Impact of WTO reforms on the world dairy sector [i]

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Selected paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26, 2006.

The EU dairy sector is facing a period of significant changes that are due to three major decisions: the EU enlargement, the Luxembourg reform and on-going WTO negotiations. The enlargement of the EU to include 10 new member states has increased both the production capacities and demand for dairy products in the EU. The Luxembourg 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, Coleman, Chavas and Zhu, 1999; Shaw and Love, 2001; Donnellan and Westhoff, 2002). To prepare for the Luxembourg reform in the dairy sector, an in depth study was developed (INRA-Wageningen consortium, 2002). The impacts of the reform decided in Luxembourg was analysed by different teams (Binfield et al. (2003), Bouamra-Mechemache, Hadj Ali-Kein and Réquillart (2003)). Finally few researchers have also studied the impact of the enlargement for the dairy sector (Banse, 2005).

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 further WTO agreement on world dairy markets in the context of the EU-25 Luxembourg reform. The analysis takes into account possible changes in the EU dairy policy. In the first two sections, we present the theoretical framework and the applied model. In Section 3, we define the baseline and scenarios of WTO reforms. In section 4, we present the impact of the Luxembourg reform on the dairy sector. In section 5, we analyse the impact of WTO reform scenarios on market equilibrium and welfare. Finally, the conclusion summarizes the main results and limits of the paper.

The theoretical framework

We develop a partial equilibrium model of the dairy sector. It has two key features. First, it is a hedonic model that explicitly models the processing technology of milk into final commodities. Milk is valued through the value of its two main components (fat and protein) in the final dairy commodities. Moreover, the underlying technology is consistent with milk availability. Thus, the set of final commodities productions is compatible with milk availability.[ii] Second, the model is spatial allowing for the modelling of trade between countries. We now detail 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:

$$\sum_k Y_{i,k}\gamma_{k,s} \le X_i\alpha_{i,s} \qquad \forall i \in I_1, s \qquad (1)$$

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:

$$\sum_{j,ex,imp} XD_{i,j,k,ex,imp} \leq Y_{i,k} \qquad \forall i \in I_1, \forall k \tag{2}$$

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

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

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

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: [iii]

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

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

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 (footnote 2). For more details on how policy instruments are modelled, the reader can refer to Bouamra et al. (2002).

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

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

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.

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 4 importing regions (Asia, Africa and Middle East, America, CIS and Rest of Europe). In the following, we provide some details on the main assumptions of the model.

Modelling of EU25

The model gives a complete picture of the EU25 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 Luxembourg that are aggregated. For the New Member States (EU-10), we distinguish the three main producers (Poland, Hungary and Czech Republic) and consider the seven other countries as an aggregate.[v] All of the 25 European Union 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 (RoW).

In the model, milk supply functions are very 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 make the number of cows vary. Because we are interested by 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 (INRA-Wageningen Consortium, 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-Kein, Soregaroli and Trevisiol, 2005).

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. In the model, we thus consider that the European Union competes on international markets with Oceania. 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 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. We thus define a subset of products for Oceania. Thus, Oceania produces Butter, SMP, WMP, SHC and PRC for domestic and export markets and also produces fluid milk and fresh products only for its domestic market.

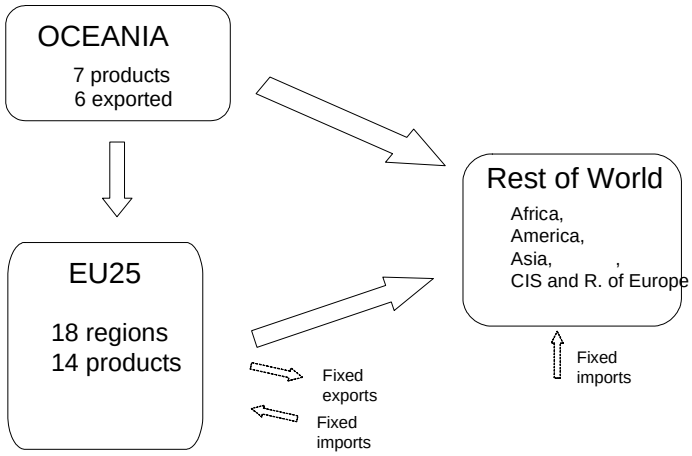
Modelling of importing regions

On the import side, we distinguish four importing regions that are the main importers of EU25 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 area and then aggregated (Hadj Ali-Kein, Soregaroli and Trévisiol, 2005).

