EU dairy policy and WTO negotiations

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Abstract. The EU dairy sector is facing a period of significant changes that are due to three major decisions: the EU enlargement, the Luxemburg reform and on-going WTO negotiations. In this paper, we focus on the analysis of changes in both domestic and trade dairy policies using a spatial model of the dairy sector that includes EU25 member countries, the modelling of the rest of the world including the main world dairy exporter (Oceania) and 4 importing areas (Africa, America, Asia and the Rest of Europe). The paper provides detailed results with respect to dairy markets in the EU. We show that in the context of the Luxemburg reform, the WTO might have positive impacts on EU milk price. The positive impact on EU milk price of a reduction of the tariffs in the importing countries exceeds the negative one of removing export subsidies as well as lowering EU import tariffs. We explore the sensitivity of the results to alternative assumptions on demand for dairy products, EU competitiveness and price transmission in the dairy chain.

Keywords: WTO, agricultural policy, dairy industry, partial equilibrium model.

1. Introduction

The EU dairy sector is facing a period of significant changes that are due to three major decisions: the EU enlargement, the Luxemburg reform and on-going WTO negotiations. The enlargement of the EU to include 10 New Member States (NMS) has increased both the production capacities and the demand for dairy products in the EU. The Luxemburg reform will result in a significant decrease in the support prices for butter and skim milk powder, the introduction of decoupled payments and the maintenance of the milk quota system even if in a longer term milk quotas are still uncertain. On the international scene, the outcome of the ongoing Doha Round of the WTO trade negotiations is likely to follow the direction of the Uruguay Round Agreement. This will imply a reduction in both import barriers and subsidised exports.

Each of these three changes will have significant impacts on the whole EU dairy sector. Previous studies have analysed separately the impact on the dairy sector of such changes. A lot of work was done at the end of the 90's about the impact of further trade liberalisation (Larivière and Meilke, 1999; Cox, *et al*., 1999; Shaw and Love, 2001; Donnellan and Westhoff, 2002). To prepare for the Luxemburg reform in the dairy sector, an in depth study was developed (Consortium INRA-Wageningen, 2002). The impacts of the reform decided in Luxemburg was analysed by different teams (Binfield *et al*. (2003), Bouamra-Mechemache *et al*. (2003)).

However none of these studies has jointly analysed the impact of the three changes that will shape the EU dairy sector in the future. This is a limit of these studies as trade policy and domestic policy are obviously not independent. In this paper, we mainly analyse the impact of the Luxembourg reform and of further WTO agreement in the context of the EU-25. In Sections 2 and 3 we present the theoretical framework and the applied model. In Section 4, we analyse the impact of the Luxembourg reform on the dairy sector. Section 5 is devoted to the analysis of WTO scenarios. We conclude in Section 6.

2. The theoretical framework

We develop a partial equilibrium model of the dairy sector. It has two key features. First, it is a hedonic model of the vertical structure that explicitly models the processing technology of milk into final

commodities. Milk price is derived from the value of its two main components (fat and protein) in the final dairy commodities. Second, the model is spatial allowing for endogenous trade between countries. We now briefly present the analytical framework.

The inverse supply function for milk in region *i* is denoted $S_i(X_i)$ with X_i the quantity of milk collected. Because milk is a bulk product, we do not allow trade of raw milk between regions. We denote $Y_{i,k}$ the production of the processed commodity *k* in region *i*. Production of commodity *k* involves basic components that are an integral part of raw milk and that are "rearranged" and allocated among processed commodities. We denote $\alpha_{i,s}$ the quantity of the s^{th} component per unit of raw milk produced in region *i* and $\gamma_{k,s}$ the quantity of the s^{th} component per unit of processed commodity *k*. Under a Leontief technology, the transformation of raw milk into processed commodities must satisfy:

$$\sum_k Y_{i,k}\gamma_{k,s} \le X_i\alpha_{i,s} \qquad \forall i,s \tag{1}$$

Equation (1) ensures the balance in the allocation of component *s* in each producing region *i*. In addition to milk components, the production of commodity *k* also involves other inputs, which are provided at a marginal cost function $c_{i,k}(Y_{i,k})$.

The inverse demand function for each final commodity *k* in region *i* is denoted by $D_{i,k}(Z_{i,k})$ where $Z_{i,k}$ denotes the consumption of commodity *k* in region *i*. Trade across regions involves transportation cost. We assume a constant marginal cost for transportation of commodity *k* from region *i* to region *j* and denote it $t_{i,j,k}$. Trade flows, denoted by $XD_{i,j,k,ex,imp}$, represent the quantity of commodity *k* that is transported from region *i* to region *j* under the export regime *ex* (of region *i*) and under the import regime *imp* (of region *j*). We distinguish subsidized exports (*ex* = "*sub*") from non subsidized exports (ex = "*nsub*"). The per-unit export subsidy for commodity *k* is denoted by $ES_{k,ex}$. Obviously, $ES_{k,"nsub"} = 0, \ \forall k$. On the import side we consider import tariffs and tariff rate quota (TRQ). TRQs are modelled as an import quota associated with a low tariff (*imp*="*min*") and over quota imports associated with a higher tariff (*imp*="*ovq*"). We also consider the case where no tariff prevails (*imp*="*no*"). The per-unit import tariff for commodity *k* is denoted by $IT_{k,imp}$. Obviously, $IT_{k,"no"} = 0, \ \forall k$. Finally, note that $XD_{i,i,k,"nsub","no"}$ is the quantity of commodity *k* that is both produced and consumed in the same region *i*. The trade flow constraints across regions are:

$$\sum_{j,ex,imp} XD_{i,j,k,ex,imp} \le Y_{i,k} \qquad \forall i,\forall k \tag{2}$$

$$Z_{i,k} \le \sum_{j,ex,imp} XD_{j,i,k,ex,imp} \qquad \forall i,k \tag{3}$$

In any region, these equations guarantee that exports plus domestic use cannot be larger than domestic production (2), and that domestic consumption cannot exceed domestic production plus imports (3).

