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A stochastic approach of the assessment of EU intervention mechanisms for dairy products

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Résumé

The objective of this paper is to analyse the potential market consequences of raising the current level of intervention prices for dairy products in a context of volatile milk and dairy prices in the next decade through the use of a partial equilibrium model ran stochastically. Results show that increased intervention price might result in a significant probability that persistent stocks of butter and SMP reappear, while in similar macroeconomic conditions, the EU milk price does not seem to affected. Given the integration of dairy world markets, intervention can take place to face EU oversupply but it seems to be particularly the case also in the event of world oversupply.

Mots-clés : CAP, Agro-economic modelling, market, Intervention, Stochastic analysis

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Introduction

Following market disturbance in the wake of the Russian import ban, a number of Members of the European Parliament, Ministers and stakeholders in the milk supply chain requested the Commission to temporarily increase the level of the European safety net.

According to EU Regulation N°1308/2013, public intervention is available for butter and skimmed milk powder (SMP), from 1 March to 30 September, up to 50 000 tonnes for butter and 109 000 tonnes for SMP each year at fixed intervention prices. Outside this period, intervention can be opened as an exceptional measure by a delegated act. Beyond the quantitative limits, intervention operates by tender.

Buying-in prices are set at:

- EUR 2 217.5 per tonne for butter (90% of the threshold price);

- EUR 1 698 per tonne for SMP (100% of the threshold price).

The Regulation provides that the price thresholds shall be kept under review by the Commission, taking account of objective criteria, notably developments in production, costs of production (particularly inputs), and market trends.

The objective of the present work is to simulate possible market consequences of raising the current level of intervention prices for dairy products. Two scenarios, reflecting a moderate and a stronger increase of the existing levels of safety net, are run and are then compared to the present situation (“reference scenario”).

The average price levels projected for dairy products in the next 10 years in the latest medium-term prospects exercise are too high to trigger any intervention even in cases where intervention prices would be significantly higher. However, accounting for the sensitivity of agricultural production to weather conditions and to macroeconomic uncertainties, dairy product price variations will certainly occur in the next 10 years. That is why a range of

alternative scenarios for yields and macroeconomic variables are assumed to reproduce a certain degree of price variability in a context of higher intervention prices.

1. Methodology and modelling approach

Annually, the OECD and the FAO jointly release a ten-year horizon assessment of medium-term projections of national, regional and global agriculture commodity markets (OECD/FAO, 2015). The baseline scenario is taken from the European Commission contribution to the latter published as "prospects for EU agricultural markets and income" (European Commission, 2014) which is produced within the Aglink-Cosimo modelling framework. The modelling framework ensures that the overall set of equations balances with plausible outcomes.

Aglink-Cosimo is a global economic recursive-dynamic, partial equilibrium, supply demand modelling framework which covers the main agricultural commodities (Araujo Enciso et. al 2015; OECD-FAO 2015b). The model is a collaborative work integrating the OECD's Aglink and FAO's Cosimo sub-modules. It is used to simulate the developments of annual supply, demand and prices for the main agricultural commodities produced, consumed and traded worldwide. The Aglink-Cosimo model covers 44 individual countries and 12 regions, 93 commodities and 40 world market clearing prices with a total of around 36000 equations.

Most behavioural equations in Aglink-Cosimo can be linearised in logarythms (i.e. "double-log" functions), including those for estimating production and demand functions, where the underlying relationship between y and x resembles a logarithmic function (e.g. y experiences diminishing marginal returns with respect to increases in x):

$$ln(y_i) = a_i + \xi_{ij} \cdot ln(x_{ij}) + \gamma_i \cdot t \quad + ln(e_i)$$

where i and j correspond to the agricultural commodities covered in the model. The relationship between x and y is parameterized through the introduction of a constant term (α_i), a slope term (ξ_{ij}) which corresponds to the elasticity between X and Y (Araujo Enciso *et al.*, 2015) and a term trend (γ_i). The residual is captured by the error term (e_i), which is frequently referred to as 'calibration term'.

Three scenarios are examined, summarized in table 1 :

The Reference scenario reflects current intervention price levels. However, to take into account that milk price is not uniform across the EU, intervention is triggered when EU prices reach a level slightly above the strict intervention price. In addition, private storage aided schemes are not considered in this analysis.

The moderate increase scenario corresponds to an increase in intervention prices for SMP (+8%) and butter (+12%), so that, expressed in milk equivalent, the support price is equivalent to the 2012 average EU operating costs in the EU-15, at 24.1 cents/kg (European Commission, 2013)[1]. Starting from the milk price equivalent, the change in intervention price for butter and SMP is derived following the same methodology as for the 2003 CAP reform, reflecting concerns for greater risks for imbalance in the dairy-fat market.

The strong increase scenario 2 corresponds to intervention prices for SMP and butter expressed in milk price equivalent, at 28.3 cents/kg, cover average EU-15 cash costs (operating costs plus wages, interests and rent).[2] This correspond to the intervention price levels prior to the decrease agreed upon in the 2003 CAP reform, which were compensated by the introduction of direct payments.