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 RoW excepted from Oceania and fixed imports for the importing regions include trade flows from other countries than EU25 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).



The 6 main exported products are: Butter, SMP, WMP, SHC, PRC, Casein

Figure 1. Regions and Trade Flows Considered in the Dairy Industry Model.

We model trade policy (export and import policies) for EU25 member countries as well as for importing regions in the RoW. 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. Both export and import policies are modelled for EU25.

In our modelling, export subsidies are endogenously determined.[vi] Actually, there is no commitment on their per-unit level but on the total volume and value of subsidized exports for 4 products or 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 adjusts 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) needs to drop 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 the import policy in the model. Over quota tariffs are implemented. We model the tariff rate quota for cheese in America. However, as we consider aggregations of countries, it was 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.

Definition of scenarios

We first define a baseline scenario and then we test the impacts of WTO reform under alternative assumptions on EU domestic policy. Scenarios are defined over the period 2004-2014. The baseline scenario corresponds to the EU dairy policy that was decided in Luxembourg in June 2003. In accordance with the Luxembourg 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.[vii]

Because a scenario is defined over 10 years, the model also includes assumptions on the evolution of demand and supply parameters. As shown by previous results (INRA-Wageningen Consortium, 2002), autonomous changes in the demand have a strong impact on the results. We base our assumptions on EU-25 demand trends from Trévisiol, 2005. We choose to consider trends that are lower than those estimated in this study to take into account two effects: a demand saturation effect and a decrease in the fat content of a lot of dairy products. The trends are the highest for cheese and fresh products and the lowest for fluid milk and butter with zero or negative trends. Obviously, demand in RoW will also change over time. We assume an increase by 2% per year of the autonomous demand for imports that are addressed to EU25 and Oceania.

We test the impact 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. Import tariffs are also reduced in all importing areas.

In the first scenario, we assume that the EU domestic policy defined in Luxembourg is not changed and we thus study the impact of a WTO agreement in the framework of the baseline (WTO).[viii] Because, it is likely that the EU25 domestic policy will be further reformed, we test the impact of a WTO agreement when the EU relaxes its quota policy. We test the impact of a 1% and a 2% (starting in 2008-2009) increase per year in the milk production quota (denoted respectively by WTO1 and WTO2).

Results for the Baseline

As shown in Figure 2, the Luxembourg reform has a significant impact on the EU25 farm milk price which declines till 2006-2007. Then it remains stable till 2008-09 and then it increases. During the first period, the price of milk declines due to 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 that the increase in milk production quota could generate is balanced by the raise 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.