Dairy policy instruments are easily integrated in this framework. For example, milk production quotas in region *i* ($\overline{X}_i$) are simply integrated through a constraint:

$$X_i \le \overline{X}_i \tag{4}$$

Trade policies are explicitly taken into account. For example, a constraint on the volume of subsidized exports in region *i* for product *k* ($\overline{XE}_{i,k}$) is written as: [1]

$$\sum_{j\neq i,imp} XD_{i,j,k,"sub",imp} \le \overline{XE}_{i,k} \qquad \forall k \tag{5}$$

Dealing with a constraint on the expenditures of subsidized exports is identical. In this case, the left hand

[1] In this setting, we assume that constraints on subsidized exports apply for each product and each country. In practice, some constraints apply for a group of products (countries). In that case, the constraint needs to be defined over a group of products (countries) rather than over one product (country).

side of (5) is now written as exported quantities times the per unit value of export subsidies and obviously the right hand side is expressed in value.[2]
Modelling import policy through TRQ is also straightforward:

$$\sum_{i \neq j,ex} XD_{i,j,k,ex,"min"} \leq \overline{XI}_{j,k} \qquad \forall j,k \tag{6}$$

with $\overline{XI}_{j,k}$ the tariff rate quota associated to commodity k in the the j^{th} country. As for (5), one can easily extend this definition to deal with group of products or group of countries. For more details on how policy instruments are modelled, the reader can refer to Bouamra *et al.* (2002a).

As a basis for representing resource allocation, we consider the following optimization problem:

$$\begin{aligned} &Max_{X_i, Y_{i,k}, Z_{i,k}, XD_{i,j,k,ex,imp}} QW(X_i, Y_{i,k}, Z_{i,k}, XD_{i,j,k,ex,imp}) = \\ &\sum_{i,k} \int_0^{Z_{i,k}} D_{i,k}(u)du - \sum_i \int_0^{X_i} S_i(u)du - \sum_{i,k} c_{i,k}(Y_{i,k}) - \\ &\sum_{i,j,k,ex,imp} (t_{i,j,k} - ES_{k,ex} + IT_{k,imp}) XD_{i,j,k,ex,imp} \end{aligned} \tag{7}$$

Subject to (1)-(6), $X_i \geq 0, Y_{i,k} \geq 0, Z_{i,k} \geq 0, XD_{i,j,k,ex,imp} \geq 0$.

The quasi-welfare function (7) is equal to the sum of producer and consumer surpluses across all regions minus the total cost of labour and capital in the processing sector minus the total cost of transportation net of import taxes (that are an additional cost) and export subsidies (that are subsidies and thus considered as negative costs) . The solution to (7) can be shown to generate a competitive resource allocation (see Chavas *et al*., 1998). We derive the equilibrium on:

- the milk market in producing and exporting regions: production, price (country level);
- the intermediate products markets: fat and protein prices (country level);
- the dairy products markets: production, price, subsidized and unsubsidized consumption (country level);
- trade: imports, subsidised exports, unsubsidised exports.

3. The applied framework

We define a spatial equilibrium model of the world dairy industry. It integrates an agricultural product (cow milk), 2 milk components (fat and protein), and 14 final dairy products (butter, skim milk powder (SMP), whole milk powder (WMP), condensed milk, casein, liquid milk, cream, fresh products and five categories of cheese: fresh cheese, semi-hard cheese (SHC), hard cheese (HAC), processed cheese (PRC), blue cheese, soft cheese). It integrates two exporting areas (EU and Oceania) as well as four importing regions (Asia, Africa and Middle East, America, CIS and Rest of Europe).

3.1. Modelling of EU-25

The model gives a complete picture of the EU-25 dairy sector as well as its trade relationships with the main importing or exporting areas in the world. The model distinguishes 18 European countries or group of countries. Each of the EU-15 countries is considered, except for Belgium and Luxemburg that are aggregated. For the NMS (also referred as EU-10), we distinguish the three main producers (Poland, Hungary and Czech Republic) and consider the seven other countries as an aggregate.[3] All of the 18 regions are considered both as a supplier of milk and dairy products and as a demanding region for dairy commodities. They can trade among each other or with the rest of the world.

[2] Even if export subsidies are determined endogenously by iterating the model, at each step of the procedure, the export subsidies are fixed which thus allowing for writing (5) in value.

[3] These countries are Cyprus, Estonia, Latvia, Lithuania, Malta, Slovenia and Slovakia. We aggregate these 7 NMS as they represent less than a quarter of the EU-10 milk production which amounts to 22 Mt that is 18% of the EU-15 production.

In the model, milk supply functions are simple functions: they are linear and the only variable is the milk price. In practice, milk supply reacts to various prices (beef prices, feed prices, …). Moreover, the stock of cattle plays also an important role. In the short run, the milk price elasticity is much lower than in the medium or long run. This is because in the short run, the number of cows is fixed and an increase in production is thus only possible through feed increase while in the medium or long-run it is possible to vary the number of cows. As we are looking to the impact of policy reforms on the milk sector, we choose to use medium-run supply equations. We use a reduced form of the milk supply equations that summarized the work by Jongeneel and Ponsioen (2006) and Jongeneel and Tonini (2005).

Results of the model are very sensitive to demand characteristics (demand elasticity and trend). For instance, previous results (Consortium INRA-Wageningen, 2002) show that, everything else being equal, a 1% increase in the derived demand for milk generates an increase in milk price by 3%. Because of the importance of these parameters, a particular attention was devoted to the demand side of the model. In particular, estimates of autonomous demand trends (defined as changes that are not explained by price changes) can be found in Trevisiol (2005) and estimates of demand elasticities in some EU15 countries can be found in Hadj Ali, Soregaroli and Trevisiol (2005).

3.2. Modelling of Oceania

Because Oceania (New Zealand and Australia) is the main exporter of dairy products in the world, the model includes Oceania as a producing zone. Because, the domestic consumption of dairy products in Oceania is small relative to the production, we consider that consumption in Oceania is fixed. Moreover, because imports from Australia and New Zealand are mainly intra-trade flows between these two countries, we do not consider imports from other areas.

Thus, Oceania is a producing zone and exporting zone. The exports are simply the difference between productions that depend on prices and a fixed consumption. Oceania does not produce all the products that are considered in the model. It mainly produces butter, SMP, WMP, SHC and PRC for domestic and export markets as well as fluid milk and fresh products only for its domestic market.

