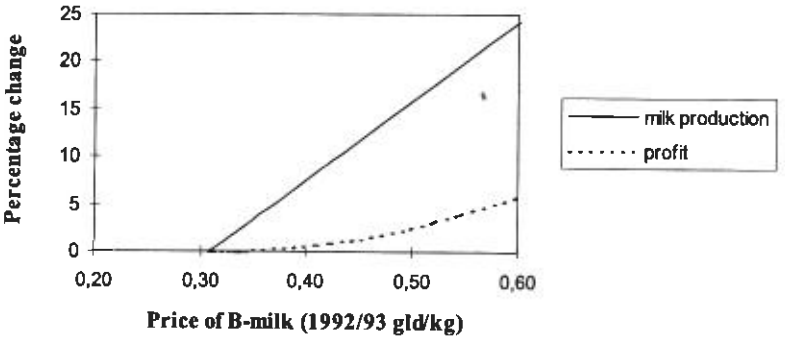
The effects of a two-tier price system when quotas are tradable are shown in Table 2 and in Figure 1. As in the base simulation the calculated marginal cost for all farms is NG 0.31/kg. This is also the average marginal cost of producing A-milk, because of the linear supply equation. In the trajectory where the price of B-milk is less than the average marginal costs of producing A-milk, no B-milk is produced. Thus, the relevant quota price r_A^T* is NG 0.39/kg (= 0.70 – 0.31).

Figure 1 shows that milk supply does not change if $v_B \leq 0.31$. There is no production of B-milk, but just as in the base simulation 1 060 million kg of A-quota change hands at the market price of NG 0.39/kg

[3] Milk prices are standardized for 1992/1993 and a fat content of 3.7 %.
[4] The average world market price of milk is assumed to be NG 0.35/kg (Ministry of Agriculture, 1996).

(= 0.70 – 0.31). There are 12 567 quota buyers and 14 948 quota sellers. If v_B > 0.31, there is also B-milk produced and there is less quota trade. The most efficient farmers produce B-milk instead of buying quota. The relevant quota price r_A^T* is NG 0.70 – v_B and therefore lower than in the base simulation. Profits are higher than in the base simulation. The supply of the other output is lower than in the base simulation, while the demand for variable inputs is higher.

Figure 1. Effects of a two-tier system if trade in A-quotas is allowed



The results indicate that, at low levels of world market prices (lower than the industries'average marginal costs of producing A-milk *i.e.* NG 0.31/kg), a two-tier milk price system with free quota trade will not change milk production and farm profits. Higher world market prices induce the farmer to produce B-milk and profits will increase. Provided that the world market price of milk is high enough, the quota price under a two-tier system would be lower than the present quota price, because the most efficient farmers will produce B-milk instead of buying A-quota.

Agenda 2000

In the reform agreement of the European Commission intervention prices of butter and skimmed milk powder are cut by 15 % in three annual steps of 5 % between 2005/2006 and 2007/2008 (*Agra Europe*, 1999a). Furthermore, a 1.5 % quota increase is to be implemented in three steps in parallel with the price reductions. Additionally, specific quota increases totalling 1.39 million tonnes in two years (2000/2001-2001/2002) are to be implemented for Italy, Greece, Spain, Ireland and Northern Ireland.

For simplicity, the Agenda 2000 reform is simulated by allowing the present Dutch farm quota level to increase instantly with 1.5 % and reducing the milk price instantly by 15 % for all farms. It is assumed that

the reduction in intervention prices of butter and skimmed milk powder are fully reflected in the producers price. With more favourable world market conditions this may not be the case. Moreover, milk represents only part of the input costs of producing butter and skimmed milk powder. The resulting milk price becomes NG 0.60/kg and the average amount of milk quota per farm is 390,640 kg. The quota increase is allocated evenly among all farms in the sample. Free trade of milk quotas is assumed.

A 15 % milk price reduction, combined with a 1.5 % increase in quotas, result in less supply of the other outputs (– 0.30 %) and increased demand for variable inputs (purchased feed 2.81 %, dairy cattle 2.38 % and other input 0.06 %). The shadow prices of fixed inputs also increase (labour 2.44 %, land 4.23 %, buildings 24.56 % and machinery 17.79 %). However, profits decrease by 17.06 % compared to the base simulation, because quota rents decrease. An average direct payment of NG 106 per tonne of initial milk quota will offset farmers for this loss in profits. This compensation should be higher for the average intensive farm (NG 119 per tonne) than for the average extensive farm (NG 95 per tonne)[5]. If the compensation were given per hectare, the average payment should be 1 291 NG/ha.

