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Milk quota expiry impacts and sensitivity analyses using the CAPSIM model

Auswirkungen der Milchquotenabschaffung und Sensitivitätsanalysen mit dem CAPSIM Modell

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Abstract

Various scenarios for an expiry of European Union milk quotas are analysed with the Common Agricultural Policy SIMulation (CAPSIM) model. This comparative-static, partial equilibrium modelling tool covering the whole of agriculture for all EU member states has been disaggregated to represent nine secondary dairy products. Impacts are compared to a reference run where the 2003 Common Agricultural Policy Reform is projected into the future. The main milk quota expiry scenario is for 2020. Key results are that milk production would increase by 3.0% in EU-27 whereas milk prices would drop by 7.2%. The resulting decline in butter prices is shown to be larger if EU authorities cannot rely on export subsidies for market management. The regional pattern of impacts is strongly determined by the specification of quota rents. Furthermore, details of intra EU price transmission are shown to influence the differences between Member States. An applied welfare analysis of the main expiry scenario gives a significant redistribution from EU-27 farmers and much less from taxpayers to dairies and final consumers. The estimated small positive overall welfare gain would increase in a situation without export subsidies.

Key words

'Health Check'; milk quotas; quota rent; price transmission; export subsidies

Zusammenfassung

Verschiedene Szenarien zur Abschaffung der EU-Milchquoten wurden mit dem 'Common Agricultural Policy SIMulation' (CAPSIM) Modell untersucht. Dieses komparativ-statische partielle Gleichgewichtsmodell wurde im Milchsektor erheblich disaggregiert (neun Verarbeitungsprodukte). Der Referenzlauf beinhaltet eine Beibehaltung der derzeitigen Ausgestaltung der EU-Agrarpolitik bis zum Jahr 2020. Im Hauptszenario eines Auslaufens der Quotenregelung in 2015 ergibt sich in der EU-27 eine Produktionsausdehnung von 3.0% und ein durchschnittlicher Verfall der Rohmilchpreise um 7.2%. Der resultierende Preisrückgang bei Butter ist abhängig davon, ob Exporterstattungen zur Abfederung des Preisdrucks eingesetzt werden. Die Ergebnisse werden stark von der Spezifikation der Quotenrenten geprägt, während das Bild auf Mitgliedsländerebene auch von der Intra-EU-Preistransmission beeinflusst wird. Im Hauptszenario mit Exporterstattungen kommt es zu einer deutlichen Umverteilung von der Landwirtschaft und, weitaus weniger gewichtig, von Steuerzahlern zur Molkereiwirtschaft und Endverbrauchern. Der resultierende Wohlfahrtsgewinn ist klein, würde aber ansteigen, wenn die Quoten in einer Situation ohne Exporterstattungen auslaufen würden.

Schlüsselwörter

'Gesundheitscheck'; Milchquoten; Quotenrente; Preistransmission; Exportsubventionen

1. Introduction

The aim of this study is to provide a multi commodity analysis on European Union milk market reform options in the context of the ongoing Common Agricultural Policy 'Health Check' (HC). The analysis is carried with the Common Agricultural Policy SIMulation (CAPSIM) model (WITZKE et al., 2008). In a reference run or 'baseline scenario' the 2003 Common Agricultural Policy (CAP) Reform is projected into the future (2014 and 2020) giving a yardstick for quota expiry scenarios. The main scenarios (quota expiry in 2015 and soft landing until 2014) correspond to the Commission's proposal. In addition, for the quota expiry scenario it is investigated whether the presence or absence of export refunds matter. Sensitivity analyses are carried out for some of the most important methodological aspects in this analysis, notably: different quota rent assumptions and flexible intra EU price transmission.

This paper is structured as follows. In Section 2 we present the structure, assumptions, and database of the model and describe the functional forms used for both supply and demand. In the same section market clearing and price transmission, and the behaviour of dairies are illustrated. In Section 3 the definitions of reference run, policy scenarios and sensitivity analyses are given. In Section 4, scenario results are discussed, including the sensitivity analyses. Section 5 concludes.

2. Structure of the model

2.1 Basic structure and assumptions

Key characteristics of CAPSIM can be summarised as follows. It is an agricultural *partial equilibrium* model relying on exogenous inputs of macroeconomic variables. It is *comparative static*, but may be used for any sequence of projection years provided that exogenous variables have been forecasted for these years and parameters are adjusted according to the length of the run. In terms of empirical specification, it relies on *calibration* techniques and a *rigorous microeconomic framework* for behavioural functions rather than on a full econometric estimation. Several *technological balances* have been incorporated to supplement the microeconomic framework. Examples are balances

* Disclaimer: The views expressed are purely those of the authors and may not in any circumstances regarded as stating an official position of the European Commission.

of: male and female calves, land, feed energy and protein, milk fat and protein. For each of these it is imposed that aggregate use and supply exactly match, based on complete coverage of the agricultural sector in each EU Member State (MS). CAPSIM is a *deterministic* model trying to capture the mean result from a set of exogenous variables, so far starting from a three-year average base year to eliminate as far as possible the influence of yield fluctuations and short-run price fluctuations. *Market clearing* differs depending on the products. For most products, including dairy products, it explicitly distinguishes imports and exports, while for others (mainly 'non tradable' items, see below) it only gives net trade. Major *policy instruments* include various premiums for activities with associated ceilings, set-aside, intervention prices, quotas, domestic subsidies, border measures (tariffs, flexible levies/export refunds). The main *simulation outputs* of CAPSIM are market balances, agricultural production, income and welfare. CAPSIM may be run in two modes: the *reference run* mode and the *policy simulation* mode. The *reference run* mode is used to calibrate the unknown time-dependent parameters (shifters) in model equations, building on exogenous forecasts and ex post observations for the related variables (i.e. the activity levels). In *policy simulation* mode all parameters are given and exogenous inputs, for example yields, final consumption expenditure, and the inflation rate, are usually taken over from the *reference run*.