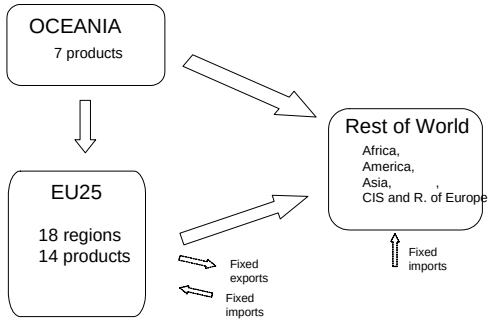
3.3. Modelling of importing regions

On the import side, we distinguish four importing regions that are the main importers of EU-25 and Oceania's products. The regions are: i) CIS (Commonwealth of Independent States) and the rest of Europe (including Turkey), ii) Asia, iii) Africa and Middle East countries, and iv) America. For each of these importing areas, we define a function of net import demand for the internationally traded commodities (butter, SMP, WMP, SHC and PRC). Demand elasticities were estimated for the main importing countries in each areas and then aggregated (Hadj Ali-Kein, Soregaroli and Trévisiol, 2005).

3.4. Modelling of trade flows and trade policy

Figure 1 illustrates the trade flows that are taken into account in the model. Fixed imports for EU25 represent the trade flows that come from the rest of the world excepted from Oceania and fixed imports for the importing regions include trade flows from other countries than EU 25 or Oceania. These imports are considered as exogenous. The fixed exports for EU25 deal with exports of products that are not modelled as commodities exported on the world market in the model (mainly some categories of cheese and fresh dairy products).

Figure 1. Regions and trade flows considered in the dairy industry model.



The main exported products are: Butter, SMP, WM, SHC, PRC, Casein

We model trade policy (export and import policies) for EU25 as well as for importing regions in the rest of the world. Both export and import policies are modelled for EU25.[4] As Oceania does not subsidise its exports and does not significantly import from other countries, we consider that Oceania export policy is free trade and we do not consider import policy.

In our modelling, export subsidies are endogenously determined.[5] Actually, there is no commitment on their per-unit level. Commitments apply to the total volume and value of subsidized exports for four product categories (Butter, SMP, Cheese, Other dairy products). Because our model is used to analyse sustainable policies, we do not allow for building stocks. Rather export and domestic subsidies are adjusted in order to equilibrate the market. We assume that the policy maker adjust the level of subsidies in order to make the domestic price of butter and SMP as close as possible to the intervention price. As long as subsidies are authorized, three situations can arise at the equilibrium. In the first one, the domestic price of butter (SMP) is equal to the intervention price. This means that there exist some positive subsidies which are given to fat products (protein products) in order to sustain the demand. In the second situation, even with positive subsidies it is not possible to maintain the price of butter (SMP) at the intervention price. This is because export subsidies are subject to a maximum. In this case, the level of exports is not sufficient to equilibrate the market and thus the price of butter (SMP) drops under the intervention price. In the third situation, the domestic price of butter (SMP) is greater than the intervention price. This corresponds to the situation where all subsidies given to fat products (protein products) are set to zero. However, the demand is sufficient to maintain domestic prices greater than the intervention price.

The model also includes trade policy for Africa, America, Asia and the rest of Europe. As we model only the demand for imports from these regions (net imports demand), we only integrate their import policy in the model. Over quota tariffs are modelled and, in the specific case of cheese in America, we consider tariff rate quota. As we consider aggregations of countries, it was in general not possible to introduce the other tariff rate quotas because the corresponding quota rate was above the average over quota tariff. Similarly, preferential tariffs were not modelled. This assumption is not too restrictive as it only concerns small quantities compared to total imports in the over quota regime.

4. Baseline scenario

Scenarios are defined over the period 2004-2014. The baseline scenario corresponds to the dairy policy that was decided in Luxemburg in June 2003.

4.1. Definition

In accordance with the Luxemburg reform, the intervention price for butter is decreased by 25% in 4 steps from 2004-05 to 2007-08 while the intervention price for SMP is decreased by 15% in 3 steps from 2004-05 to 2006-07. The gradual increases in milk quota are implementing during the period 2006-07 to 2008-09 in EU15. Direct payments are introduced in 2004-05 and we consider that they are fully decoupled.[6] The baseline scenario includes a trend of the demand for dairy commodities in EU25. We base our assumptions on trends on the results provided by Trévisiol (2005). However, we choose to consider trends that are slightly lower to take into account two effects: a saturation effect and the decrease in fat content of a lot of products.[7] The trends are the highest for cheese and fresh products and the lowest for fluid milk and butter with zero or negative trends.

[4] In this paper, we mainly focus on EU-25 after 2004. A version of the model was developed to deal with the period 2000-2004, that is before entry of New Member States. In this latter case, we integrated the specific policies (domestic and trade) of each of the NMS.

[5] Domestic subsidies for some uses of butter and SMP are also endogenously determined.

[6] In some countries, they will be decoupled in 2007-08. However, it will not change the results for the period from 2004-05 to 2007-08. This is because of the existence of quota rents that make the supply inelastic to a price decrease as long as the price decrease is lower than the quota rent.

[7] In practice, we use half of the estimated trends. However, we will analyse the sensitivity of our results to alternative assumptions on trends. For the rest of the world, we assume an increase by 2% per year of the autonomous demand for imports that are addressed to EU25 and Oceania.

4.2. Market equilibrium

As shown on Figure 2, the reform has a significant impact on the farm milk price which declines till 2006-2007. Then it remains stable till 2008-09 and then it increases. The first period of milk price decline is mainly explained by the gradual decrease in the intervention prices of butter and SMP. After 2006-2007, the reform has a lower impact as only the price of butter can be reduced. Moreover the negative impact on prices of the increase in milk production quota is fully balanced by the increase in the domestic demand. Finally during the last period, the reform is over and the farm milk price goes up in response to the increase in demand.

The EU-25 milk production increases slightly over the period. Due to quota rents, the decrease in price does not induce a decrease in production. Actually, the decrease in farm milk price is lower than the initial quota rents. The increase in milk quota allows a marginal increase in the milk production in EU-15. Moreover, in EU-10 (acceding countries), there is an increase in production because initially quotas were not binding. Due to the dynamics of the supply (technical progress and re-structuring), supply in EU-10 expands almost every year. However, the increase in production remains small.