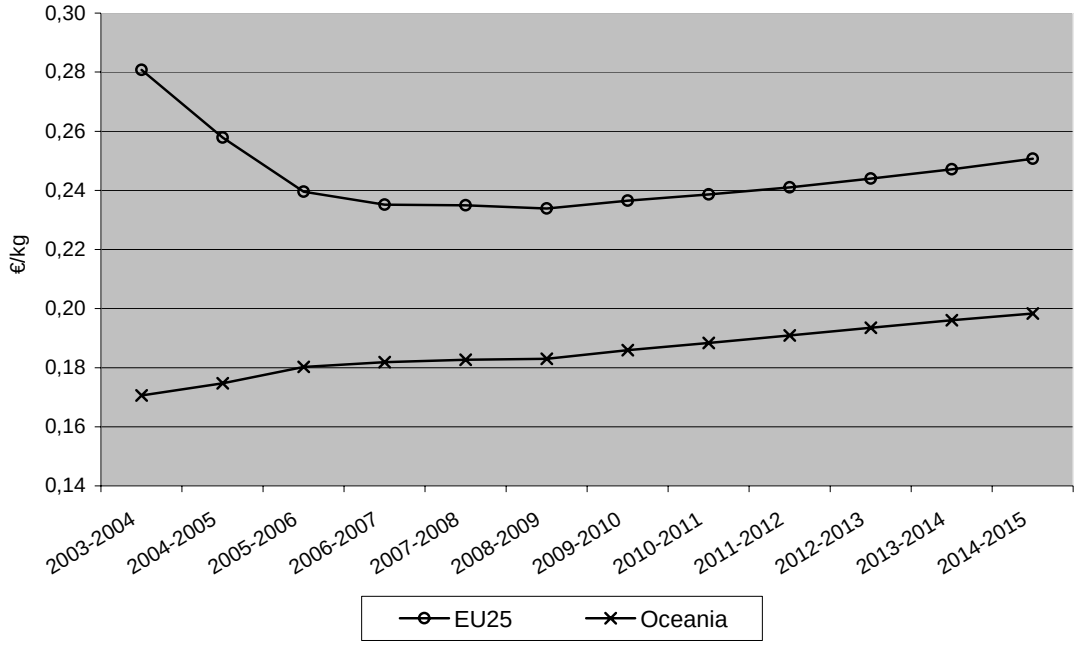


Figure 2. Raw Milk Price in EU25

Due to the milk production quota, the EU25 milk production remains roughly stable. Actually, it increases in response to the (small) increase in quota. The significant decrease in farm milk price does not generate a decrease in the milk production as initial quota rents were generally larger than the price cut.

Conversely, the farm milk price in Oceania slightly increases over the period in response to the increase in consumption both in the EU and in the RoW. Even if the EU is more competitive on the world markets, the milk production quota in the EU strictly limits the production. Thus, the increase in demand in the EU that comes from both the autonomous demand trend and the reduction in price generates a decrease in the EU exports on world markets. Oceania, the EU competitor on world markets, benefits from the lower net EU exports. Actually, this reduction in EU exports raises the demand from RoW

addressed to Oceania and thus tends to increase world prices. Obviously, the increase in Oceania farm milk price induces an increase in milk production.

As a consequence the difference between the farm milk price (as well as between dairy products prices) in EU25 and the farm milk price in Oceania is significantly reduced. Initially, it was about 0.11 €/kg while after the EU reform the difference is reduced to 0.05 €/kg. Changes in milk price results from changes in the implicit prices of fat and protein. On the whole, the decrease in the fat value is significantly larger than the decrease in the protein value in the EU. First, the intervention price of butter is reduced more than the intervention price of SMP. In addition, at the end of the simulation period, the SMP price in the EU is significantly greater than the intervention price while the butter price is at the intervention price. This is a consequence of the increase in demand over time for protein while the demand for fat does not significantly increase.

In table 1, we present the impact of the Luxembourg reform on market equilibrium in the EU.[ix] In the EU, prices decrease for all dairy products while their production is differently affected. As the milk production is almost unchanged, if the production of one dairy product increases then the production of at least another dairy product should decrease. 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).

Table 1: Market Equilibrium for Dairy Products. Relative Results, Index 100 = Result in 2003-04 for the Baseline.

2012-2013	Farm milk	Butter	Skim milk powder	Whole milk powder	Cheese	Semi hard cheese	Fluid milk
EU25							
Price	86.9	76.5	95.7	88.2	-	95.0	94.1
Production	102.5	91.4	88.6	96.3	112.2	118.6	98.8
Exports		7.6	82.5	85.7	134.6	158.4	
Imports		5.4	100.0		98.5	97.4	
Oceania							
Price	113.4	104.5	114.2	110.9		108.0	
Production	110.1	119.0	112.6	119.1	92.85	94.0	