Agricultural producers and the processing industry (oilseeds, dairy) are profit maximisers. The food industry and compound feed industry apply a fixed margin between producer and consumer prices. Total land supply is exogenous, but land may turn fallow if land prices drop strongly. Final consumers maximise utility. Policy is usually exogenous but export refunds and import levies are linked to the difference of administrative and market prices. Export demand (import supply) from the Rest of the World is described by an ad hoc behavioural function dependent on the EU export price (import price) relative to an exogenous world price.

2.2 Database description and milk quota rents

In total the current product list of CAPSIM includes 21 agricultural outputs, 5 inputs (imported energy rich feed, protein rich feed, a primary factor aggregate, labour, intermediate consumption) and 11 processed products. The largest part of the database is filled from various domains coming from the Directorate General ESTAT (Eurostat) and comprises areas, crop and animal production, market balance positions, price data, consumer expenditure, and macroeconomic variables. In addition, there are a number of supplementary data from various sources (Directorate General for Agriculture and Rural Development, World Trade Organization (WTO), Food and Agriculture Organization of the United Nations (FAO), International Labour Organization, Food and Agriculture Policy Research Institute websites (FAPRI), Zentrale Markt- und Preisberichtsstelle für Erzeugnisse der Ernährungs-, Land- und Forstwirtschaft GmbH (ZMP)) see also WITZKE et al. (2008). Different sources are rendered Consistent and Complete in a routine called COCO (BRITZ and WITZKE, 2008, Section 2.3).

For dairy modelling an important source of information is represented by milk quota rents. Quota rent can be defined

as the discounted sum of the future stream of net benefits to milk producers which comes from maintaining the quota. The milk shadow price is the producer price that would induce a profit-maximising producer to produce the current quota level in the absence of production restrictions. The difference between the market price and the shadow price defines the so-called unit quota rent. For a survey on empirical approaches and results regarding quota rents or marginal costs see TONINI (2008). The milk quota rents for the base year are taken, in percentage form, from RÉQUILLART et al. (2008) for the former EU-15 countries whereas for the New Member States they are set to zero given that milk quotas were not yet phased in.

2.3 Functional forms used for supply and demand

The behavioural functions for producers are derived from a Normalised Quadratic (NQ) profit function (LAU, 1978) in terms of so called net revenues and net prices. Net revenues of activities are market revenues net of shadow values for land (crops), feed energy and protein (animals). Net prices of feed items are correspondingly prices corrected for shadow values of feed energy and protein, see also WITZKE and ZINTL (2007) for details of this approach to include physical balances. The normalised profit function in MS (m) and year (t) is thus:

$$(1) \quad \pi_{m,t}(\mathbf{N}_{m,t}) = \alpha_{m,0,0,t} + \sum_j \alpha_{m,j,0,t} N_{m,j,t} + \sum_j \sum_k \alpha_{m,j,k} N_{m,j,t} N_{m,k,t},$$

where

$$(2) \quad \mathbf{N}_{m,t} = (\mathbf{NREV}_{m,t}, \mathbf{NP}_{m,t}) / \text{PP}_{m,REST,t},$$

is a column vector of price variables s normalised by the general price index $\text{PP}_{m,REST,t}$;

$\mathbf{NREV}_{m,t}$ is a column vector of net revenues $\mathbf{NREV}_{m,j}$ for activity j ;

$\mathbf{NP}_{m,t}$ is a column vector of net prices $\mathbf{NP}_{m,i}$ of input i ;

$\alpha_{m,j,0,t}$ is a time dependent parameter of the profit function;

$\alpha_{m,j,k}$ is a time invariant parameter of the profit function.

This gives behavioural functions of netputs $Y_{m,j,t}$ linear in $\mathbf{N}_{m,t}$. Treating parameters $\alpha_{m,j,k}$ as time invariant permits to shift behavioural functions without affecting curvature.

To implement a binding dairy quota, milk production is fixed and the net revenue is rendered a free variable, a shadow revenue. In the supply side parameter calibration this shadow revenue has been determined as market revenue net of milk quota rents.

The specification for food demand follows from a Generalized Leontief (GL) type indirect utility form. Ryan and Wales (1999) have shown that theoretically consistent demand systems with linear Engel curves stem from an indirect utility function of the following form:

$$(3) \quad V_m(\mathbf{CP}_m, EX_m^{HD}) = -G_m / (EX_m^{HD} - F_m),$$

where

V_m is an indirect utility function;

$\mathbf{CP}_m$ is a column vector of consumer prices;

EX_m^{HD} is consumer expenditure per head (HD);

G_m, F_m are linear homogenous functions of consumer prices.

Roy's identity gives demand functions of the form:

$$(4) \quad CNS_{m,i}^{HD} = -\frac{\partial V_m}{\partial CP_{m,i}} \bigg/ \frac{\partial V_m}{\partial EX_m^{HD}} = \frac{G_{m,i}}{G_m} \times (EX_m^{HD} - F_m) + F_{m,i},$$

where

$CNS_{m,i}^{HD}$ is the per capita demand quantity of item i ;

$$G_{m,i} = \partial G_m / \partial CP_{m,i};$$

$$F_{m,i} = \partial F_m / \partial CP_{m,i};$$

where $F_{m,i} = \delta_{m,i,t}$ is a time dependent parameter and function F_m is linear in prices:

$$(5) \quad F_m(CP_m) = \sum_u \delta_{m,u,t} CP_{m,u}.$$

Function G_m is of GL form:

$$(6) \quad G_m(CP_m) = \sum_u \sum_v \beta_{m,u,v} CP_{m,u}^{0.5} CP_{m,v}^{0.5}.$$

2.4 Market clearing and price determination

The aggregate difference of supply and demand functions of all agents and MS gives EU net trade. This ultimately depends on the EU market price to which national prices are linked. This aggregate net trade equals the difference of EU exports and imports:

$$(7) \quad NET_{i,t}(PE_{i,t}) = X_{i,t}(PX_{i,t}) - M_{i,t}(PM_{i,t}),$$

where

$NET_{i,t}(PE_{i,t})$ is EU net trade as a function of EU market price $PE_{i,t}$;

$X_{i,t}(PX_{i,t})$ is EU exports as a function of EU export price $PX_{i,t}$;

$M_{i,t}(PM_{i,t})$ is EU imports as a function of EU import price $PM_{i,t}$.