As shown on Figure 3, till 2005-06, the butter price follows the intervention price and thus decreases. Then, it decreases but at lower rate than the intervention price. Finally at the end of the period it reaches again the intervention price. From 2005-06 to 2012-13, as the domestic price is larger than the intervention price, the subsidies (export as well as domestic) are set to zero. According to this simulation, the decrease in the butter price and the global increase in the demand for dairy products (trend effect plus price effect) are sufficient for equilibrating the market of butter. However, at the end of the period, because the demand for butter continues to decrease (trend effect) the market is equilibrating thanks to the use of subsidies.

The production of butter decreases significantly over the period (Table 1). In the first years, the decrease is mainly explained by the decrease in exports. EU exports drop dramatically during the reform period and are equal to zero from 2006 (at this date, there is no more export subsidies). Indeed, as explained before, to maintain the EU price at the intervention price level, it is needed to cut export subsidies. This makes the EU exports of butter uncompetitive on the world markets. The decrease in production is also due to competition for the different uses of milk in the EU. Actually, the demand for cheese and fresh dairy products increases over time. As milk production is restricted, the increase in the demand for fat incorporated in cheese and other products can only be compensated by a decrease in the production of butter. Finally, the decrease in butter production is also explained by the negative trend in the domestic demand.

Figure 2: Raw Milk Price in EU25

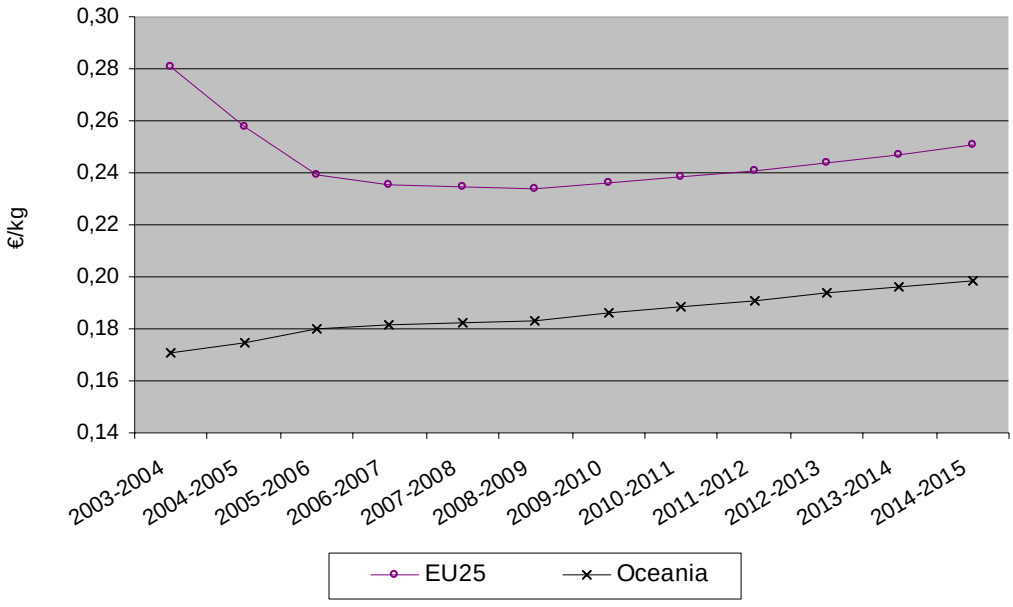
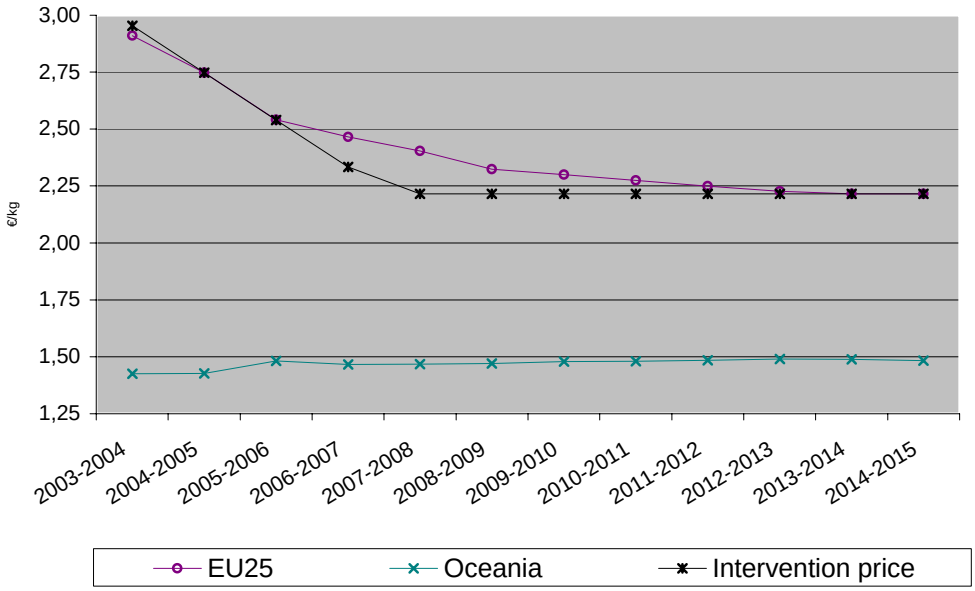
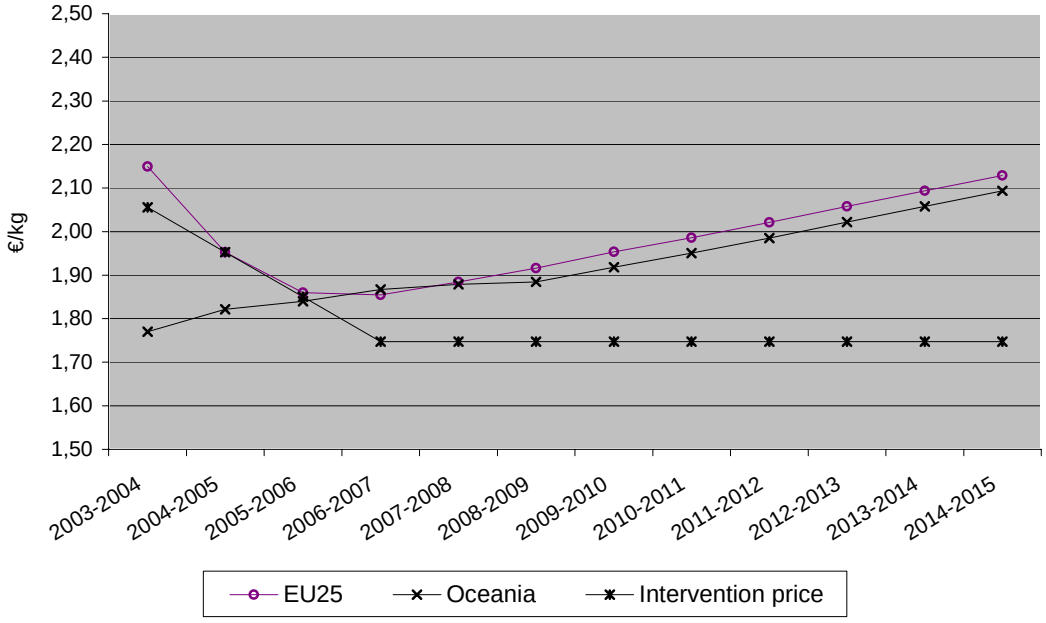