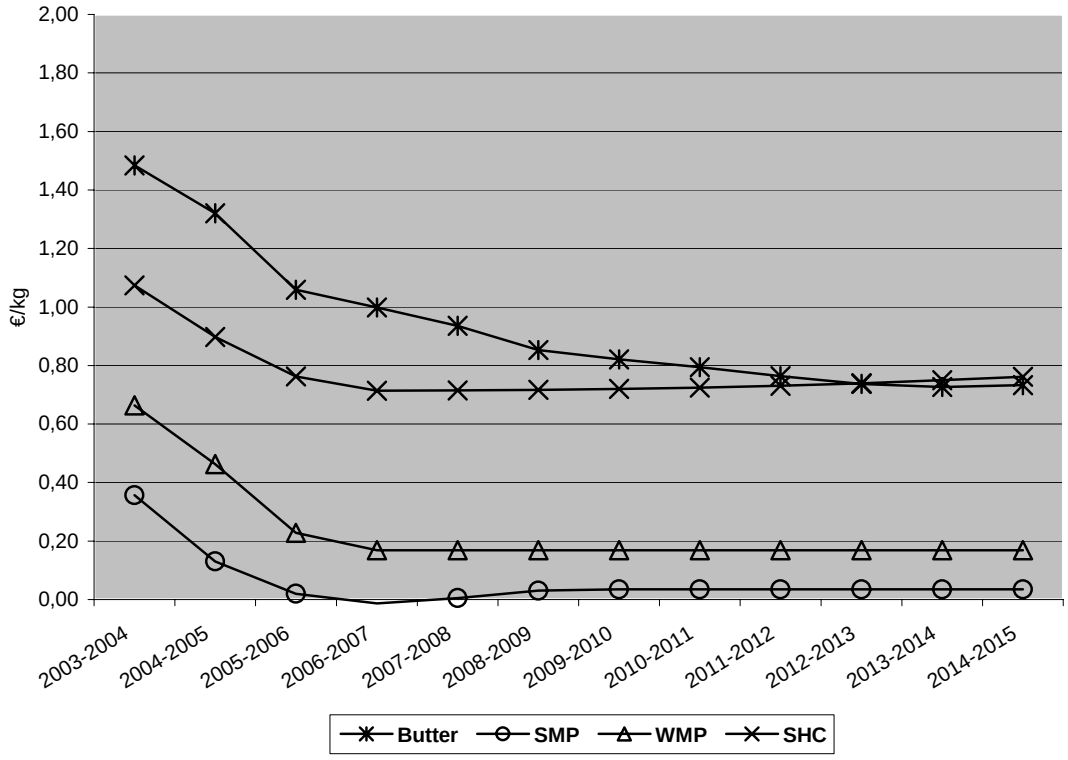


Figure 3. Difference Between EU and Oceania Prices

Thus, the difference in EU and Oceania prices has shrunk for all dairy products (Figure 3). The remaining difference is small particularly for SMP and WMP. For SHC (and for cheese in general) the difference is larger but the product is not homogenous. Actually, the EU produces many different categories of cheese and at least some of them benefits from a price premium due to product differentiation. Conversely, as butter is a homogenous good, the EU is not competitive on the world market of butter. In addition, it is important to note that, at the end of the period, EU exports cheese, SMP and WMP without subsidies.

Impact of a Multilateral WTO Agreement

No change in the EU domestic policy

For Oceania, which is basically an exporting area, the price impact of a WTO agreement is obviously positive. First, as import tariffs are decreased, the demand from importing regions (including EU) increases. Second, as export subsidies are removed, the competitiveness of its main competitor, the EU, is reduced. As a result, the price and the production of farm milk and dairy products increase (Figure 4). For the EU, the price impact of a WTO reform is a priori 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 domestic prices. Thus the price impact of a WTO agreement will depend on the magnitude of each of these effects.