EU export prices differ from EU market prices if export refunds are used (and import prices differ in a similar way from EU market prices in case of tariffs):

$$(8) \quad PX_{i,t} = PE_{i,t} - ESUT_{i,t}(PE_{i,t}),$$

where $ESUT_{i,t}(PE_{i,t})$ is average EU export refund.

If there are administrative prices (intervention prices) $ESUT_{i,t}(PE_{i,t})$ may be endogenously increased to ensure that the ratio of EU market prices to the administrative price does not fall significantly below the base year value. Conversely $ESUT_{i,t}(PE_{i,t})$ will drop to zero if market prices strongly increase (see WITZKE and ZINTL, 2007). If there is no administrative price, per unit export refunds are exogenous.

Intra EU price transmission from EU to MS market prices occurs through a conversion factor decreasing in MS net trade rather than being a fixed parameter as in WITZKE and ZINTL, (2007).

$$(9) \quad PP_{m,i,t} = PE_{i,t} \cdot \phi_{m,i}(NET_{m,i,t}),$$

where

$PP_{m,i,t}$ is producer price,

$NET_{m,i,t}$ is MS net trade and

$$(10) \quad \phi_{m,i}(NET_{m,i,t}) = \phi_{m,i,0} \times \left\{ \left(\phi_{m,i,lo} \times wgt_{lo,m,i,t} \right) + \left(\phi_{m,i,up} \times wgt_{up,m,i,t} \right) \right\},$$

with

$\phi_{m,i,0}$ is a parameter capturing base year price differences between EU level and MS;

$\phi_{m,i,lo}$ is a lower bound parameter for item i ;

$$(11) \quad wgt_{lo,m,i,t} = (1 - wgt_{up,m,i,t}) = \frac{1}{1 + \exp \left[-\phi_{m,i,1} \left(\frac{NET_{m,i,t}}{PRD_{m,i,t} + DEM_{m,i,t}} \right) \right]},$$

where

$PRD_{m,i,t}$ is total production and $DEM_{m,i,t}$ is total demand;

$\phi_{m,i,up}$ is an upper bound parameter for item i and

$\phi_{m,i,1}$ is a responsiveness of lower bound weight to $NET_{m,i,t}$.

The conversion factor between MS prices and EU prices ($\phi_{m,i}(NET_{m,i,t})$) may reflect differences in composition and in quality of the products involved. As they will also depend on transaction cost of trade (including the Cost Insurance Freight (CIF) – Free On Board (FOB) difference) the conversion factor between the EU and MS level varies between a lower bound ($\phi_{m,i,0} \times \phi_{m,i,lo}$) and an upper bound ($\phi_{m,i,0} \times \phi_{m,i,up}$) according to a weight depending on net trade. Upper and lower bound have been related for tradable products to average CIF-FOB differences according to a FAO based dataset. A modified version of equation (10) has been specified for 'non-tradable' items like fodder and raw milk such that any change in MS net trade would quickly imply strong price changes, ensuring that net trade of non tradable items is nearly maintained as projected for the reference run situation.

Intra EU price transmission according to (10) is a pragmatic solution to the widely discussed specification problems for spatial price transmission and integration of regional markets (FACKLER and GOODWIN, 2001). It captures transportation costs as in a TAKAYAMA and JUDGE (1964) type of model. At the same time the smooth functional form acknowledges the fact that even within regions the notion of a central point market for homogeneous goods is a fiction. The Armington approach is another modelling choice for heterogeneous products but the difficulties to calibrate bilateral intra EU trade flows render this unattractive. Intra EU price transmission equations in AGMEMOD partnership (2008) include the self sufficiency ratio which is evidently related to net trade. CLUFF (2003) provides a review on the spatial price transmission mechanism in some of the major world multi-commodity models where price transmission elasticities different from one are often used (in contrast to (10)). From econometric research it appears that findings of incomplete market integration within the EU (e.g. FOUSEKIS, 2007) might be due to the difficulty to reflect switching regimes in the presence of transactions costs (BROOKS and MELYUKHINA, 2005; MEYER et al., 2006).

2.5 Behaviour of dairies

The CAPSIM database has been disaggregated and extended to include additional dairy products, giving the fol-

lowing list of dairy products: butter, skimmed milk powder, cheese, fresh milk products, cream, concentrated milk, whole milk powder, whey powder, casein. They are linked to each other and to supply of raw milk through balances on milk fat and protein:

$$(12) \sum_{s \in \text{SEMLK}} \gamma_{m,s,c} PRD_{m,s,t} = \sum_{r \in \text{RAWMLK}} \gamma_{m,r,c} PRC_{m,r,t},$$

where

$PRD_{m,s,t}$ is production of secondary milk product s ;

$\gamma_{m,s,c}$ is the exogenous content of secondary product s in terms of $c \in \{\text{fat, protein}\}$;

$PRC_{m,r,t}$ is processing of raw milk type $r \in \{\text{cow milk, sheep milk}\}$;

$\gamma_{m,r,c}$ is the exogenous content of raw milk type r in terms of $c \in \{\text{fat, protein}\}$.