Figure 3: Butter Price



The difference between the EU and the world price of butter shrinks because of the significant decrease in the EU butter price. From 1500 €/t at the beginning of the period, the price difference is about 750 €/t at the end of the period.

Figure 4: SMP Price



From 2003-04 to 2005-06, the price of SMP in the EU-25 decreases with the intervention price (Figure 4). Then it increases gradually and remains significantly above the intervention price. The increase in price is due to the increase in the demand for protein in the EU which is a consequence of the increase in the demand for cheese and fresh products. At the end of the period, the price of SMP is roughly as high as in the beginning of the period. Because, the SMP price is above the intervention price,

the subsidies for SMP are set to zero. However, contrary to the butter case, the EU can export SMP without export subsidies as the EU domestic price is very close to the world price of SMP.

Production of SMP decreases over the period. This is due to the competition for milk protein. As the domestic demand for cheese and fresh products increases, less protein is available and this leads to a decrease in the SMP production. Some decrease in the EU exports also explained the decrease in production.

The price of cheese in the EU-25 drops following a similar pattern to farm milk price. It first drops and then regularly increases. The production of cheese (as well as fresh dairy products) significantly increases over the period. This is the consequence of the increase in domestic demand. EU exports first increase at the beginning of the period as they benefit from export subsidies. Then, they gradually decrease from 2006-07 to the end of the period as there is competition between domestic demand and exports.

As shown in Table 1, the production of dairy products in the EU is more and more oriented towards cheese and fresh products at the expense of industrial products.

Table 1: Market equilibrium for dairy products in EU 25. Relative results, Index 100 = result in 2003-04 for Base 1.

2012-2013	Farm milk	Butter	Skim milk powder	Whole milk powder	Cheese	Semi hard cheese	Fluid milk
Price	86.9	76.5	95.7	88.2	112.2	95.0	94.1
Production	102.5	91.4	88.6	96.3	134.6	118.6	98.8
Exports		7.6	82.5	85.7	98.5	158.4	
Imports		5.4	100.0			97.4	

The changes in prices (as well as the introduction of direct payments) obviously affect the producer surplus. First, the farmers' surplus decreases because of the reform and because direct payments do not compensate for the reduction in the milk price. Then it regularly increases (Figure 5) because of the increase in the milk price that positively reacts to the evolution of domestic demand in the EU. The surplus of farmers in 20010-11 is roughly equivalent to the initial one.

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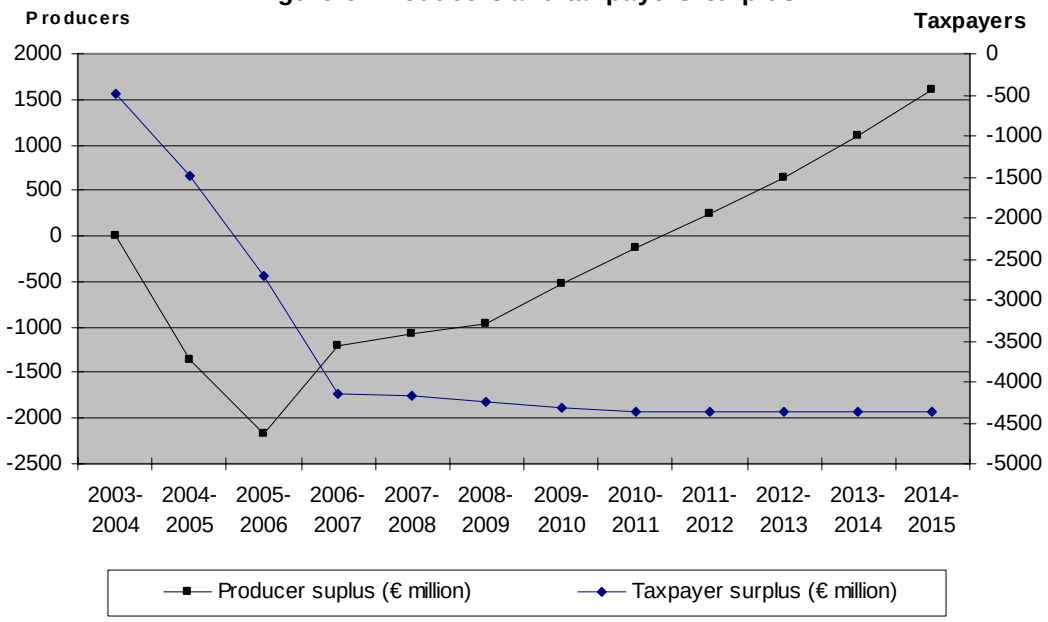
Figure 5: Producers and taxpayers 'surplus