The proposed compensation of the EU for Dutch dairy farms amounts to 24.87 euros per tonne. The dairy cow premium is divided into a statutory EU element of 17.24 euros per tonne (from 2007 onwards) and a national element of 7.63 euros per tonne (from 2008 onwards). Member States have freedom to allocate the latter payments. Using an exchange rate of 1 euro = NG 2.20371, the proposed compensation is NG 55 per tonne, which would cover 52 % of the calculated loss in profits. The calculated market price of milk quota is 0.27 NG/kg, which is much smaller than in the base simulation.

The advantage of the Agenda 2000 measures over the two-tier system for the policy maker is that the increase in milk production is controlled *i.e.* fixed. However, farm profits are much lower inducing a policy of compensation, whereas profits are non-decreasing in the two-tier system. Quota trade prices are difficult to compare because support prices and the level of quota differs between the two-tier and the Agenda 2000 cases. However, in the way we have modelled both policies, the calculated market price of quota in the two-tier system equals

[5] Intensity is calculated as the initial milk output per hectare. If a farms' intensity is higher (lower) than the average intensity, it is determined to be an intensive (extensive) farm.

the quota price in the Agenda 2000 simulation if the world market price of milk is 0.43 NG/kg.

Quota abolition

Although the Commission agreed that milk quotas will stay until 2006, the abolishment of quotas is still an interesting case to analyse. Moreover, reviews of the dairy regime might be necessary before the agreed reforms have been finalised (*Agra Europe*, 1999b). If milk quotas are abolished, the price of milk determines milk production, as it did before quotas were implemented in 1984. The price of milk is determined either by the policy makers or by the market. Since the model does not include the consumption side of the milk market, it is assumed that the milk price is given exogenously. For a given milk price v_0, the milk supply equation is used to simulate the corresponding milk supply q_{0b}. The results of quota abolition are determined for a range of prices for milk.

Table 3. **Effects of quota abolition (percentage changes compared to base simulation)**

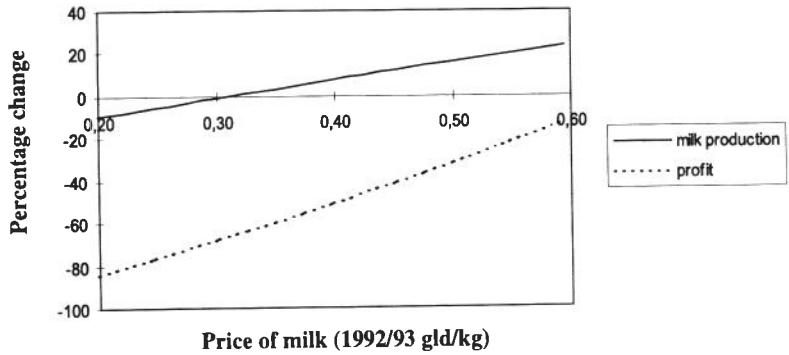
Price of B-milk	Netput quantities					Profit	Shadow prices			
(1992/1993 NG/kg)	Milk output	Other output	Purchased feed	Dairy cattle	Other input		Labour	Land	Buildings	Machinery
0.20	-9.35	1.02	-16.23	-13.33	0.70	-84.15	-15.20	-26.38	-152.99	-110.85
0.25	-5.34	0.77	-9.54	-7.93	0.18	-76.64	-8.69	-15.08	-87.43	-63.35
0.30	-0.84	0.15	-1.54	-1.29	-0.01	-67.81	-1.36	-2.36	-13.66	-9.90
0.35	3.17	-0.68	6.00	5.10	0.18	-59.62	5.16	8.95	51.91	37.61
0.40	7.18	-1.79	13.95	11.96	0.70	-51.10	11.67	20.26	117.47	85.12
0.45	11.68	-3.36	23.37	20.23	1.69	-41.14	19.00	32.98	191.24	138.56
0.50	15.69	-5.05	32.17	28.07	2.92	-31.93	25.52	44.28	256.80	186.07

The results of abolishing quotas are summarised in Table 3 and Figure 2. Milk supply and the shadow prices of fixed inputs decrease compared to the base simulation when the price of milk is less than NG 0.31/kg. Profits decrease over the simulated range of milk prices. The demand for purchased feed and dairy cattle decrease, while the supply of the other output increases up to the point where the milk price is 0.31 NG/kg. The demand for other input increases, except when the milk price is between 0.29 and 0.31 NG/kg.

