IMPACT OF THE AGENDA 2000 MID-TERM REVIEW ON LAND AND QUOTA RENTS FOR FRENCH DAIRY FARMS

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Abstract

With the Mid-Term Review (MTR) of the Common Agricultural Policy (CAP), the specific "milk premium" and the "special premium" for fattening cattle have been changed into Single Farm Payments. In this paper, we explore the impact of this reform on dairy farms in one French region (Nord Pas de Calais). The response of different types of dairy farms to the CAP-MTR is measured using a farm model approach and *ex-ante* simulations for three types of farms: grassland farms, specialized dairy farms and mixed farms. Two main results are analyzed: the changes in outputs and in the dual value of milk quotas and land. Implementation of the CAP-MTR would lessen the opportunity for cattle fattening in the three farm types, and cereals would become more competitive. As expected, the reform would decrease the dual value of the milk quotas, but the effect on the dual value of land would not be uniform across systems. For specialized and mixed farms, land value would increase with the reform. In the long run, this measure may affect the allocation of production factors among dairy farms, and particularly land across dairy systems which are dominant in the region.

Keywords: dairy farms; mathematical programming; CAP; MTR; decoupling, France

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Introduction

Like other European milk producers, the livelihood of around 6 000 dairy farmers from the Nord-Pas-de-Calais region (France) depends on the Common Agricultural Policy (CAP) and on the subsidies linked to production (6 % of the European budget). Until 1995, the milk price was heavily supported through a minimum price for butter and milk powder. The CAP-MTR has modified these rules: part of this support is now directly distributed to farmers in proportion to their quota size (35.5 €/ton from 2006 onwards) to compensate for a 25 % decrease in the institutional price of butter and a 15 % decrease in the price of milk powder. In the Nord-Pas-de-Calais 59 % of the milk produced is transformed into industrial products, whose prices are strongly dependent upon European policy. In addition to these price decreases, dairy farmers are also confronted with the partial decoupling of CAP direct payments on arable crops and bovine animals now integrated into a Single Farm Payment (SFP). The milk subsidy is entirely decoupled and farmers are no longer required to produce in order to receive this decoupled subsidy. In addition, the total amount of direct subsidies is modulated and farmers also have to deal with new cross-compliance rules concerning the environment, public safety and animal welfare in order to receive the decoupled premium.

In the Nord-Pas-de-Calais, dairy farms represent 1/3rd of all farms. The dairy production systems are varied: mixed crop-livestock farms, grazing dairy farms, specialized dairy farms. In the Nord-Pas-de-Calais, 2/3rd of the dairy farmers are also crop producers, who are considering ceasing as bovine producers to specialize in crops, without losing the benefits of the decoupled subsidies. After implementation of CAP-MTR in France, intensive specialized and mixed crop-dairy farms receive higher SFPs than extensive grazing dairy farms because of higher references linked to crop areas declared in 2002. Most dairy farms comprise both crop and forage areas, which can easily be converted into commercial cropping or into urban or industrial areas. In this context, and considering the projected milk price decrease expected from CAP-MTR, livestock farmers are questioning their farm management choices. Is it better to substitute crops for grassland (with the same level of decoupled subsidy)? Considering the various areas in Nord Pas de Calais (according to different climatic and soil contexts, and to the proximity of urban areas), it is clear that the choice between permanent pasture and crops is more or less realistic. But the intensification of dairy supply in some areas also risks inducing environmental degradation (in vulnerable areas), which are denounced by the new CAP (Oglethorpe, 2005).

This CAP-MTR is applied in the French dairy quota framework. In France, dairy quotas are not tradable. They are linked with the land and can be traded or rented, in certain conditions, within the land market. So, in France there is a land market for both types of land: with and without dairy quotas. In addition, the land market is regulated by public organizations that can redirect land exchanges, and especially land sold with dairy quotas in order to favor specific farmers according to regional priorities. Public intervention is especially used to favor the entry of young farmers into agriculture or to develop the activities of small farms. In this framework, it is impossible to observe the effect of a single policy change on the dairy quota market, nor the effect of such policy on the land market since it is influenced by national or regional public intervention. Observed land prices can't be totally coherent with shadow prices resulting from partial equilibrium models since such public intervention is not accounted for in these models. But the relative changes in shadow prices of land and dairy quotas before and after reform can be estimated *ex ante* with the farm level model.

In this context, the aim of this paper is to analyze the effects of the 2003 CAP-MTR on three kinds of typical dairy farms in the Nord Pas de Calais Region. A farm level mathematical programming model is employed to assess the effects of the reform on factor allocation and on the optimal output choices for farmers including the implications for their incomes. Farm-level models have limitations in relation to the global agricultural supply, but they are built at a scale which permits technical approaches to the production function and that enables the relationship between technical and environmental processes to be depicted (Flichman Jacquet 2003, Janssen and Van Ittersum 2007, Heckelei and Britz, 2005). At this scale, we can also show the changes in the pressure on natural resources, and particularly, on land. The specificity of this approach is to depict the complexity of production functions of dairy farms and also to account for environmental issues linked with the technical patterns (Crosson *et al.*, 2006; Veysset *et al.*. 2005; Revell and Oglethorpe, 2003, FAPRI Ireland 2000, Kleinhanss *et al.*. 2002, Ridier and Jacquet, 2002, Colman, 2002).