Behavioural functions for supply of dairy products and demand for raw milk (derived from the NQ form again) are depending on processing margins $PM_{m,i,t}$:

$$(13) PRX_{m,i,t} = \theta_{m,i,0} + \sum_j \theta_{m,i,j} PM_{m,i,t} / PP_{m,rest,t},$$

where

$PRX_{m,i,t}$ is processing demand $PRC_{m,i,t}$ for $i \in \{\text{raw milk types}\}$ or supply $PRD_{m,i,t}$ for $i \in \{\text{secondary milk products}\}$; $\theta_{m,i,j}$ is a parameter of behavioural functions;

$$(14) PM_{m,i,t} = PP_{m,i,t} - \sum_c \gamma_{m,i,c} PS_{m,c,t},$$

where $PS_{m,c,t}$ is a shadow price of content c .

Note that for dairy products equation (13) is a supply function which should respond positively to an increase in the margin whereas for raw milk equation (13) is a derived demand function. Some specific supply side relationships among dairy products such as complementarities between whey powder and casein or cheese and partly between butter and skimmed milk are reflected in the parameters¹ $\theta_{m,i,j}$, as these go beyond the linkages imposed by fat and protein balances.

3. Scenarios

3.1 Reference run

The *reference run* (hereafter called RE) is prepared for 2014 and 2020 and includes recent CAP reforms, and forecasts on policy driven variables such as set aside aligned with those of Commission of the EUROPEAN COMMUNITIES (2008c). The main aspects of Regulation 1782/2003 (COMMISSION OF THE EUROPEAN COMMUNITIES, 2008a) are included.² In addition to the 2003 Luxembourg Reform, 2004

Mediterranean Reform, and the first 2 percent expansion of milk quotas in 2008 it incorporates the recent so-called mini milk reform (COMMISSION OF THE EUROPEAN COMMUNITIES, 2007). This has been reflected in an exogenous decrease in the protein content of milk powders of 1.6 percentage points, together with the related lowering of the intervention price for skimmed milk powder by 2.8%. In terms of future international price evolution, this study relied on FAPRI (2007). For dairy products, however, these were merged with projections from the EDIM model of RÉQUILLART et al. (2008). The standard RE ignores a WTO agreement but in a sensitivity analysis an abolishment of export refunds has been analysed (see Section 4.1). Given its comparative-static character and the parameterisation mainly based on calibration to a base period, CAPSIM is not intended to be a stand alone projection tool. Instead it incorporates external projections from specialised agencies which are merged with default trends (WITZKE and BRITZ, 2005). In the dairy sector the key external source was RÉQUILLART et al. (2008), such that the CAPSIM RE results closely resemble the baseline of this source, including the development of quota rents over time.

3.2 Dairy reform scenarios

In the legal proposals of the Commission for the HC (COMMISSION OF THE EUROPEAN COMMUNITIES, 2008b) it is confirmed that the milk quota system should not be continued after the expiry in 2015 and that this transition should be prepared through an earlier 'soft landing' policy. The main dairy reform scenarios performed in this paper are:

- Quota expiry scenario (hereafter called EX-15, year 2020), 5 years after the scheduled expiry in 2015;
- A part of the Commission's soft landing strategy³ is a series of quota expansion steps. The situation after the last of these steps will be simulated as well (thereafter called EX-SO, year 2014).

An interesting scenario for an analysis of the soft landing strategy is:

- Hypothetical expiry coming into force some years earlier (in 2009) but simulated for the same year as EX-SO, that is 2014. This will be called EX-09 henceforth.

The relevance of abolishing export refunds in the context of a Doha conclusion is checked for the simulation year 2020. The yardstick for the expiry impacts without export refunds is a policy scenario itself:

- RE with default quota rents, but export refunds abolished (thereafter called RE-NS);
- Expiry with default quota rents, export refunds again abolished (EX-NS).

¹ Parameters $\theta_{m,i,j}$ are calibrated based on an assumed set of initial elasticities. This usually gives a high own margin elasticity (>5) to reflect ample possibilities to increase production of dairy products, if milk fat and protein are available. The 'cross margin' elasticities for complementary relationships (see main text) have been initialised with positive values whereas the starting values for all other pairs were negative.

² In particular the total payment amounts for coupled and decoupled support from Annex VIII, sugar payments from Annex VII, specific support to tobacco, cotton, olives, hops, and amounts exempted from modulation due to the franchise. The

wine market reform according to EU Regulation 479/2008 from 29.06.2008 has been ignored.

³ It should be noted that the long run results for 2020 from a comparative static model such as CAPSIM would be the same with or without such preparation. The short run effects of soft landing as compared to a 'big bang' quota abolition in 2015 without preparation cannot be analysed with comparative static models.

Table 1. CAPSIM simulations

Acronym	Milk Quotas	Export refunds	Initial rents	EU Price transmission	2004	2014	2020
RE	Status quo	Active	Default	Default	☒	☒	☒
<i>Main scenarios</i>							
EX-15	Prior abolishment	Active	Default	Default			☒
EX-SO	EC proposal	Active	Default	Default		☒	
EX-09	Prior abolishment	Active	Default	Default		☒	
<i>Sensitivity analysis (price transmission and quota rents)</i>							
EX-99	Prior abolishment	Active	Default	Default	☒		
EX-HI	Prior abolishment	Active	High	Default	☒		
EX-FX	Prior abolishment	Abolished	Default	Fixed	☒		
<i>Sensitivity analysis (export refunds)</i>							
RE-NS	Status quo	Abolished	Default	Default			☒
EX-NS	Prior abolishment	Abolished	Default	Default			☒

Source: own

3.3 Sensitivity analyses

To investigate methodological issues several sensitivity analyses are carried out with a focus on different quota rent assumptions and flexible intra EU price transmission. The reference run (RE) equals the calibration point, i.e. the observed data with quotas in place for the base year 2004. Alternative scenarios are:

- Expiry (in 1999, results simulated for 2004) with default initial quota rents and default (flexible) price transmission (hereafter called EX-99);
- Expiry with increased quota rents and flexible price transmission (hereafter called EX-HI, simulated for 2004);
- Expiry with default quota rents and fixed price transmission¹ (thereafter called EX-FX, simulated for 2004).