The results show that, for the simulated range of milk prices, farm profits decrease as a result of quota abolition. Total milk production

equals the national production in the base simulation when the price of milk is NG 0.31/kg. In that case, profits are 65.8 % lower than in the base simulation. Therefore, the average direct compensation for this loss in profit should be NG 344/tonne (or NG 4 477/ha). In Table 4 the necessary average compensations are shown for given milk prices. The compensation decreases with an increasing milk price.

Figure 2. Effects of quota abolition



If quotas are abolished and the (world market) price of milk becomes NG 0.60/kg (which is rather high), the profit decrease (– 13 %) is smaller than in the Agenda 2000 simulation (where the price of milk is also NG 0.60/kg). Therefore, the necessary compensation for farmers at a price of mick of NG 0.60/kg is smaller if quotas are abolished. However, milk production is unconstrained and therefore larger (23.7 %) if the quota system is abolished.

Table 4. Necessary average compensation for loss in profit when quotas are abolished (1992/1993 NG/ha and /tonne)

Price of milk (1992/1993 NG/kg)	Compensation per tonne	Compensation per hectare
0.20	456	5 830
0.25	411	5 281
0.30	357	4 628
0.35	306	4 014
0.40	252	3 371
0.45	189	2 611
0.50	130	1 903

Comparing the results of quota abolishment and the two-tier system with quota trade (Tables 2 and 3) shows that the increases in milk production (and shadow prices) are equal if the milk price is high enough. In both simulations the world price determines milk production (at the margin). However, part of the production in the two-tier system (pro-

duction of A-milk) is supported and therefore profits are higher in that case. Thus, the two-tier system implies less uncertainty for the farmer.

CONCLUSIONS

This research determines the short-run effects of a two-tier price system for the Dutch dairy sector. The effects of the Agenda 2000 reform, with a reduced milk price and increased quota levels, and the effects of abolishing the quota system, are also shown.

The results indicate that in a two-tier milk price system with free quota trade, B-milk will be produced if the world market price is higher than the industries' average marginal costs of producing A-milk (NG 0.31/kg). In that case, profits will increase. If the world market price of milk were NG 0.31/kg, the present level of total milk production would not be exceeded. Provided that the world market price of milk is higher than NG 0.31/kg, the quota price under a two-tier system would be lower than the present quota price, because the most efficient farmers will produce B-milk instead of buying A-quota.

The results of simulating Agenda 2000 for dairy farming indicate a 17 % loss in profits. The proposed direct payment per tonne of initial quota only compensates 52 % of this profit loss. The profit loss is mainly due to the decrease in milk prices. Because of the 1.5 % quota increase, the demand for variable inputs will increase, while the supply of other output decreases. The diminished milk price also results in a lower quota price compared with the base simulation.

If quotas were abolished, milk production increases if the price of milk is higher than the current average marginal costs. However, profits decrease, asking for compensating payments. At a world price of 0.60 NG/kg, the necessary compensation in the case of quota abolishment is smaller than in the Agenda 2000 case, while milk production is higher.

The model presented is a flexible tool to analyse the short-term effects of EU dairy policy changes in the Netherlands. The results show that the disadvantages of Agenda 2000, *i.e.* increased budget costs and the insufficiency to meet future WTO demands, are complemented with strong negative income effects for Dutch dairy farmers. The income of the farmer is guaranteed in a two-tier price system and it serves farmers with some flexibility (partly giving in to the WTO demands), while the burden on the government budget stays. Quota abolition is for Dutch dairy farmers from an income point of view still less attractive (although highly dependent on the price at the world market) but more freedom

in production could outweigh this disadvantage. The fact that the Dutch government did not opt for quota abolition probably has to do with the fear that a rise in milk production would increase environmental problems and would lead to a weakened financial position of farmers because their quota lose value.

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