Table 1 - Summary of intervention price scenarios

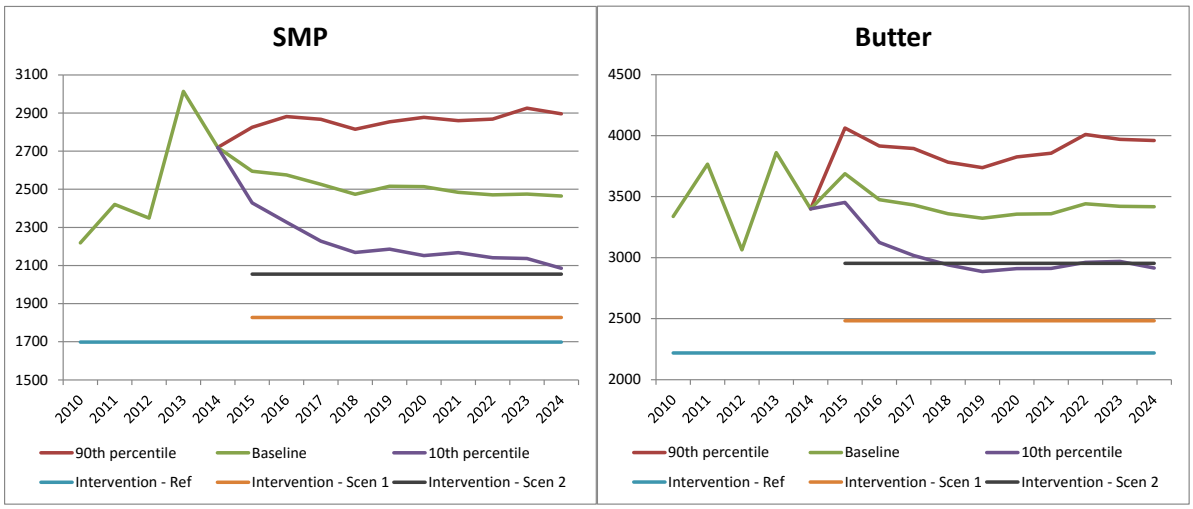
	Butter intervention price (% diff to Ref. scen.)	SMP intervention price (% diff to Ref. scen.)	Milk price equivalent (% diff to Ref. scen.)
Reference scenario	2 218	1 698	21.7
Moderate scenario	2 482 (+12%)	1 827 (+8%)	24.1 (+11%)
Strong scenario	2 954 (+33%)	2 055 (+21%)	28.3 (+30%)

[1] Note that average costs are higher in the EU-15 than in the EU-N13, and that 2012 was a year of rather high operating costs because of feed prices driven by historically strong crop prices. In addition, 15 Member States had operating costs lower than this average in 2012.
[2] 2011 EU-15 cash costs, based on FADN milk report (EU, 2013)

The reference scenario and the two other scenarios are run stochastically: close to 550 alternative sets of macroeconomic and yield conditions (hereafter called "draws") are analysed, for each of the three levels of intervention prices following the methodology described in Burrell and Nii-Naate (2013) anss subsequently developed (European Commission, 2014 and 2015, OECD-FAO, 2015a).

Such draws do not include all types of uncertainties: some drivers of uncertainties not related to yields or macroeconomic context (e.g. animal health related crises, trade disruptions, etc.) are not taken into account. For simplification purposes and better focus on public intervention, it is assumed that private storage schemes are not activated in any of the three scenarios. No ceiling in buying-in quantities is modelled, which implies the assumption of Commission intervention by tender without limits if prices continue to remain below intervention prices.

Figure 1 - Baseline, price range and intervention price for SMP and butter (EUR/t)



The use of such partial equilibrium model for a ten years ahead projections does not take into account possible changes in price and income elasticities over the period. To this respect, such a tool represents a simplification of what is likely to happen in the ten coming years. In addition, such a model considers the dairy industry and each commodity concerned as one single commodity, while the reality is likely to be characterised by segmentation into different types of dairy products, each of them reacting differently to the shock. For the present exercise, the model (Aglink-Cosimo) used for the simulation has two more limitations: first,

only one average price is used for the EU market, while Member States have different price levels. Second, intra-annual price variation is not captured, while in reality intervention can be triggered when the price in one Member State falls below the intervention price for much less than a full year. Therefore, a correction factor of the buying-in prices was applied to simulate intervention even though the EU annual average price is not below intervention price.

2. Results : How often is intervention triggered and stocks accumulate?

The total number of simulations when intervention is triggered and buying-in operations occur at least in one year during the projection period (2015-2024) varies between scenarios. Given the prospects of favourable dairy market developments at medium term, current intervention price levels in the reference scenario give rise to intervention only in a reduced number of cases (less than 3% of the simulations).