Carrying out the methodological sensitivity analyses for the base year simplifies matters because all model versions (default, high rents, and fixed price linkage) calibrate to the same point, the base year data. This gives a fixed yardstick² for the identification of impacts. Assuming that expiry would have taken place in 1999 ensures that adjustments to the new equilibrium would have been well advanced by 2004. The different simulations are summarised in the following table 1.

4. Scenario results

4.1 Quota expiry scenario for 2020

This sub-section focuses on the quota expiry scenario, implemented as of 2015 according to the HC proposals (Health Check proposals), but simulated for 2020. A key result of the analysis is that EU-27 raw milk production would increase by 3.0%, driving down milk prices by 7.2% on average (table 2). Both production and price changes show some regional variation within the range of cases³ selected for table 2. The regional variation of price changes for raw milk exceeds that of dairy products because the former is basically non-tradable. Price drops are particularly strong if initial quota rents were high (on those compare figure 1 below), but price changes of dairy products also matter (in particular in Spain). Price impacts are slightly

Table 2. Expiry impacts for raw milk, 2020

	RE		EX-15		EX-NS	
	Price [Euro/t]	Production [1 000t]	Δ Price [%]	Δ Production [%]	Δ Price [%]	Δ Production [%]
France	281	25 922	-6,8	2,1	-7,5	1,8
Germany	295	30 472	-6,4	2,9	-7,0	2,6
Netherlands	318	11 043	-9,2	10,6	-9,5	10,5
Spain	302	6 532	-19,4	10,8	-19,5	10,6
United Kingdom	291	15 105	-2,5	-1,0	-3,0	-1,2
EU15	289	126 359	-7,4	3,4	-8,0	3,1
Czech Republic	225	2 773	-5,3	0,3	-6,0	0,0
Estonia	218	649	-3,3	-0,9	-4,1	-1,0
Poland	216	11 603	-8,1	2,0	-8,5	1,7
10 New MS	218	21 483	-6,4	1,1	-6,9	0,8
Bulgaria/Romania	173	5 932	-3,6	1,3	-3,8	1,3
EU27	275	153 774	-7,2	3,0	-7,7	2,7

Source: CAPSIM simulations

¹ Technically this involved setting $\phi_{m,i,lo} = \phi_{m,i,up}$ in (10).

² Whereas a reference run for 2020 under fixed price linkage or high quota rents will differ somewhat from the default reference run.

³ The surprisingly high drop in raw milk prices in Spain is not only due to a strong expansion of supply which resembles the situation in Netherlands. In addition, Spain is expected to face above average declines of dairy prices, in turn motivated by *strongly* increasing net trade.

reinforced and production impacts are somewhat more negative if the comparison is made in a CAP environment without export refunds (column EX-NS).

Table 3 gives a summary on market impacts of quota expiry scenarios for selected products on the EU-27 level. The first two columns apply under status quo policy for export refunds, the last two assume that export refunds are abolished. Focussing first on the results with export subsidies in place we may note that the increase in supply exceeds that of raw milk (+3.0%) for 'industrial' products like butter (+6.5%) and various powders (up to 11% for whey powder, omitted from table 3), because raw milk costs (for milk fat and protein) have a high share in product value. On the contrary the increase is below average (3%) for cheese and fresh milk products (and below 0.3% for cream and concentrated milk, also omitted from table 3)⁴.

The right column EX-NS shows that butter prices would drop stronger (-4.1% rather than -0.5%) if EU market management could not rely on export refunds. Note also that net trade would become slightly positive (-90+122=+32) in the expiry scenario with export refunds. For dairy products other than butter, export refunds would not be used such that the differences between columns EX and EX-NS are relatively small, deriving from indirect linkages to butter. Dairy products are linked to meat markets on the supply and demand side. Supply side impacts on the beef market are small if the additional calves from an increasing number of dairy cows are used for the production of veal (rather than being used for adult cattle fattening) or if there is a parallel decline in the suckler cow herd. According to the CAPSIM simulations the latter would indeed largely neutralise the impact on beef supply in EU-27 (+0.4%). Some decline of meat consumption may be expected on the demand side if dairy consumption increases which tends to reduce market prices of meats. As was the case for butter, EU market management limits the decline of beef prices in EX-15 compared to EX-NS. The additional milk production would increase feed demand, including fodder, which would require some area reallocations (e.g. an increase of the area for 'fodder on arable land' by 0.5% in EU-27 under EX) and increase prices for feed items in general. These price changes tend to dampen the increase in milk production, just as the decline in calves prices (about -17%).

RÉQUILLART et al. (2008: Annex p.14) obtained somewhat higher impacts with EDIM: +5.2% for production, -10.7% for prices. As quota rents and several supply and demand elasticities in the dairy sector have been initialised based on EDIM, these cannot explain the differences. The dampening repercussions from other sectors in agriculture are a potential explanation as these are neglected in EDIM. However, it is conjectured here that the main reason for differences is the representation of external trade. The aggregate behavioural functions for exports and imports from the Rest

⁴ Some products have to compensate for the above average expansion of industrial products given balances on milk fat and protein.