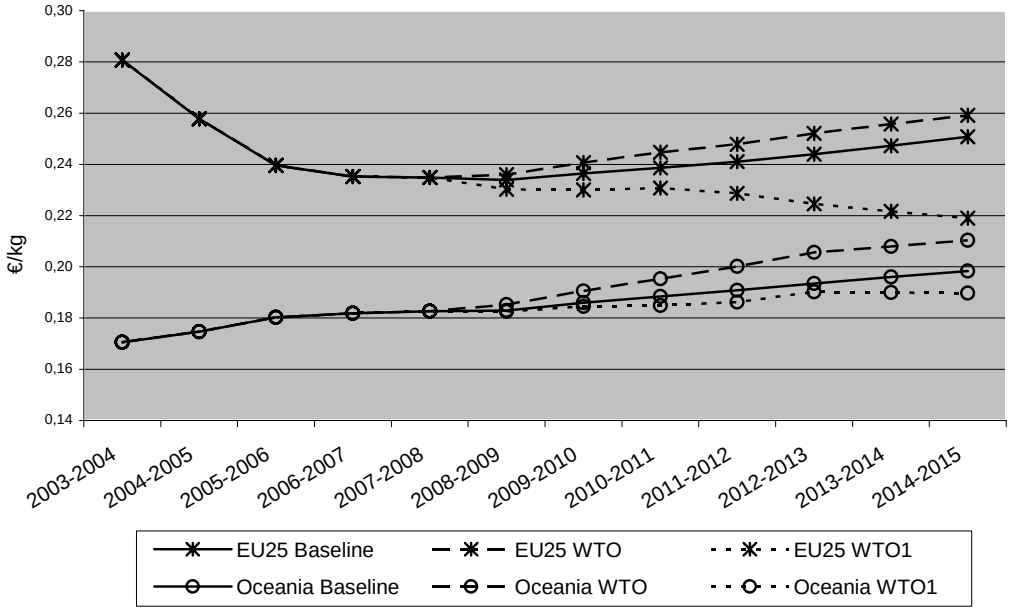
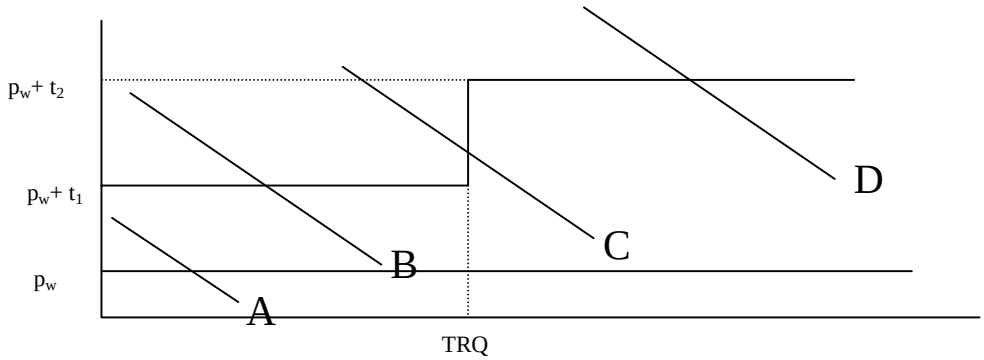


Figure 4. Raw Milk Price in EU25 and in Oceania

As explained above, the farm milk price in Oceania increases with the WTO agreement (Figure 4, scenario WTO). More surprisingly, it is also the case in the EU, meaning that the positive impact generated by the WTO reform in the rest of the word overpasses the negative effects of the reform in the EU. These price increases generate an increase in Oceania production but not in the EU as the quota system limits the expansion of production. In the EU, the increase in milk price is due to an increase in the implicit price of protein only as the price of fat does no change.

We now analyse more precisely why the WTO agreement has a positive impact on the farm milk price in the EU. On the import side, the impact of a reduction in tariffs depends on the initial situation. We illustrate on Figure 5 the different possibilities (A, B, C, D) for an importing country. In situation A, given the demand for imports and the tariffs

within the TRQ, there are no import (cf. Table 2). In this setting, a marginal decrease in the in-quota tariff will have no impact on imports. In situation B, the country imports but the quota is not binding. Thus, any change in the in-quota tariffs will have an impact on imports. In situation C, the country imports exactly the import quota. Then, a change in the tariff does not have an impact while a change in the quota does have. Finally, in situation D, the country imports in both regimes (in-quota and over-quota). In this case, a change in the over-quota tariff has an impact on the level of imports while a change in the in-quota tariff has no impact.



P_w stands for world price, t_1 for in-quota tariff and t_2 for over-quota tariff.

Figure 5. Different Regimes of imports

In table 2, we compare the import tariffs (before and after a WTO agreement) with the price difference between EU and Oceania. For butter, before the WTO reform, the in-quota tariff is larger than the price difference (regime A in Figure 5). With the reform the price difference is reduced. However, the EU will now import given the reduction in the in-quota tariff. With respect to SMP, the initial situation is A and the change in the in-quota tariff has no consequence. For SHC, the initial situation is C and the change in the in-quota tariff

has no consequence. In addition, the difference in price between EU and Oceania after the reform is still slightly lower than the over quota tariffs, meaning that no imports of SHC should occur in the over quota regime. Nevertheless, SHC remains the dairy product that is the most sensitive to changes in over quota tariffs or to exogenous shocks on the world price.