Using this approach, the relative profitability of the three farms types after the implementation of CAP-MTR can also be assessed through the stress on both land and quota values, which can be determined through their shadow prices.

The model's assumptions are presented in the first section of the paper. The farm-level model is then calibrated according to the three different farm types (section 2). After that, two policy scenarios are tested (2008 with and without CAP-MTR) and the results are presented and discussed in the third section of the paper.

1- The dairy farm model

A farm level deterministic static model is built to represent the main dairy farm systems of the *Nord-Pas-de-Calais* region. The mathematical programming method is based on the conventional assumption of maximizing annual net margin.

The objective function

The planning horizon is one period (one year) . The objective function is based on net margins i.e. the quantity of sales *S* in crops *c* (wheat, maize, sugar beet), and animals *a*, quantities of milk sold (calculated by multiplying milk productivity per cow $y_m(a)$ by the number of cows kept *Kept(a)*) minus variable costs *w* per hectare of crops *X(c)* , forages *X(f)* or per animal *N(a)* and fixed costs *FC* (renting of land, cost of machinery, provision for depreciation of farm equipment), $price_m$ is the price of milk. Another variable cost is from animal feeds not provided by the farm (bought forage *B(f)*, bought cereals *B(c)*).

Concerning the different livestock direct subsidies before 2006, two kinds of premiums are distinguished: slaughter premiums (*slaughprem(a)*) and other premiums; $(prem_i(a))$, which depend on stocking density conditionality. The subsidies for arable crops areas are *(prem(c))*. In order to take conditionality into account, binary variables are introduced (*BINi*). After 2006, the new support scheme (partial decoupled payments in France) is introduced with both a single farm payment (*SinglePayment)* per eligible area (*ELLAND*) and a mean regional set-aside single payment (*Setaside Payment*) (equation 1)[1]. The total direct payments is modulated (*Modu*), meaning that 5% is withdrawn above a threshold of 5000€. The set-aside constraint appears when the crop area exceeds a certain threshold (around 15 ha for the Nord-Pas-de-Calais region). In this case the farmer has to set aside part of his crop area. A binary variable *BIN* is introduced to represent this alternative (equations 2 and 3). If the crop area is over the

[1] Details of the calculation of this single payment are developed later on.

threshold, i.e. BIN=0, then, at least 10% of the crop area is set aside. If the crop area is under this threshold (*BIN*=1), then there is no compulsory set-aside.

$$
\begin{aligned}
&ObjectiveFunction = \\
&\sum_{c}\left(S(c)\times price(c) - X(c)\times w(c)) - X(f)\times w(f)\right) \\
&+\sum_{a}\left(S(a)\times price(a) - N(a)\times w(a)\right) \\
&+\sum_{a}(Kept(a)\times y_{m}(a)\times price_{m}) \\
&-\sum_{f}B(f)\times price(f) - \sum_{c}B(c)\times price(c) \\
&-FC \\
&+(1-Modu)\times\left(\begin{array}{l}\sum_{c}X(c)\times prem(c) + \sum_{a}N(a)\times(slaughprem(a) + prem(a)\times BIN(a)) \\ +SETASIDE\times SetasidePayment + ELLAND\times SinglePayment\end{array}\right)
\end{aligned}
$$

Equation (1)

$$BIN\times\sum_{c}X(crops)\le threshold\times BIN$$

Equation (2)

$$(1-BIN)\times X(setaside)\ge(1-BIN)\times 0.1\times\sum_{c}X(crops)$$

Equation (3)

Concerning livestock payments under stocking density compliance, before 2006, two stocking density (*SD*) thresholds have been introduced. If the density is less than 2 Livestock Units (LU) per hectare each bovine male receives a Special Premium for Male Cattle (SPMC) of 149.5 €. If the density is less than 1.4 LU per hectare, each livestock unit supported receives an additional extensification premium of 40 €. The alternative between both density thresholds is introduced by way of a binary variable (*BIN*) (equation 4).

$$\sum_{a}N(a)\times BIN(a)\le SD$$

Equation (4)

Activities

Dairy farmers can sell three outputs: milk, beef and cereals. Cereals can be sold outside the farm or utilized as forage and both outputs compete for land use.

In the model, there are 19 activities for cattle and 15 for crops and pasture. These activities correspond to different outputs associated with a range of technical processes corresponding to various levels of intensification.

For example, cows can be fed with more or less maize or grass. In so doing, the consequences of the reform can be assessed in terms of land use intensity. Male calves can be sold before fattening, or can be fattened into bull-calves with two types of rations producing different weights. The choice between selling or keeping calves to grow them into bulls depends on market conditions and farm building availability. Animals can be fed with either grown and stored crops or with bought crops.