The taxpayer cost in the EU is increased as compared to the beginning of the period, as the cost of direct payments is significantly larger than the savings in costs that arise from a decrease in export and domestic subsidies

4.3. Sensitivity analysis

We test the sensitivity of results to alternative assumptions on demand trends, quota rents and price transmission. To ease the analysis of results in each sensitivity analysis, we change only one parameter as compared to the central assumptions (Base 1). Base 2 and 3 deal with demand parameters. In Base 2, we assume that the demand from importing areas does not increase (while it increases by 2% a year in Base 1). In Base 3, we assume that the domestic demand in the EU-25 increases at a higher rate (we consider an increase of demand that is twice the trend in Base 1). Base 4 deals with quota rents. We assume that the production costs are 25% larger than in the standard case. Finally Base 5 deals with imperfect price transmission from processors to consumers (the standard assumption is perfect transmission of all price changes). We model an imperfect price transmission from processors to consumers by a reduction in the price elasticities of demand. We analyse the impact of these alternative assumptions on market equilibrium at the end of the period of simulation (2012-13).

4.3.1. Sensitivity to demand parameters

In Base 2, the demand in the importing areas does not increase (while it increases by 2% a year in Base 1). This has a negative impact on the price of protein (SMP price) but does not significantly affect the EU price of fat (butter). In Base 1 the price of butter is close to the intervention price. Thus there is no way for a decrease in its price. Conversely the price of SMP is significantly higher than the intervention price. The reduction in the world demand has therefore a negative impact. The farm milk price is affected significantly as it decreases by more than 5% (Table 2).
In Base 3 the demand in the EU-15 experiences a higher increase as compared to Base 1. Actually, the increase in the demand for dairy products in EU-15 in Base 3 is twice the one in Base 1 (except for butter for which the demand decreases overtime at a similar rate). The increase in domestic demand has a significant impact on farm milk price which is 9% higher in Base 3. Prices of all dairy products are increased and EU exports decrease. Due to the milk production quota, the increase in price has no impact on milk production in the EU. As a consequence, the changes in the production of the different dairy products in the EU are strongly constrained. The production of cheese and fresh products increases at the expense of the production of industrial products.

4.3.2. Sensitivity to quota rents

Given our assumptions on initial quota rents, whatever the market demand conditions, the quota constraint in EU-15 was always binding when simulating the Luxemburg reform. Then, Base 4 evaluates the impact of lower initial quota rents on the results presented above (Table 2). Results in Base 1 and 4 are very similar. With lower quota rents (Base 4), the production quotas in EU-15 remain binding in the majority of countries and the aggregate EU-25 production is slightly lower (milk production decreases by 0.4%, meaning that some countries do not produce the totality of their quota). Thus prices are slightly larger (milk price is 1.4% larger). Because there is virtually no changes in the EU milk production, then all other variables that characterize market equilibrium remain almost unchanged.

4.3.3. Sensitivity to price transmission

We test the impact of an imperfect transmission of prices in the chain. Actually, results in Base 1 do crucially depend on how price decreases are transmitted to consumers. If the price decreases are fully transmitted to consumers, then this provokes an increase in the final consumption of all dairy products. Because the milk supply is fixed (quotas), this increase in domestic demand induces a significant decrease

in the exports of the EU (at least for some products) and the EU no longer uses export subsidies to equilibrate its dairy products markets. However, if price decreases are not fully transmitted to final consumers, the picture might be different. The increase in domestic consumption will be lower and the EU will need to use export subsidies to equilibrate the market (or to proceed in further reduction in intervention prices in particular for butter). In particular, in the case of butter, a lot of analysts of dairy markets anticipate difficulties in equilibrating the EU market. Results of Base 1 are much more 'optimistic' in the sense that the increase in domestic consumption of fat products is sufficient to equilibrate the EU market.

Table 2: Sensitivity of market equilibrium variables to alternative assumptions on key parameters. Relative results, Index 100 = Results in 2012-13 for Base 1.

	Base 1	Base 2	Base 3	Base 4	Base 5
Farm milk					
Price	100.0	94.4	109.1	101.4	98.1
Production	100.0	99.9	100.1	99.6	100.0
Butter					
Price	100.0	99.5	109.0	101.7	99.5
Production	100.0	100.8	97.4	99.5	102.4
Exports	100.0	210.8	100.0	100.0	938.2
SMP					
Price	100.0	92.8	105.7	100.5	98.7
Production	100.0	101.2	92.8	92.8	107.1
Exports	100.0	93.3	79.9	98.1	129.3
WMP					
Price	100.0	93.9	105.5	100.6	98.3
Production	100.0	93.2	83.8	96.9	99.6
Exports	100.0	85.1	65.6	94.1	311.1
Cheese					
Production	100.0	99.7	103.8	100.0	99.7
Exports	100.0	90.4	77.4	99.4	101.1
SHC					
Price	100.0	95.9	105.8	100.7	98.6
Production	100.0	99.1	101.0	99.8	99.4
Exports	100.0	87.0	57.2	99.1	101.8
FLM					
Price	100.0	96.7	104.3	100.8	98.8
Production	100.0	100.6	97.0	99.9	99.0

Base 2: No increase in the demand in importing areas; Base 3: Increase in the EU-25 domestic demand twice the standard one; Base 4: marginal cost of production in EU-15 25% higher than in standard case; Base 5: Imperfect transmission of prices from processors to consumers.

To deal with this issue, rather than to explicitly model an imperfect price transmission, we assume that the price elasticities of demand for dairy products are lower. To reach an equilibrium, prices need to decrease more. In this case, the price of butter follows the intervention price pattern and export subsidies are necessary to keep market prices at the intervention price level. Then the support to butter can only be achieved through export subsidies. Exports, as well as production of butter are larger than in Base 1. Because of the increase in the production of butter, the production of skim milk powder which is jointly produced increases in the benefit of exports. The production of the other products decreases because of the necessary adjustments due to the quota constraint. However as prices are lower, EU is more competitive on world markets and its exports increase (mainly of whole milk powder).