Table 2. Comparison of Import Tariffs and Price Differences between EU and Oceania

	Butter	SMP	WMP	SHC
Before the WTO reform				
Price difference EU-Oceania	737	35	169	739
In quota tariff	860	480	-	180
Over quota tariff	1900	1190	1320	1600
*After the WTO reform**				
Price difference EU-Oceania	565	41	169	738
Final In quota tariff	430	240	-	99
Final Over quota tariff	950	595	660	880

*The tariff cuts assumed for the WTO scenarios are equal to 50% for all commodities but cheese and 45% for cheese.

On the export side, removing export subsidies has only a small impact on the EU as in the baseline export subsidies were already almost removed. Finally, as the EU is competitive on the world markets of protein products, the increase in the demand from importing countries has a significant impact on milk price in the EU. We provide the main quantitative results in Table 3 (column WTO).

Table 3. Impact of Alternative Scenarios on Market Equilibrium Variables in EU 25. Relative Results. Index 100 = result in 2012-13 for the Baseline.

	EU25			Oceania		
	WTO	WTO1	WTO2	WTO	WTO1	WTO2
Farm milk						
Price	103.4	92.0	86.2	106.2	98.3	94.7
Production	100.3	103.8	105.5	102.8	99.2	97.6
Butter						
Price	98.8	85.9	77.9	109.8	105.1	104.0
Production	98.8	104.0	106.3	105.6	106.7	108.0
Consumption	100.3	104.0	106.3	100.0	100.0	100.0
Exports	100.0	100.0	100.0	106.7	108.2	109.7
Imports	691.7	100.0	100.0	-	-	-
SMP						
Price	104.7	98.3	95.3	104.5	98.1	95.1
Production	95.5	105.5	109.2	112.9	113.0	114.4
Consumption	97.8	100.8	102.2	100.0	100.0	100.0
Exports	89.1	119.6	129.8	118.0	118.0	120.0
WMP						
Price	103.7	97.3	93.8	104.0	97.1	94.1
Production	103.4	128.5	139.6	100.4	83.0	76.1
Consumption	99.0	100.8	101.8	100.0	100.0	100.0
Exports	107.6	154.5	175.2	100.4	79.0	70.6
SHC						
Price	102.8	96.0	92.8	103.7	97.5	94.2
Production	102.0	106.1	108.9	100.9	94.9	89.1
Consumption	99.6	100.6	101.1	100.0	100.0	100.0
Exports	120.4	147.0	167.3	101.5	91.3	81.3
Imports	100.0	100.0	100.0	-	-	-

As explained before, the positive impact of a WTO agreement on milk price is essentially a consequence of the positive impact on the protein price while the fat price is not significantly affected. The EU butter price only slightly decreases. The EU butter exports do not change. On the import side, the EU increases its butter imports. The decrease in the butter price is very small (1.2%) as in parallel to the increase in imports the domestic production decreases. The latter is explained by competition for fat within the EU markets.

In particular, the productions of some other dairy products (WMP and cheese) increase generating an 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 SMP market (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 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. However EU production of SMP decreases, which results from the limitation of milk production and the adjustments with the other product markets. Because the EU milk production does not change, an increase in the production of some commodities results in a decrease in the production of other commodities. This is exactly what happens for SMP. For a given year, due to the WTO reform, the production of SMP decreases as the productions of WMP and some categories of cheese increase. EU exports of SMP marginally decrease.

Multilateral WTO agreement and increase in EU milk quota

As explained above, due to the quota system, the EU production does not expand in response to market liberalization. Rather the positive effect is capitalized by producers at the expense of consumers. The EU has decided to keep the quota system till 2013-2014. However, we test here the implications of increasing the production quotas rather than to

analyse the impact of a complete removal of the quota system in the EU. More specifically, we analyse the impact of a WTO agreement that would be accompanied by an increase in the EU production quota by 1% or 2% per year (WTO1 and WTO2). In order to analyse the impact of the increase in production, we compare the results of these two scenarios to the results of the scenario WTO (that is WTO agreement keeping unchanged the EU dairy policy).