Input-output coefficients for each activity are calculated from data provided by expert sources (livestock and accounting network of the Institut de l'élevage in Nord-Pas-de-Calais, Institut de l'élevage, 2003):

- Feed rations for each bovine category for the different forages and the corresponding milk and meat yields and costs per animal; in the model, three levels of milk yield have been used (5,000; 6,500 and 7,000 litres/cow). In the simulation scenarios, it is assumed that milk yield increases per cow between 2003 and 2008 (+50 litres per cow per year).
- Crop, forage and grassland: input needs, and corresponding yields and costs per hectare. For wheat, maize and pasture, two levels of yield have been employed according to agronomical potentials and intensification levels.
- Fixed costs.

Constraints presentation

Breeding constraints define the balance between the different herd classes (cows, calves and bull-calves). Numbers are determined by the breeding cycle (index of fertility and mortality, sex ratio), assuming that the replacement heifers are exclusively provided by the farm herd.

In an annual planning perspective, land and building capacity are limited. The land resource is divided into two categories: arable *(Arland)* and non-arable land *(Nonarland)*. Non-arable land cannot be ploughed (permanent pasture) (equation 5). The proportion of non-arable land to total land *(Land)* is an exogenous parameter ε_j which varies according to the type of farm *j* and its location (equation 6).

$$\sum_{C} X(c) \leq Arland + Nonarland \qquad \text{(Equation 5)}$$

$$Nonarland = \varepsilon_j \times Land \qquad \text{(Equation 6)}$$

The CAP regulations for dairy, crops and sugar beet provide additional constraints on the production function. Quotas can limit both milk and sugar beet supply. The quota system for dairying fixes an exogenous upper limit for the global milk supply from each farm, based on historical references called here *Milkquo* (equation 7). The sugar beet system consists of three types of quotas (A, B, C) linked to three decreasing prices. Only quota C is not supported by the CAP and sold at the world price. In the model, this system is simplified; a single quota constraint is employed representing the sum of quotas A and B, called here *Sugarquo*, with a mean price (equation 8). There is no sugar beet supplied under quota C in the model.

$$\sum_{a} Kept(a) \times y_m(a) \leq Milkquo \qquad \text{(Equation 7)}$$

$$\sum_{Sb} X(Sb) \times y(Sb) \leq Sugarquo \qquad \text{(Equation 8)}$$

With X(Sb) : areas in Sugar beet, y(Sb): Sugar beet yield per hectare

After 2006 a fraction of the coupled premiums is decoupled and transferred into a Single Farm Payment (SFP). In this analysis, this payment includes:

- 75% of the crop compensatory payments
- 100% of the special premium for male cattle
- 60% of the slaughter premiums
- 100% of the dairy premium
- 100% of the extensification premium

A decoupled payment for set-aside area is also introduced, whose amount is specific to each region, depending on historical yields (404 €/ha in Nord-Pas-de-Calais).

The Single Payment doesn't include the specific supplementary payment for proteins. This and the other CAP subsidies, which are not decoupled, keep the same eligibility rules as before.

The modulation of direct payments is considered through a systematic 5% (see the term *Modu* in equation 1) decrease of the total amount of CAP subsidies (see equations 2 to 4).

2- Case study of the Nord Pas de Calais dairy farms

Three dairy farm types in Nord-Pas-de-Calais

The technical data in the model is sourced from agronomical references for the three types of Nord-Pas-de-Calais region dairy farms: specialized dairy systems, grazing systems and mixed crop-livestock systems (table 1). Some of these farm types reflect different physical characteristics (notably soil and climate) but they differ in terms of outputs mix.

- In **grazing systems ("grazing")**, the maize area is less than 10% of the total forage area. These farms represent 9% of the dairy farms of the Nord-Pas-de-Calais region[2] and are located in the eastern and western parts of the region. This type is determined by exogenous factors. Grazing farms are located in pasture areas of the Nord-Pas-de-Calais, where arable crops can only be sown with difficulty. Moreover, the conversion towards arable farming has been getting increasingly difficult since 2003 because the EU requires each member state to maintain a minimum area of permanent pasture. Thus, in the "grazing" farm type, there is no arable land available and the intensification level for pasture is lower than in the two other types and, it is impossible to improve the level of intensification given the natural conditions. Consequently, the milk yield per cow remains low (under 5 000 litres/cow) compared to the other farm types which is a consequence of livestock feeding regimes with a low input of maize and cereals.
- In **specialized dairy systems ("specialized"),** more than 70% of the area is dedicated to forage (grassland and maize). These farmers can either sell calves or fatten bulls. They represent 25% of the region's dairy farms and are mainly located in the intermediate areas of the region, where the agronomic potential is low.
- **Mixed crop-livestock systems ("mixed")**, have a mean area of 3 ha of sugar beet quota. The forage area is less than 70% of the total area and maize constitutes more

[2] Source: French general agricultural survey "RGA", 2000

than 10% of the forage area. The crop area frequently includes sugar beet, wheat, barley and peas. These farmers also can either sell calves or fatten bulls. These farms constitute 66% of the region's dairy farms and are mainly located in the central part of the region.