5. WTO scenarios

5.1. Definition

We test the impacts of a new WTO agreement that would start in 2008-2009. This agreement would be implemented gradually over a 5-year period. At the end of the period (2012-2013), we assume that export subsidies are completely removed while import tariffs are decreased as in the Mandelson proposal. Both in-quota and over-quota import tariffs are thus reduced by a percentage that depends on the initial tariff (ad valorem equivalent). The larger the initial tariff, the larger the reduction in percentage.[8]

We study the impact of such an agreement in different cases. First (WTO 1), we use the framework of Base 1. We thus assume that the EU domestic policy defined in Luxembourg is not changed.[9] Second (WTO 1bis), the same scenario is implemented in the case of an imperfect price transmission in the dairy chain. Third (WTO 2), we assume that the milk production quotas in the EU are increased by 1% per year from 2008-2009 to the end of period (in the framework of parameters defined in Base 1).
Finally in a last scenario, we study the impact of classifying butter as classified as a sensible product in the EU (WTO3). In that case, butter would benefit from a reduced tariff cut (both in the in-quota tariffs and in the over-quota tariffs), compensated by an expansion of TRQs.

5.2. Results

5.2.1. Multilateral WTO agreement

For Oceania, which is basically an exporting area, the price impact of a WTO agreement is obviously positive. Import tariffs are decreased which thus increase the demand from importing regions. Moreover, export subsidies of the EU, the main competitor, are removed. Then, both elements go in the same direction. As a result, the farm milk price and the production of milk and dairy products increase (Table 3). For the EU, the a priori price impact of a WTO reform is uncertain. On the one hand, the reduction in tariffs in importing areas has a positive impact as it is the case for Oceania. However, because the EU is also an important importer, the reduction of its own tariffs has a negative impact on domestic prices. Finally, the removal of export subsidies also has a negative impact on prices. Thus the price impact of a WTO agreement will depend on the magnitude of each of these effects.

According to our simulations, the farm milk price in the EU would be positively affected by a WTO agreement (Table 3, column 'WTO1'). Due to the milk production quotas, this price increase does not induce a significant increase in milk production. The increase in milk price is explained by an increase in the implicit price of protein and no change in the price of fat.[10]

Let's first consider the butter market. The EU butter production only slightly decreases. The EU butter exports do not change. In the Baseline, the EU was not exporting butter. With the WTO agreement, because the EU price of butter is significantly larger than world price, the EU cannot take advantage of a larger world market. On the import side, the EU would import butter. Due to the decrease in EU tariffs, the difference in prices between the EU and Oceania is now larger than the tariffs (in the minimum and current access) while it was not the case in the Baseline. The decrease in the butter price is very small as the increase in imports is compensated by a decrease in the domestic production. The latter is explained by competition for fat within the EU markets. In particular, the exports of some other dairy products (WMP and cheese) increase in response to the decrease of import tariffs in importing regions. This increase in the exports of dairy products thus generates additional demand for fat.

Because the EU is much more competitive on world markets for SMP as well as for WMP and cheese, the impact of WTO agreement on the market of SMP (and more generally on products that contain significant proportion of protein) is positive. According to our results, the EU will neither suffer from a reduction in its tariffs (the imports do not increase) nor from removal of export subsidies as

[8] In the case of EU, given an ad valorem equivalent import tariff equals to 89.6% for butter, 60% for powders and 55% for cheese, the tariff cuts are equal to 50% for all commodities but cheese and 45% for cheese.
[9] However, because the simulation of the Baseline suggests that consumption subsidy are not used in 2008, we consider that no more consumption subsidy applies from 2008 and thus remove the possibility from this date to use domestic subsidies to maintain domestic prices.
[10] The implicit price of protein and fat are easily deduced from the price of SMP and butter.

products are competitive (SMP case) or are sufficiently differentiated to keep some market shares even if they are more expensive (cheese). As a consequence, the EU benefits from the decrease in the tariffs of importing areas. Thus the SMP (protein) price increases due to the WTO agreement (Table 3 column WTO 1).

Table 3: Impact of alternative WTO scenarios on market equilibrium variables in EU 25. Relative results. Index 100 = result in 2012-13 for Base 1.

	WTO 1	WTO 2		WTO 1	WTO2
Farm milk			**Fluid milk**		
Price	103.4	92.0	Price	102.1	96.7
Production	100.3	103.8	Production	99.6	100.6
Butter			**Skim milk powder**		
Price	98.8	85.9	Price	104.7	98.3
Production	98.8	104.0	Production	95.5	105.5
Exports	100.0	100.0	Exports	89.1	119.6
Imports	691.7	100.0	Imports	100.0	100.0
World price	109.8	105.1	World price	104.5	98.1
Whole milk powder			**Semi hard cheese**		
Price	103.7	97.3	Price	102.8	96.0
Production	103.4	128.5	Production	102.0	106.1
Exports	107.6	154.5	Exports	120.4	147.0
Imports			Imports	100.0	100.0
World price	104.0	97.1	World price	103.7	97.5
Oceania milk price	106.2	98.3	**Oceania milk production**	102.8	99.2

Does this 'optimistic' view of WTO agreement still hold if the butter market, in absence of WTO agreement, is equilibrated thanks to the use of export subsidies? This situation (WTO 1bis) is simulated using assumptions of Base 5 rather than those of Base 1.

Table 4: Impact of the WTO scenarios on market equilibrium variables in EU 25. Relative results. Index 100 = result in 2012-13 with alternative assumptions on demand elasticity.

2012-13	Base 1	WTO1	Base 5	WTO1bis
Farm milk				
Price	100	103.4	100	101.5
Production	100	100.3	100	100.0
Butter				
Price	100	98.8	100	90.5
Production	100	98.8	100	96.8
Exports	100	100	100	10.7
Imports	100	691.7	100	100
SMP				
Price	100	104.7	100	106.1
Production	100	95.5	100	87.9
Exports	100	89.1	100	66.1

As shown in Table 4, the impact of WTO agreement on EU milk price is still positive but in a lower proportion. Contrary to the previous case, in absence of WTO agreement, export subsidies are

necessary to export butter on the world market. Then, the WTO reform eliminates export subsidies and as a result, exports of butter drop. The price of butter in the EU significantly drops. This drop in price has also consequences on the EU imports of butter which do not increase. On the contrary, the impact on SMP (protein) price is larger than before. This is because the decrease in the price of fat makes the products that combine fat and protein (WMP and cheese) more competitive. This induces an additional demand for protein which translates in the price of SMP.

