EU dairy farming in the face of change: An exploration using a bio-economic farm model

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Introduction

Dairy farmers in the European Union (EU) face important challenges associated with changes in policy and market conditions. First, the European Commission has proposed to abolish the milk quota system in 2015 as part of the reform of the Common Agricultural Policy (CAP). The milk quota system was introduced in 1984 because of the surplus of milk production in the EU and the heavy burden on budget costs of intervention in the market for dairy products. Anticipating the complete abolishment of the quota system in 2015, the EU has decided to increase the milk quota with 2% per year in the beginning of 2008. Second, dairy farmers have been confronted recently with a sharp increase of the price of feed concentrates due to a number of reasons among others the increased demand for biofuels. Feed concentrates are one of the major inputs in dairy farming that have contributed to the productivity increase of the EU dairy sector during the last decades.

Both developments imply that EU dairy farmers need to cope with more volatile market conditions with respect to both milk prices and prices of concentrates. An ex-ante assessment of the likely consequences of the market instability supports the dairy sector and policy makers to adapt to these changing conditions. The aim of this paper is to explore the effects of changes in milk quota regime and in feed concentrate prices on farm income, resource use and milk production using a bio-economic farm model. This model has been applied in two EU regions with contrasting dairy farming systems, i.e. an intensive system (about 1.5 dairycow per ha) in Flevoland (Netherlands) and a more extensive system (about 0.5 dairycow per ha) in Auvergne (France).

Methods

The used method is based on the Farm System Simulator (FSSIM) developed within the EU FP6 SEAMLESS project (Van Ittersum *et al.*, 2008). FSSIM is a bio-economic farm model which simulates the behaviour of farmers given a set of biophysical, socio-economic and region-specific policy constraints, and their responses under technological innovations and policy changes. It consist of a static comparative programming model, which maximizes a non-linear utility function defined as a combination of expected income and risk, according to the Mean-Standard deviation method (Louhichi *et al.*, 2007). FSSIM integrates a large number of crop and animal activities to facilitate the endogenously matching between feed availability and feed requirements in mixed farming system. The model is calibrated on average farm data applying a variant of the Positive Mathematical Programming (PMP) approach and information from the Farm Accountancy Data Network (FADN). In this case study, FSSIM is applied for two dairy farm types as identified in the EU-wide farm typology developed within the SEAMLESS project (Andersen *et al.*, 2007).

Two different policy scenarios are simulated and compared to a baseline scenario incorporating policy changes formulated in the 2003 CAP reform. The first scenario, simulates the reform of the milk quota regime based on an annual increase of milk quota by 2% during the period 2008–2013 and the second scenario, adds to the previous one a progressive increase of feed concentrates prices from 0 to 100%.

Results and discussion

Compared to the baseline scenario, the implementation of the milk quota reform leads to a slight increase of both milk production and farm income in the two regions (Point of intersection of the lines with the Y-axis in Figure 1): milk production and farm income increase with 2% and 9%, respectively, in Flevoland and with 1% and 4%, respectively, in Auvergne. The increase in milk production is associated with the intensification of milk production in both regions, i.e. higher milk yields per cow. The economic effects in Flevoland are associated with a strong increase of the farm gate nitrogen surplus mainly due to an increase in the use of mineral fertilizers.

Results of the gradual increase of the concentrate prices show the strong dependency of the intensive farm type in Flevoland on feed concentrates as farm income is much more affected than the extensive farm type in Auvergne. The response of farmers to the gradual increase of concentrate prices differs between both farm types, i.e. a strong a reduction in the number of animals (i.e. selling of animals) in Flevoland and an extensification of production system (i.e. lower supplement feed import) in Auvergne. The slightly higher farm income as a result of the relaxation of milk quota is completely lost in both farm types if current concentrate prices increase by more than 40%. The increase of concentrate prices has a positive impact on the farm gate nitrogen surplus due to the lower import of nitrogen in concentrates.



Figure 1. Change of farm income, milk production, livestock units and nitrogen surplus due to the increase of the milk quota and of the concentrate price (% change to baseline).

This case study shows that future policy and market changes may affect EU dairy farming differently depending on the characteristics of the prevailing farming systems. The application of this bio-economic modelling approach illustrates its potentials to integrate technical, economic and environmental knowledge and to make the policy debate on the CAP reforms more transparent thus contributing to well-informed decision-making.

References

Andersen, E., et al., 2007. J. Environ. Manage. 82: 353-362.

Louhichi, K., *et al.*, 2007. A generic template for FSSIM for all farming systems, SEAMLESS PD3.3.11, 82 pp.

Van Ittersum, M.K., et al., 2008. Agricultural Systems 96: 150-165.