Some "specialized" systems can, through extensification, become "grazing" systems but the contrary is not possible. The "specialized" and the "mixed" farms are located in areas with the same soil and climatic conditions, and can move from one to the other according to changes in relative prices and to the availability of sugar beet quota.

The three farm types chosen here are a simplification of the dairy farm systems in Nord Pas de Calais. It is not assumed here that after CAP-MTR any different or innovative system will appear. What can be expected is that the proportion of farms in the different systems may change.

Table 1: The three main dairy systems in Nord-Pas-de-Calais.

	Grazing	Specialized	Mixed
Main characteristics			
Milk Quota (litres)	210 500	238 000	260 000
milk yield (litres /cow)	5 263	6 611	7 027
Cows (number)	40	36	37
Total agricultural area (ha)	44.0	55.0	60.0
Annual labor units	2	2	2
Gross farm income (€)	27 791	38 577	45 911
Cropping plan (ha)			
Wheat1 (type 80 quintals /ha)			17.0
Wheat 2(type 70 quintals /ha)		5.2	
Barley (type 80 quintals /ha)			8.1
Maize1 (type 11,5 tons /ha)			12.0
Maize2 (type 10 tons /ha)		12.5	
Peas (type 110 quintals/ha)			4.0
Sugar Beets			3.0
Set aside area		1.0	2.2
Grassland for Pasture	25.7	24.0	11.2
Grassland for Pasture+hay	18.2	12.3	2.5

Source: Institut de l'Elevage Nord-Picardie, 2003

Price and Policy assumptions

In this context, farmers are price takers and price hypotheses are given by the general equilibrium model analysis (Gohin, 2006). The baseline situation depicts prices and CAP hypotheses for the 2003 period. To analyze the effect of the CAP reform, we consider two scenarios in order to compare the projected situation in 2008, both with and without application of the mid-term review reform. The structural change (land and quota size increases) is exogenous. It is assumed that from 2003 to 2008 the trend towards increased mean farm size is the same as in the past, i.e. around +20% of extra-land in the three systems. A 1.5% increase per year in the milk quota is assumed, which is relevant considering the actual farm structural adjustment trend (Butault, Delame, 2006).

- **Scenario 1 – 2008 without CAP reform:** in the first scenario, the prices of cereals and sugar beet decrease (-5% and –15% respectively), while the prices of bovine meat and milk, along with the CAP subsidy scheme, remains the same as in 2003. For other products (peas) prices remain at 2003 levels (Table 2).
- **Scenario 2 – 2008 with reform:** in this scenario, output prices are decreased in the same way as in scenario 1 and the CAP subsidy scheme is changed to integrate the effect of CAP-MTR reform:
    - Milk price decrease (15 %) associated with a new dairy premium.
    - 1.5% milk quota increase
    - The remaining part of coupled payment (table 3),
    - Single Farm Payment (SFP), including the decoupled payment combined with set-aside,
    - The modulation principle (5%) (Table 4).

The conditionality measures are not integrated in either scenario.

Table 2: Price of the main agricultural goods in Nord-Pas de Calais in 2003 and assumptions for 2008.

	Wheat (€/tonnes)	Barley (€/t)	Peas (€/t)	Sugar Beet (€/t)	Milk (€/l)
Baseline 2003	95	90	110	39.6	0.31
2008 Assumptions – scenario 1	90	85	110	33.7	0.31
2008 Assumptions – scenario 2	90	85	110	33.7	0.22

Source: Institut de l'Elevage, 2003

Table 3: Assumptions concerning coupled payments.

Coupled premiums	Baseline 2003 and Scenario 1	Scenario 2 (2008)
Cereals	404 €/ha	101 €/ha
Set-aside	404 €/ha	0
Supplementary for proteins	54 €/ha	54 €/ha
Slaughter	80 €/head	32 €/ head
Supplementary for slaughter	18.29 €/ head	0
Special pr. For Male Cattle	149.50 €/ head	0
Extensification premium	40 €/ head	0

Source: Institut de l'Elevage,2003

Table 4: Single Farm Payment (SFP) amount and modulation in Nord-Pas de Calais according to farm type.

Farm type	Set-Aside SFP		SFP		Total amount of SFP	Modulation (5%)
	Quantity (ha)	Amount per ha	Quantity (ha)	Amount per ha		
Grazing	0	404 €/ha	44	237 €/ha	10 440 €	- 386 €
Specialized	1	404 €/ha	54	365 €/ha	20 139 €	- 893 €
Mixed	2.2	404 €/ha	54.8	409 €/ha	23 301 €	- 1 151 €

Source: Institut de l'Elevage,2003

The model evaluation

The model is calibrated to represent the average situation for the three main dairy farm types (reference to 2003 situation). Thus, it is important to ensure that the calibrated model provides an accurate simulation of current farming activity for the representative farm types. The key variables of interest in the validation process are: scale of the various farm activities (number of animals, percentage of crops and livestock, percentage of forage area to total area, etc.), income from all activities and total farm income.