As a global consequence, the impact of WTO reform on farm milk price is positive even if it is in a lower extent as compared to the previous situation. Thus, the decrease in price on the fat market is more than offset by the increase in the price of protein.

5.2.2. Multilateral WTO agreement and increase in EU milk quota

The impact of an increase in the EU quota is very significant. In 2012-13, the farm milk price has decreased by more than 11% and production has increased by 3.5% (comparison of results from WTO 1 and WTO 2, Table 3). Then a 1% increase in milk production implies a decrease in the farm milk price by around 3 %. The increase in production is lower than the increase in milk production quota (5%). This means that, due to the decrease in price, the production quotas are not binding. Actually, it is the case in a lot of countries.

As milk production increases significantly in the EU, the prices of dairy products also drop. The price of butter significantly drops under the intervention price. Thus, at the end of the WTO agreement, the EU has no more price instrument to avoid a drop in the butter price: export subsidies are no more allowed and we assumed that domestic subsidies will not be used. This drop significantly reduces the price difference between EU and world prices. As a consequence, the EU does not import significant amount of butter. The exports of butter are also very small as the EU price remains larger than the domestic price.

The price of SMP is also negatively affected by the increase in milk production. However, the SMP price remains larger than the intervention price. More generally, prices of the different dairy products decrease compared to scenario WTO1. Obviously, as domestic demand is rather price inelastic, a large part of the increase in EU production is exported on the world markets. As shown in Table 3, the increase in EU exports is significant while the increase in consumption is very small in comparison. Results suggest that the EU mainly increases its exports of WMP and cheese. Obviously, the increase of EU production has a negative impact on world prices as part of the increase is sold on the world market.

As shown in Table 5, the WTO reform has a slight negative impact on EU25 welfare compared to Base 1 (Luxemburg reform only) because it generates an increase in prices in favour of producers but in the detriment of consumers. The cost for taxpayer increases because the revenue from tariffs is reduced in the WTO reform situation (reduction in EU tariffs). This result is the consequence of the existence of quotas and other instruments that distort prices. In such a context, a partial liberalisation can be accompanied by a decrease in the welfare (Bouamra *et al.*, 2002b).

Table 5: Variation of surplus in EU25 for scenarios compared to Base 1 in 2012-2013 (Million euros)

	WTO1	**WTO2**
Producers	1099	-1229
Consumers	-967	2267
Taxpayers	-121	-133
Welfare	-25	1099

However, an increase in quota in the context of WTO reform (WTO2) increases welfare as the impact on consumers is significantly larger than on producers. Actually, an increase in quotas generates an increase in production but a reduction in prices. The increase in production does not compensate for the drop in prices, so that producer surplus is highly affected. On the contrary, consumers benefit from lower prices. The change in taxpayer cost is marginal compared to the WTO agreement alone scenario.

5.2.3. Multilateral WTO agreement and butter classified as a sensible product

With the reduction of tariffs, some analysts fear that the EU will import massive quantities of butter in the future. Thus, some argue that it is important to classify butter as a sensible product. Classifying a product as 'sensible' means that the product benefits from a lower decrease in the tariffs against an increase in the TRQ.

First, it is important to note that as a result of the simulated WTO agreement, the difference between EU and Oceania prices of butter is larger than the current and minimum access tariffs in EU25 but lower than the over quota tariffs. Thus, the EU25 imports butter under minimum and current access regime but not under over-quota regime. In addition, the TRQ is not binding because in addition to tariffs there exists transportation costs which increase the cost of butter from Oceania.[11]

In such a situation, classifying butter as a sensitive product generates some decrease in the level of EU imports as tariffs are increased (as compared to the WTO agreement). It increases the butter price in the EU and consequently the farm milk price also increases (Table 6). As a consequence the production of butter slightly increases in the EU and the consumption decreases due to price effect. The world price of butter is reduced as the demand from the EU decreases. Finally classifying butter as a sensible product in the market situation defined in Base 1 has no other significant impact.

The EU producers and processors would gain about 240 M€ mainly at the expense of consumers. The welfare impact is about 0.

Table 6: Impact of classifying butter as a sensible product in EU25. Relative results. Index 100 = result in 2012-13 for WTO.

Farm milk	
Price	100.77
Butter	
EU25 Price	102.76
EU25 Production	100.79
EU25 Consumption	99.22
EU25 Imports	14.46
Oceania price	98.07
Oceania exports	98.03

5. Main conclusions

Results show that the Luxemburg reform has a significant impact on the milk price which drops by more than 15% during the reform period. After the reform period, the milk price increases as a consequence of the increase in domestic demand. Due to the reform, the difference between EU and world prices shrinks. This has important consequences for the analysis of the impact of a WTO agreement. In particular, a decrease in EU import tariffs does not automatically induce an increase in its import.

Results also suggest that a WTO agreement in the context of the Luxemburg reform might have a positive impact on EU farm milk price. This is because the positive impact of additional demand in importing regions is larger than the negative impact due to decrease in EU tariffs and export refunds removal. We have performed some sensitivity analysis and discussed the robustness of our results on the impacts of a WTO agreement. However, it could be interesting to test the impacts of an agreement in different world price situations as with lower import tariffs, the imported quantities could be more sensible to world price variations.

It should be acknowledged that in this model all adjustments are instantaneous. This is true for price as well as quantity adjustments. In practice, reaching a new equilibrium takes more time. Due to the instantaneous adjustments the model provides a picture that is perhaps too 'optimistic'. For example, results suggest that due to the decrease in the intervention price of butter, the EU can equilibrate its

[11] By the way, this also means that Oceania does not benefit from rents when it exports to EU25.

market of butter without exporting large quantities of butter on the world market. In the model, this is linked to the fact that any price decrease is transmitted immediately to consumers who immediately increase their consumption. In addition, it is also based on the idea that production of butter adapts instantaneously to the new context. In practice all these adjustments take time, then it is likely that during the adjustment period, a larger decrease in butter price and the use of export subsidies to export on the world market would be required to equilibrate EU market. However, the model provides the general tendency of the markets even if during the period of reform the adjustments are likely to be slower.

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