Table 3. Expiry impacts for selected dairy products and meats, 2020, EU-27

		RE	EX-15	RE-NS	EX-NS
Butter					
Price	Euro/t Δ	2 944	-0,5%	2 909	-4,1%
Supply	1 000 t Δ	1 914	6,5%	1 908	4,8%
Demand	1 000 t Δ	2 004	0,1%	2 012	1,4%
Net trade	1 000 t Δ	-90	+122	-104	+64
Skimmed milk powder					
Price	Euro/t Δ	2 039	-4,9%	2 040	-3,8%
Supply	1 000 t Δ	817	8,0%	814	6,3%
Demand	1 000 t Δ	896	2,3%	893	1,8%
Net trade	1 000 t Δ	-79	+44	-79	+35
Whole milk powder					
Price	Euro/t Δ	2 872	-4,3%	2 862	-4,6%
Supply	1 000 t Δ	539	3,9%	541	4,2%
Demand	1 000 t Δ	518	2,3%	519	2,5%
Net trade	1 000 t Δ	21	+9	22	+10
Cheese					
Price	Euro/t Δ	4 667	-2,7%	4 661	-2,6%
Supply	1 000t Δ	9 607	2,3%	9 611	2,3%
Demand	1 000t Δ	9 146	1,1%	9 144	1,1%
Net trade	1 000t Δ	461	+119	467	+117
Fresh milk products					
Price	€/t Δ	703	-1,7%	701	-1,9%
Supply	1 000 t Δ	48 433	0,9%	48 422	0,9%
Demand	1 000 t Δ	48 550	0,7%	48 535	0,8%
Net trade	1 000 t Δ	-117	+60	-113	+65
Beef					
Price	Euro/t Δ	2 846	-0,1%	2 838	-0,3%
Supply	1 000 t Δ	7 518	0,4%	7 516	0,4%
Demand	1 000 t Δ	8 135	-0,3%	8 136	-0,2%
Net trade	1 000 t Δ	-617	+55	-620	+44
Pork					
Price	Euro/t Δ	1 270	-0,2%	1 261	-0,3%
Supply	1 000 t Δ	23 639	-0,1%	23 608	-0,1%
Demand	1 000 t Δ	21 624	-0,2%	21 636	-0,3%
Net trade	1 000 t Δ	2 015	+26	1 972	+30

Source: CAPSIM simulations

of the World imply heterogeneity of products whereas EDIM basically follows TAKAYAMA and JUDGE (1964) assuming homogeneous products at the given level of disaggregation. This may have led to stronger price impacts for dairy products in the EDIM model.

Table 4 summarizes the welfare effects from the scenarios. Strongly declining producer prices for milk are reducing income in agriculture, whereas dairies would benefit, because prices of dairy products decline less than raw milk prices. The main effect is evidently a reallocation of income to final consumers. There would be some losses to taxpayers, in total 336 million Euro for EU-27 under scenario EX-15. These would be due to increased European Agricultural Guidance and Guarantee Fund (EAGGF) expenditure (+157 million Euro, almost exclusively from increased butter export refunds) but also due to losses in tariff revenues from reduced imports of dairy products and some meats (-181 million Euro). At the bottom line, there would be a small welfare gain (+37 million Euro) for EU-27.

Table 4. Welfare in expiry scenarios, 2020, selected countries [million Euro]

	EX-15 (Δ to RE)				EX-NS (Δ to RE-NS)			
	Producers	Taxpayers	Consumers	Welfare	Producers	Taxpayers	Consumers	Welfare
France	-314	-60	293	-81	-399	-28	381	-46
Germany	-309	-72	386	5	-393	-34	480	54
Netherlands	-49	-16	98	33	-75	-7	112	30
Spain	-92	-30	185	62	-115	-14	207	78
United Kingdom	-121	-38	186	27	-151	-18	235	66
EU15	-1 326	-323	1 699	50	-1 689	-152	2 063	222
Czech Republic	-30	-2	28	-4	-38	-1	36	-3
Estonia	-7	0	5	-1	-8	0	7	-1
Poland	-141	-5	130	-16	-163	-2	156	-9
10 New MS	-229	-12	215	-26	-273	-5	262	-17
Bulgaria/Romania	-26	-2	41	13	-34	-1	49	14
EU27	-1 581	-336	1 954	37	-1 996	-159	2 374	219
of which:	Agriculture	EAGGF			Agriculture	EAGGF		
	-2 763	157			-3 121	1		

Source: CAPSIM simulations

Net impacts are estimated on average less favourably for EU-10 countries than for the old MS or Romania and Bulgaria. They depend on many factors such as the importance of agricultural income relative to food expenditure (higher in France than in Germany), on initial quota rents (zero rents as in UK and Estonia give losses for agriculture without gains to dairies), on the share of milk in total output (tends to limit producer losses in Spain, Bulgaria, Romania), on EU financing shares (unfavourable for EU-15 countries), and, not to be neglected in the interpretation, on the size of countries.⁵

As Scenario EX-15 reflects a liberalisation in a second best environment for EU-27, with border measures and other support still in place, a negative sign of total welfare effects (as in RÉQUILLART et al., 2008, table 28) is theoretically possible. Scenario EX-NS (vs. RE-NS) shows that the overall welfare gains would be indeed larger (+219 million Euro rather than +37 million Euro) if export refunds had been abolished and second best effects were basically limited to the tariff revenue side. Furthermore the welfare results in table 4 are biased downward because the aggregate analysis with CAPSIM does not capture the efficiency gains from an equalisation of quota rents to zero across regions and even within regions of each MS. Whereas transaction costs to trade quota rights may be low in some countries (Netherlands, United Kingdom) they are certainly high in others where tradability of quota rights is strongly restricted (France).