The model provides two sets of results: i) the primal solution: main characteristics of the farm (level of the output variables: areas, number of animals, quantities of goods sold…). ii) The dual solution: dual values of the limited production factors (land, quota). These values change with movement in relative prices and/or when the factors' availability changes. They reveal the rental value of land and quota, i.e. the opportunity from increasing the land area or quota size.

The primal solution

For the grazing farm, soil and climate limits the share of arable land in the total area. Accordingly, with the absence of maize in the feeding ration, milk productivity remains low. The farm modeled, considering the technical limits, is very close to the observed one (table 5).

For the "specialized" farm type, the maximum yield is 70 quintals/ha for wheat and 10 tons[3]/ha for forage maize. There is no sugar beet quota available. Thus, the main activities are dairying with bull-fattening. The milk yield is under 7,000 litres/cow due to limited genetics. Considering these constraints the model provides a solution very close to the observed farm (Table 5).

For the "mixed" farms in the region, the model predicts some bull-fattening (Table 5). In reality, due to labor constraints, higher cereal areas (+8 ha) would be preferred to bull-fattening. Since the model result is consistent with the technical capacities of dairy farm systems in this region, it is kept as the baseline farm.

Table 5: Main differences between real farm types and modeled farms characteristics (baseline).

	Grazing farm		Specialized farm		Mixed farm	
	Observed	**Δ Modeled**	**Observed**	**ΔModeled**	**Observed**	**ΔModeled**
Number of Cows	40	**0**	36	**0**	37	**0**
Cropping plan (ha)						
Wheat1 (type 80 q /ha)					17.0	**-5**
Wheat 2(type 70 q /ha)			5.2	**+3,4**		
Barley (type 80 q /ha)					8.1	**-2,3**
Maize1 (type 11,5 tons /ha)					12.0	**-3**
Maize2 (type 10 tons /ha)			12.5	**12.1**		**+3.6**
Peas (type 110 q/ha)					4	**-1,1**
Grassland for Pasture	25.7	**0**	24.0	**-1,9**	11.2	**+4,7**
Grassland for Pasture+hay	18.2	**+0,2**	12.3	**-1,5**	2.5	**+3,2**

The dual solution

In the region, within each farm-type, there is variability in dairy quota and land areas. The dual value determines the worth of additional land and/or quota. In order to test the sensitivity of the model to the land and quota size assumptions, the dual values of both are assessed for a range around the mean value for each. In this sensitivity analysis, milk quota varies between 150 000 and 300 000 litres per farm. It is important to note that labor is not considered as a constraint (the farm size, land and quota are assumed to increase with constant labor availability).

[3] dry matter

Table 6: Dual value of quota and agricultural area in the different farm types.

	Grazing	Specialized	Mixed
Milk Quota (litres)	210 500	238 000	260 000
Total agricultural area (ha)	44.0	55.0	60.0
Agricultural area dual value (€/ha)	*342*	*333*	*238*
Quota dual value (€/liter)	*0.10*	*0.15*	*0.16*

Quota dual: For the "grazing" type, if the quota is under 170 000 litres, the dual value demonstrates a strong opportunity to increase the milk production but when the quota increases to more than 238 000 litres, the dual value is zero because the quota cannot be fulfilled, given the limited Total Agricultural Area (44 ha, exclusively pasture) and the milk production capacity (fixed costs). For the "specialized" and "mixed" types, the dual values of milk quota are very close (table 6). The "mixed" type has a slightly higher dual value since the milk productivity capacity is higher (7 000 l/cow compared with 6 500 l/cow) in accordance with a higher intensification level.

Land dual: the "grazing" type farm, located in grazing areas (arable crops not possible) has the highest dual value (342 €/ha until 58 ha). However, grazing activities in mixed-crop areas have a negative opportunity cost since they do not appear in the solution of "specialized" and "mixed farm" models. So this high opportunity cost of land in grazing areas only applies to those areas and cannot be compared to arable areas. If grazing farmers want to increase their milk quota at the margin, they need to acquire more land. This explains the high opportunity cost for those farms. But given their milk quota (210 500 l) there is no point in increasing the land area above 58 ha. This is not the case for the two other systems, where the land dual value over 70 ha is positive.

The dual value for "specialized" (333€/ha) is higher than that for "mixed" (238€/ha) which explains the higher land availability in mixed farms compared to specialized ones (60ha *versus* 55ha). It is also explained by the decreasing marginal cost of land when that increases in the absence of economies of scale.

The sensitivity analysis shows the potential structural growth of the different farm types considering the technology and natural resource constraints (availability of arable area or not).

This growth is limited for grazing systems due to physical reasons (notably soil capacities) while it is important for both specialized and mixed farms. Thus, in the case of opportunities to buy additional quota only the "specialized" and the "mixed" systems have a real possibility of increasing milk production through intensification.