The impact of an increase in the EU milk production quotas is very significant. It induces an increase in production which generates a large decrease in farm milk price. For example, for scenario WTO1 in 2012-13 the farm milk price has decreased by more than 11% and production has increased by 3.5% as compared to "WTO". Thus, a 1% increase in milk production implies a decrease in the farm milk price by around 3 %. Because the farm milk price drops significantly, the increase in production is lower than the increase in production quotas meaning that in a lot of countries the quota is no longer binding. This also explains why the additional increase in production in WTO2 (as compared to WTO1) is only 1.7% while the potential increase was 5%.

The increase in milk production has a larger impact on the implicit price of fat than on the implicit price of protein. Actually, in scenario WTO1 (as compared to WTO) the price of butter drops by 12.9% while the price of SMP decreases by 'only' 6.4%. This is because the EU is not competitive on world markets for fat products while it is for protein products. The increase in the production of milk fat needs then to be sold on the domestic market. On the contrary, the increase in the production of milk protein is used both on domestic markets and on exports.

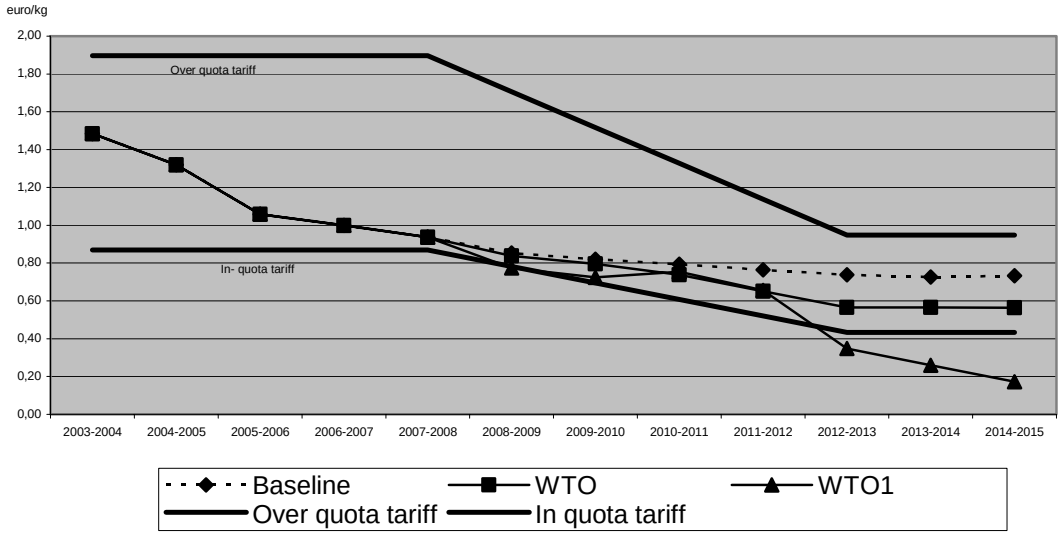


Figure 6. Difference Between EU25 and Oceania Butter Price

The price of butter significantly drops under the intervention price. This is because the EU has no more price instrument to avoid a drop in the butter price: export subsidies are removed (WTO agreement) and we assumed that domestic subsidies will not be used. This drop significantly reduces the price difference between EU and world prices (cf. Figure 6). This difference is now smaller than the in-quota tariff. This explains why 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 world price.

The price of SMP is also negatively affected by the increase in milk production. However, the SMP price in the EU remains larger than the intervention price. As mentioned before, the EU exports more SMP on the world market. This is also true for cheese and

WMP. As shown in Table 3, the increase in EU exports is significant while the percentage increase in consumption is small in comparison. For instance, in scenario WTO2, for which the increase is the largest, the increase in consumption accounts for only 20% of the increase in production for SMP and only 11% and 2% respectively for SHC and WMP.

Because a significant part of the increase in production in the EU is exported, the world market prices of dairy products decrease. This negatively affects the production as well as the farm milk price in Oceania. According to our results, while a WTO reform alone was profitable for producers in Oceania, it is no longer the case when the EU increases its production (Figure 4).