4.2 Soft landing and early quota expiry for 2014

This sub-section focuses on a soft landing scenario (EX-SO) that consists in a series of quota expansion steps that sum up to 5% against the reference run up to 2014. This is compared with a full, early quota expiry implemented in 2009 (see scenario EX-99). Table 5 gives a summary on im-

pacts for the two aforementioned scenarios. Comparing first scenario EX-09 with RE the most important finding is that milk production would only increase by 2.0% in EU-27 if the expiry is hypothesised for 2009. Comparing EX-09 with EX-SO highlights that EX-09 gives only moderately stronger market impacts than EX-SO. For example the milk price decline would be about 1.3% (= 5.1% - 3.8%) larger under EX-09 compared to EX-SO. This is due to the fact that the quota expansions under EX-SO would leave only Austria, Belgium, Netherlands and Spain with positive quota rents. This implies that the soft landing strategy would indeed guide smoothly the EU dairy sector into a future without quotas.

An interesting observation is that the corresponding increase in milk supply was 3% in 2020 for EU-27 (under EX-15, table 2) and thus 1.0% more than given here for 2014 (under EX-09, table 5). This is because economic

Table 5. Soft landing scenarios for selected dairy products, 2014, EU-27

		RE	EX-09	EX-SO
Cow milk (raw)				
Price	Euro/t Δ	250	-5,1%	-3,8%
Supply	1 000 t Δ	154 506	2,0%	1,5%
Net trade	1 000 t Δ	-471	+0	+0
Butter				
Price	Euro/t Δ	2 959	-0,5%	-0,3%
Supply	1 000 t Δ	1 938	4,2%	3,3%
Net trade	1 000 t Δ	-106	+81	+64
Skimmed milk powder				
Price	Euro/t Δ	1 895	-3,3%	-2,7%
Supply	1 000 t Δ	870	5,3%	4,0%
Net trade	1 000 t Δ	-65	+30	+24
Cheese				
Price	Euro/t Δ	4 596	-2,0%	-1,4%
Supply	1 000 t Δ	9 261	1,6%	1,2%
Net trade	1 000 t Δ	391	+78	+58

Source: CAPSIM simulations

⁵ A detailed analysis of welfare results at the level of single MS would considerably increase the length of the paper but an extended version of table 4 is available upon request.

conditions will have improved for the dairy sector by 2020: EU and global demand growth will have supported dairy prices which also increases raw milk prices while yields have improved as well.

4.3 Sensitivity analysis for the base year 2004

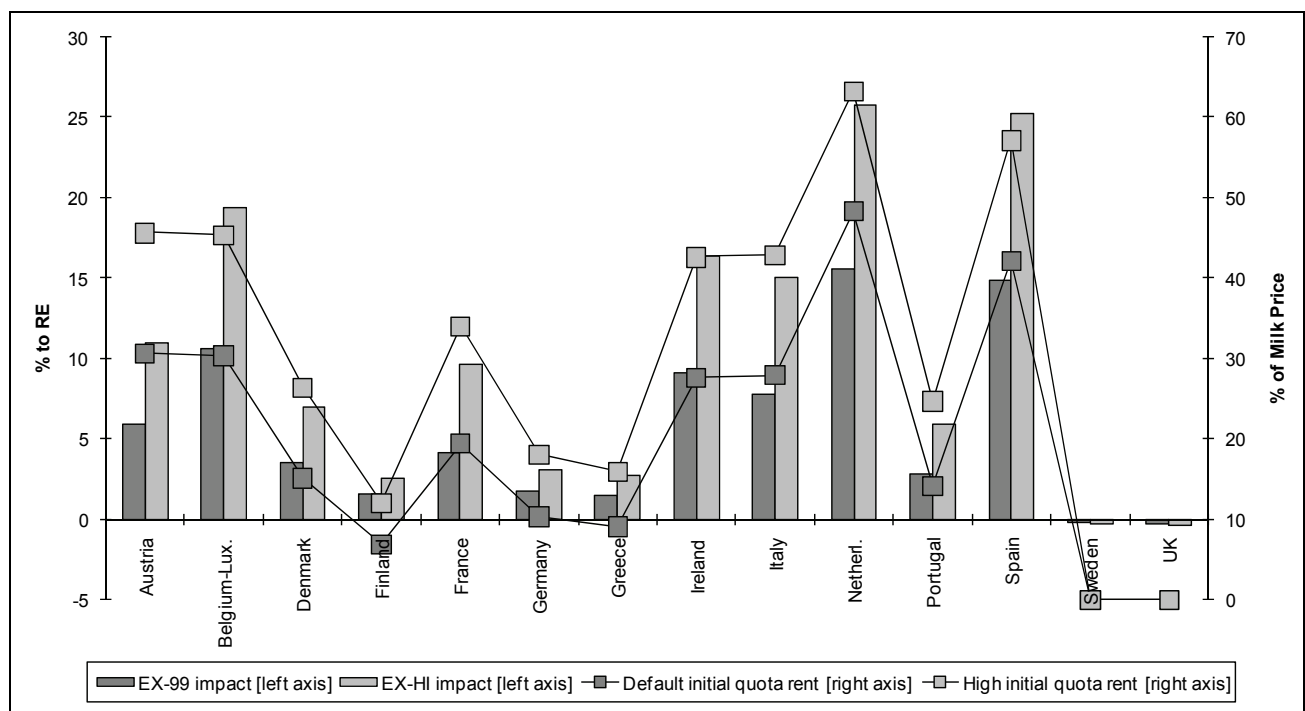
To check the importance of quota rents and the price transmission specification sensitivity analyses have been carried out for the base year 2004 (see table 1 above). For scenario EX-HI percentage quota rents (relative to the milk price) have been increased by 75% (cut-off at an increase by 15 percentage points) relative to the default values in scenario EX-99. Figure 1 presents the assumed quota rents and the response impacts for expiry scenarios EX-99 and EX-HI. The figure shows that choice of quota rents largely determines the pattern of production impacts of quota expiry scenarios.