3- Effects of policy scenarios

The scenarios (2008 without and with the reform) can influence, in different ways, the net margin and output choices. These changes are analyzed by the primal optimization solution for each farm-type and each scenario. Changes to dual land and quota values will then be presented.

A weak impact on the farms' income and on the outputs combination

The net margin (in euros) increases in 2008 compared to 2003 for the three farm types and for each scenario, (with or without reform). This is due to the structural change assumption: the continued increase in the total agricultural area, accompanied by the rise in milk quota between 2003 and 2008. But, comparing the results of the two scenarios, it is clear that the impact of reform on the net margin is negative. With the 15 % milk price decrease, the difference between the net margins, both with and without the reform, is particularly large in the "specialized" and "grazing" systems. The observed income changes in the different farm types are consistent with their initial level of specialization, considering that technological change is a uniform increase in dairy productivity observed in all systems.

Decoupling does not induce real changes from the initial situation in the terms of cropping plan. Nevertheless, a key feature of the reform is the evolution of the bull fattening activity in the dairy systems in accordance with the decoupling of the "bull premium". The results on this specific point are contrasted. This decoupling leads to a decrease in this activity in mixed farms only. Consequently, a substitution occurs between forage areas and arable areas dedicated to the cash crops[4].

Finally, following the reform, farmers can receive the decoupled fraction of the subsidies without producing. In our framework, the changes in their production choices are

[4] A sensitivity analysis on milk price has been done. It shows that the decrease in bull fattening is unchanged if the milk price decrease is lower (-10%) or grower (+20%). So, the changes observed in the bull fattening activity result from a direct effect of the decoupling of specific bull fattening premium.

marginal (mainly due to the basic assumptions of the model, particularly as non-agricultural uses are not proposed in the model) but they show important results. The decoupling of the special premium for bull calves decreases bull calf fattening and induces a substitution between sales of bovine males and cereals. This incentive should be reinforced, in the mixed system, by the observed increase in cereal prices during the second semester of 2007. The reduction in beef finishing operation has also been shown with similar models and simulations in the UK (Revell and Oglethorpe, 2003).

The impact of the CAP-MTR on land dual values

The main consequence of the CAP-MTR policy reform is the change in relative prices among the different outputs traditionally supplied by dairy farms, which impacts on land and dairy quota shadow prices.

The reform changes the dual values of land for all dairy farms in comparison with the baseline scenario and with changes without reform. In 2003, both grazing and specialized systems had high dual land values but this was lower in mixed farms. In 2008, without reform, assuming a mean structural change in each farm type of 20% increase in quota plus land dimensions, the hierarchy between the different systems is not modified. However, the difference between the specialized and the grazing farms is wider (Figure 1). Specialized farms are still encouraged to increase their size, while the interest decreases for grazing farms.

Conversely, in 2008 with reform, the trend in land dual values is different in the three systems (Figure 1). Thus, the reform decreases the land dual value in the grazing farms but increases it in the two other farm types. This result is due to different and cumulative effects. Firstly, the milk price decrease induces, for all farms, a lower dual value for dairy production compared with cereal supply. Unfortunately, in the agronomic context of grazing farms, profitable cereal production with large yields is not possible. Secondly, the decoupling of the special premium for bull calves, through the reform, diminishes the interest in “meat diversification” for all dairy farms. Since in grazing farms, it is the only possible diversification apart from milk, the dual value of land is more dramatically reduced. Thirdly, the Single Farm Payment is different across farm types since it is calculated on past situations: this also explain the different land dual values between farms due to the fact that decoupled payments are linked to eligible hectares (table 4: 237 €/ha for grazing, 365 €/ha for specialized, 409 €/ha for mixed).

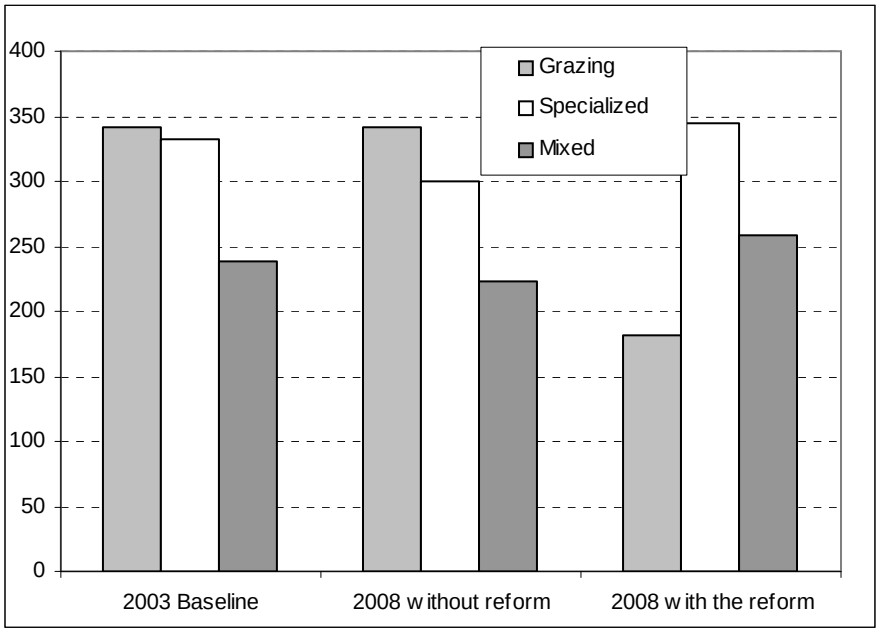

Figure 1. Land dual value (€ per hectare).