Impact of the WTO agreement on welfare

As shown in table 4, the WTO reform has a slight negative impact on EU25 welfare compared to the Luxembourg reform outcome (Baseline) 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). Note that in the baseline, export subsidies were almost unused. Then the reduction in the cost for subsidised exports does not compensate for the decrease in tariff revenues. 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 welfare (Chavas et al, 2002). Note however that the main impact is a redistribution of surplus among agents.

Table 4. **Variation of Surplus and Welfare in EU25 for Scenarios Compared to the Baseline in 2012-2013 (Million euros).**

	WTO	WTO1	WTO2
Producers	1099	-1229	-2450
Consumers	-967	2267	3940
Taxpayers	-121	-133	-133
Welfare	-25	1099	1680

However, an increase in quota in the context of WTO reform (WTO1) increases welfare as the impact on consumers is significantly larger than the impact on producers. The larger the increase in quota, the stronger the impact is. 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 and negatively affected. On the contrary, consumers benefit from lower prices. The change in taxpayer cost is marginal compared to the WTO agreement alone scenario.

The impact of a WTO agreement in Oceania as well as in the RoW depends on the EU-25 policy. If the EU does not adapt its policy (scenario WTO) then the agreement has a positive impact on the welfare in Oceania (welfare in Oceania mostly corresponds to producer surplus) while the net impact on welfare in importing countries will depend on the relative gain in consumer surplus that could be lower than the negative impact on taxpayer surplus due to the decrease in the tariff revenues. If the EU adapts its policy (scenario WTO1 or WTO2) by increasing the milk production quotas, then the welfare in Oceania is negatively affected as world prices decrease. Importing countries benefit from the EU policy. This result also shows that Oceania benefits from the present dairy policy of the EU.

Main conclusions

Results show that the Luxembourg reform has a significant impact on the EU-25 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 imports. These results are however sensitive to the evolution of demand and more particularly to the evolution of EU domestic demand, which will influence the reduction in the EU milk price.

Results also suggest that a WTO agreement in the context of the Luxembourg 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. However, it is not excluded that in some circumstances (low demand for dairy products in the EU for example) the impact of a WTO agreement on EU milk price could be negative. In our simulations, the impact of removing export subsidies was small because in the initial situation the markets for dairy products in the EU were equilibrated without using intensively export subsidies. In less favourable market conditions, this would not be the case. Then the impact of removing export subsidies would be larger. Finally, Oceania would benefit unambiguously from a WTO agreement as world market prices increase.

However, if the WTO reform is accompanied by a change in the EU policy, that is an increase in the milk production quotas, then the impacts are different. The expansion of EU

production has a positive impact on the EU welfare (at the expense of producers but to the benefit of consumers) while it has a negative one on Oceania welfare.

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 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, and 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 the 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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[i] This collaborative research is developed in the context of the 6th framework programme, "Policy Oriented research" of the European Commission under the EDIM project (EDIM 502111). We thank Hélène Raynal (University of Toulouse, INRA) for her contribution to the development of the simulation tool.

[ii] A characteristic which is not systematically verified in econometric models

[iii] 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. In that case, the constraint needs to be defined over a group of products rather than over one product. Similarly, some constraints apply to a group of countries (at the EU level for example rather than at the level of a country). In this case, the constraint is defined for the exports from all countries that belong to this group to countries that are not in the group.

[iv] 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.

[v] These countries are Cyprus, Estonia, Latvia, Lithuania, Malta, Slovenia and Slovakia. We choose to aggregate these 7 new member states because they represent less than a quarter of the EUN-10 milk production and because their statistic data are scarce. Indeed, the cow milk production of Czech Republic, Hungary, and Poland represents 76% of the total milk production of EUN-10 which is equal to 22 Mt representing 18% of the EU-15 production.

[vi] As well as domestic subsidies for some uses of butter and SMP

[vii] In some countries, they will be decoupled in 2007-08. However, according to our results, this 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.

[viii] However, because the simulation of the Baseline suggests that no more consumption subsidy remains 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.

[ix] Note that it also incorporates the impact of the changes in demand (autonomous trends) as well as supply (technical progress).