The highest quota rents are assumed to hold in Netherlands (48% in the default case, line marked with dark gray squares), Spain, Austria and Belgium-Luxembourg. In the sensitivity analysis these are increased up to 62% in Netherlands, a value very likely to give an upper bound for conceivable quota rents. Countries with high rents would have strongly increased their milk production, whereas countries with zero quota rents (Sweden, United Kingdom) would have reduced their milk production, due to declining dairy prices in this scenario. The lines for initial quota rents and corresponding bars for changes in milk production do not match exactly for several reasons. Supply elasticities are in general estimated around 0.3 but they are not all exactly equal in all MS. Furthermore, prices are not changing uniformly in all MS of EU15. Nonetheless it is evident that the key driver for intra EU differences comes from the specified quota rents.

Table 6 gives the results of the sensitivity analyses for whey powder in 2004. Whey powder is an interesting product to be considered in a sensitivity analysis because is not directly benefiting from EU export subsidies (which usually limit the price changes to less than 1%). Production impacts would have been far stronger if quota rents had been specified higher (+14.5% in EX-HI vs. +7.5% in EX-99). By contrast the return to a fixed linkage of producer prices to EU (see EX-FX column) prices did not significantly modify the production impacts for EU-15. The first reason is that the fixed linkage scenario basically removes the difference between CIF type import prices and FOB type export prices for each MS. This usually amounts between 10 to 20% of the product price only. Therefore, this is a rather moderate change compared to an increase in quota rents by 75%. Furthermore, the impacts are mainly visible on the level of single EU MS.

Comparing the price change columns of scenarios EX-99 and EX-FX in table 6 shows that the price drops at the national level are on average somewhat larger if the net trade impact is taken into account: higher net trade reduces producer prices because (lower) export prices will have a stronger influence on market prices. Another difference is moderate heterogeneity of price changes. The price drops are highest if net exports are significantly increasing (Austria and Italy). Conversely the price drop is lowest if net exports are decreasing (Sweden, United Kingdom). Modified price changes also imply different predictions for quantity impacts: Whereas a simple fixed price transmission would have yielded a decline in United Kingdom net exports of whey powder by 77% this impact would be dampened to 45% in the current specification. To conclude: while intra EU price transmission is of lower importance than quota rents for the aggregate EU-15 results, this issue is relevant for an analysis at the level of single MS.

Figure 1. Initial quota rents in EU15 and impacts on raw milk supply in 2004



Source: CAPSIM assumptions and simulations

Table 6. Sensitivity analysis for whey powder, 2004
[prices: Euro/t, quantities: 1 000 t]

	RE			EX-99		
	Price [Euro/t]	Production [1000t]	Net trade [1000t]	Δ Price [%]	Δ Production [%]	Δ Net trade [%]
Austria	455	10	4	-4,2	24,8	64,1
Italy	455	131	-26	-4,1	21,4	-78,7
Sweden	441	5	-6	-2,1	-8,3	10,9
UK	416	57	7	-1,8	-5,0	-44,9
EU15	434	1444	236	-2,8	7,5	25,7
	EX-HI			EX-FX		
	Δ Price [%]	Δ Production [%]	Δ Net trade [%]	Δ Price [%]	Δ Production [%]	Δ Net trade [%]
Austria	-7,1	44,8	113,0	-2,1	27,5	71,1
Belgium-Lux.	-7,5	39,5	-145,8	-2,2	20,2	-84,5
Denmark	-3,9	-17,3	21,6	-2,2	-10,1	12,8
Finland	-3,3	-10,5	-93,6	-2,1	-8,5	-77,1
EU15	-5,2	14,5	52,5	-2,2	6,8	23,6

Source: CAPSIM simulations

5. Conclusions

This study provided an agricultural multi commodity analysis of expiry scenarios for EU milk quotas. The analysis was carried with the Common Agricultural Policy SIMulation (CAPSIM) model which is a comparative-static, partial equilibrium modelling tool covering the whole of agriculture of EU member states. In the dairy sector it distinguishes nine dairy secondary products. Attention is given to two main scenarios: a quota expiry and a soft landing as a part of the Commission's proposal. In addition, for the quota expiry scenario it was investigated whether the presence or absence of export refunds matter. Milk quota rents and intra EU price transmission are analysed in methodologically motivated sensitivity analyses.

The main milk quota expiry scenario is for 2020 that is some years after the scheduled expiry in 2015, when a comparative static modelling tool may be expected to identify the medium run impacts. Key results are that milk production would increase by 3.0% in EU-27 whereas milk prices would drop by 7.2%. The expiry of export refunds exacerbates price impacts whereas production impacts are somewhat decreased. The regional pattern simulated is strongly influenced by the specification of quota rents. Furthermore, details of intra EU price transmission are shown to influence the differences between Member States.

On markets for derived dairy products we would usually see an increase in supply associated with declining prices, increased demand, and net exports increasing relative to the reference run. The impacts would partly depend on whether market management based on variable export refunds would dampen the price drop or not. In the standard case this market management is still relevant for butter which would limit the price change to -0.5%. In the sensitivity analysis without export subsidies the change in butter prices would be -4.1 % which is similar to skimmed and whole milk powders. Cheese and fresh milk products would see somewhat smaller price changes (-2.7% and -1.7%, respectively).

Declining prices evidently benefit final consumers at the expense of producers. The balance of welfare effects is small and partly dependent on budgetary impacts. On balance the quota expiry would give small welfare gains of 37 million Euro for EU-27 which increases to 219 million Euro if export subsidies were abolished (but tariffs still in place).

It should be acknowledged that intrasectoral efficiency gains of quota expiry which follow from nonzero transaction cost in quota trade in the reference run are not captured in the CAPSIM analysis. Furthermore, structural change over time may increase after the expiry of quotas. On the other hand environmental impacts, positive and negative, are also neglected.

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