These results show that in the Nord Pas de Calais region, with returns from the reform, specialized farms will have the greatest incentive to acquire land in comparison with other systems. Additionally, there is a real risk of land retirement in grazing regions in the absence of more lucrative alternatives than dairy production, unless ovine or suckler cows herds are enhanced. Those trends are confirmed by the observed land price in the different farming areas of the Nord Pas de Calais. In grazing regions like "Thiérache", the change in the observed non arable land price was small between 2004 and 2006 (+15%, similar to the mean rise in land price in France, for this period[5]). This relative stability is consistent with the simulation we made before and after reform (decrease of land dual value). On the contrary, in mixed regions like "Termois", the change in land price between 2004 and 2006 was huge (+103%, Agreste, 2006) and consistent with the increase in land dual values simulated with the model.

[5] In France, the urbanization process contributes to the global increase in rural and agricultural land prices.

Impact of the CAP-MTR on quota dual values

The milk quota dual values show the opportunity for farms to increase their milk supply (Figure 2). Firstly, dual values are positive after the reform for all three farm types: this confirms that all farms fulfilled their quota. In comparison with the 2003 baseline, however, the milk quota dual values decrease for all farm types. This is a direct effect of the milk price decrease and of the quota expansion assumptions which are accompanied by additional fixed costs (cost of new farm buildings) which tend to reduce the dual value of quota by circa 0.07€ per litre for all farms. The financial ability to enlarge livestock buildings is thus a principal issue for future dairy production in this region.

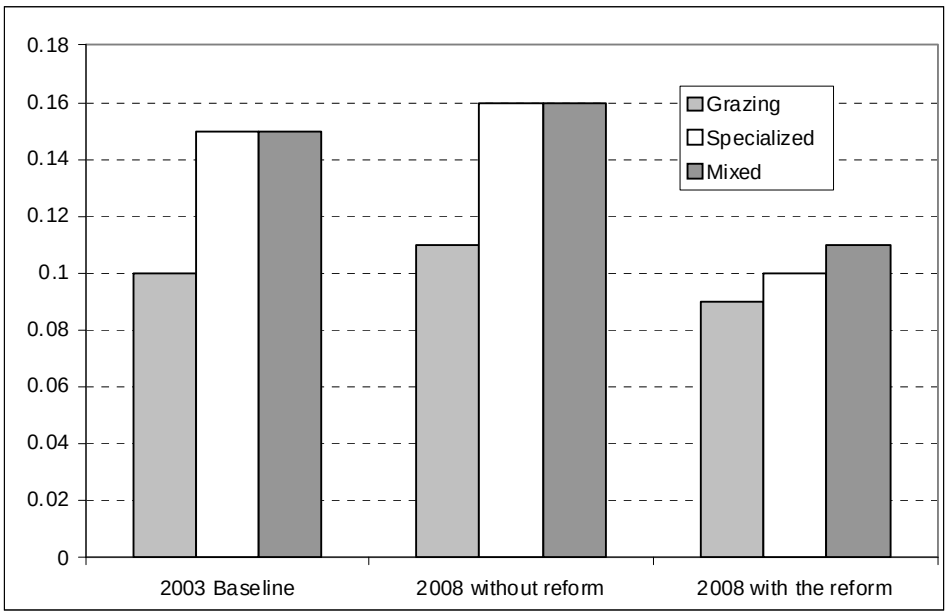

Figure 2 . Milk quota dual value (€ per litre).

Up until now, comparing the dual values of milk quota across farm types, it appears that mixed farms have the highest values after the reform. The relative decrease in quota duals, however, is lowest for grazing farms, which are less penalized (in relative terms) by the reform. This could mean grazing areas become more competitive in the future for acquisition of quota (even if their structural enlargement is limited and the land dual value sharply diminished).

The difference after reform, between the quota dual values of the specialized and the mixed farms, implies that milk supply is slightly less discouraged in mixed systems than in specialized ones. These results are consistent with our framework, but other activities such as

suckler cows or ovine herds could have been introduced in order to test more precisely the extensification of livestock activities.

4- Conclusion

The impact of the CAP-MTR on the dairy sector in 2008 is tested with a mathematical programming model based on three farm types in the Nord Pas de Calais assuming an exogenous structural change for all farms between 2003 and 2008[6]. The bovine meat and protein crop prices are assumed to be stable during this period, while cereal prices decrease (-5%). The comparison of two scenarios - with and without reform - shows that the milk compensation premium, beginning in 2005, does not compensate for the 15% milk price decrease. The farm net margin decrease is, however, compensated in all three cases if the farms are enlarged.

An important issue following the reform is the impact of decoupling the bovine premium for bull fattening for meat on dairy farms. The simulations show that bull fattening is discouraged only in "mixed systems" while sharply increased (and extensified) in the other ones. In comparison with bull fattening, selling cereals is more competitive. Overall, the level of farm intensification (notably through livestock stocking density) is not diminished after reform. A key finding of our analysis is the prices after the reform, of the dual values for both land and dairy quotas according to farm specialization. An important result is that the difference in dairy quota rent across different farm types decreases following the reform. This result must be considered from the perspective of the disappearance of the European dairy quota system because price stability is linked to the continuing existence of dairy and sugar beet quotas. On this specific point, the CAP-MTR is a transition towards the phasing out of the dairy quota system.

We do not obtain the same result if we consider the effect of the CAP-MTR on the land dual values across different farm types. The CAP-MTR increases the land dual values for specialized and mixed farms. It decreases it for the grazing ones, so this reform directly affects the position of different farm types on the land market. According to this result, we can expect

[6] According to the past, we assume for dairy farms in the region: +4% increase of land and quota availability per year.

that in France, the relationship between the land market and the manner of transferring Single Farm Payments will be a key issue in dairying regions.

Bibliography

AGRESTE (2006), - Le panorama - n° 45 - SRISE Nord - Pas-de-Calais - SRISE Picardie

BUTAULT, J.P., DELAME, N. (2006), Concentration de la production agricole et croissance des exploitations. *Economie et statistique*, n° 390, pp.47–64.

COLMAN, D., (ed.) (2002), Phasing out milk quotas in the EU, Main Report to Defra, Scottish Executive (Environmental and rural affairs department), National Assembly for Wales (Agriculture Department) and department of agriculture and rural affairs, Northern Ireland, Center for Agriculture, Food and Resource Economics, School of Economics studies, University of Manchester, April 2002, http://statistics.defra.gov.uk/esg/reports/milkquota/default.asp

CROSSON P., O'KIELY P., O'MARA F.P., WALLACE M., (2006), The development of a mathematical model to investigate Irish beef production systems, *Agricultural Systems* 89, 349-370

FAPRI-IRELAND (2000), The modelling undertaken by the FAPRI Ireland partnership, TEAGASC, Dublin, http://www.fapriireland.teagasc.ie/fapri/index.htm

FLICHMAN G., JACQUET F. (2003), Le couplage des modèles agronomiques et économiques : intérêt pour l'analyse des politiques, Cahiers d'Economie et de Sociologie Rurales, n°67

HECKELEI T., BRITZ W. (2005), Models based on positive mathematical programming: state of the art and further extensions, in Arfini (2005), Modelling agricultural policies ; state of the art and new challenges, proceedings of the 89th European Seminar of EAAE

GOHIN A. **(**2006) Assessing CAP Reform: Sensitivity of Modelling Decoupled Policies, *Journal of Agricultural Economics*, September 2006, v. 57, iss. 3, pp. 415-40

INSTITUT DE L'ELEVAGE (2003) L'élevage bovin et ovin du Nord-Pas-de-Calais. Typologie régionale quantifiée des systèmes bovins lait, bovin viande et ovin viande. Avril. 33p

INSTITUT DE L'ELEVAGE, (2003), « Réforme de la PAC, le compromis de Luxembourg de juin 2003, enjeux et premières analyses », le dossier Economie de l'élevage, numéro spécial, n°329, novembre

JANSSEN S., VAN ITTERSUM M.K. (2007) Assessing farm innovations and responses to policies: a review of bio-economic farm models, *Agricultural Systems 94(3),* pp 622-636.

KLEINHANSS W., MANEGOLD D., BERTELSMEIER M., DEEKEN E., GIFFHORN E., JAGERSBERG P., OFFERMANN F. OSTERBURG B., SALAMON P., (2002), Phasing out milk quotas – Possible impacts on German agriculture**,** Arbeitsbericht 01/2002, FAL Braunschweig, january, 102p.

OGLETHORPE D. R. (2005) Livestock production post CAP reform: implications for the environment, *Animal Science* 81: 189-192

REVELL B., OGLETHORPE D., (2003), Decoupling and UK agriculture: a whole farm approach. *DEFRA Economic Reports,* access on 6/3/05 at http://statistics.defra.org.uk/esg/reports/decoupling/QueenUni.pdf

RIDIER A., JACQUET F.(2002) Decoupling Direct Payments and the Dynamics of Decisions under Price Risk in Cattle Farms, *Journal of Agricultural Economics,* 53(3), pp 549-565.

VEYSSET P., BEBIN D., LHERM M. (2005), Adaptation to Agenda 2000 (CAP reform) and optimization of the farming system of French suckler cattle farms in the Charolais area: a model-based study, *Agricultural Systems* 83, 179-202.