In the moderate scenario, buying-in occurs in 1 case out of 4, at least one year over the ten. With the highest intervention prices, there is intervention for butter almost in all simulations at least one year over the projected period (in close to 90% of the cases). Butter intervention is significantly more triggered than SMP intervention in line with the scenario definition.

Table 2 - Simulations when intervention is triggered at least in one year over the period

	Reference Scenario	Moderate Scenario	Strong Scenario
SMP	15 (3%)	56 (10%)	237 (44%)
Butter	12 (2%)	121 (22%)	479 (89%)
SMP or Butter	18 (3%)	129 (24%)	500 (92%)

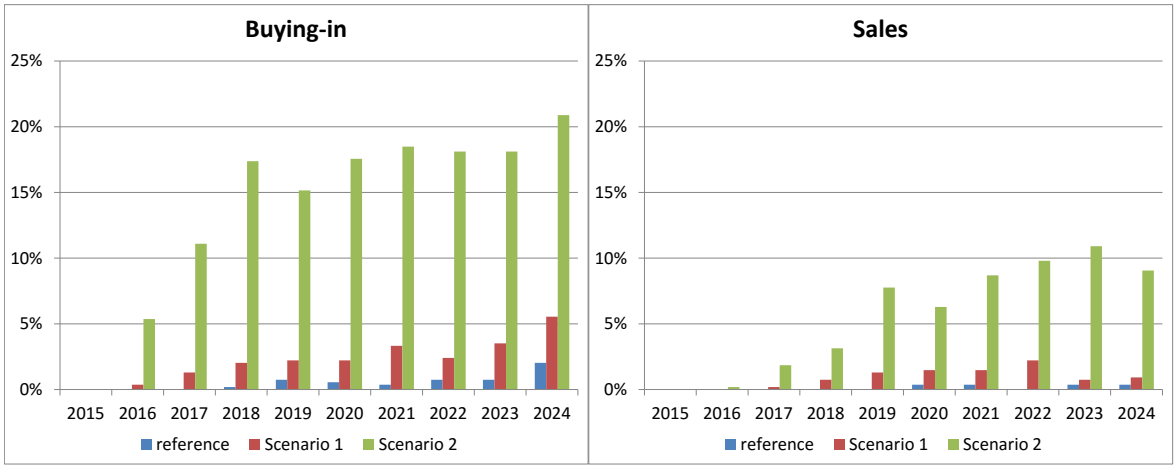
To complement the analysis of the simulations concerned in each scenario, it is worth having a look at the proportion of simulations when intervention is triggered (increasing intervention stocks), and when there are sales out of intervention stocks, for each year during the whole period of analysis.

In many cases, intervention is triggered only once or only in a few years over the projected period. The following graphs show that in all scenarios, there is a certain stabilisation in the proportion of simulations with buying-in and sales as from 2018, year when the projected

range of SMP and butter prices is the widest due to the increasing uncertainty over time, especially with respect to the macroeconomic context.

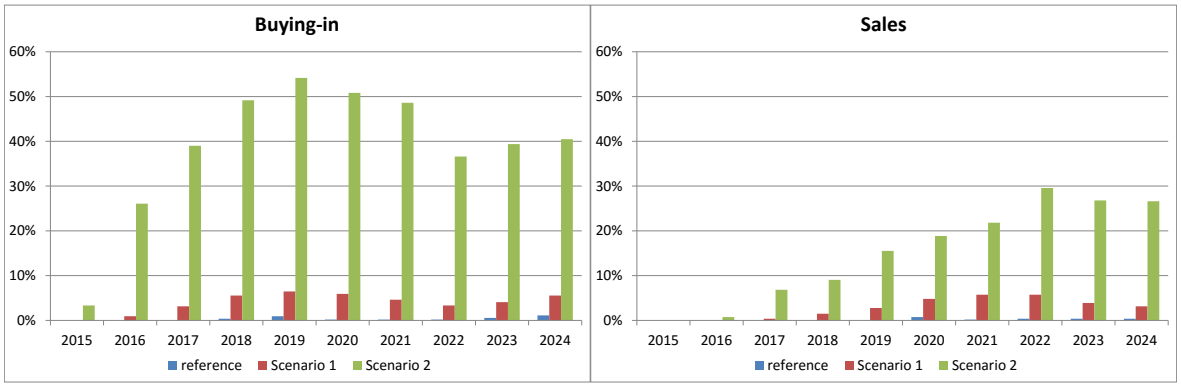
For SMP, the proportion of draws with intervention in a specific year (average 2018-2024) amounts to 1% in the reference scenario, 3% in scenario 1 and 18% in scenario 2, while sales occur in close to 0%, 1% and 8% of the cases, respectively.

Figure 2 - Proportion of draws (%) with buying-in or sales operations for SMP



For butter, as mentioned, intervention is triggered more often. Intervention occurs in respectively 1%, 5% and 46% of the draws in average every year for butter and sales in 0%, 4% and 21% of the cases.

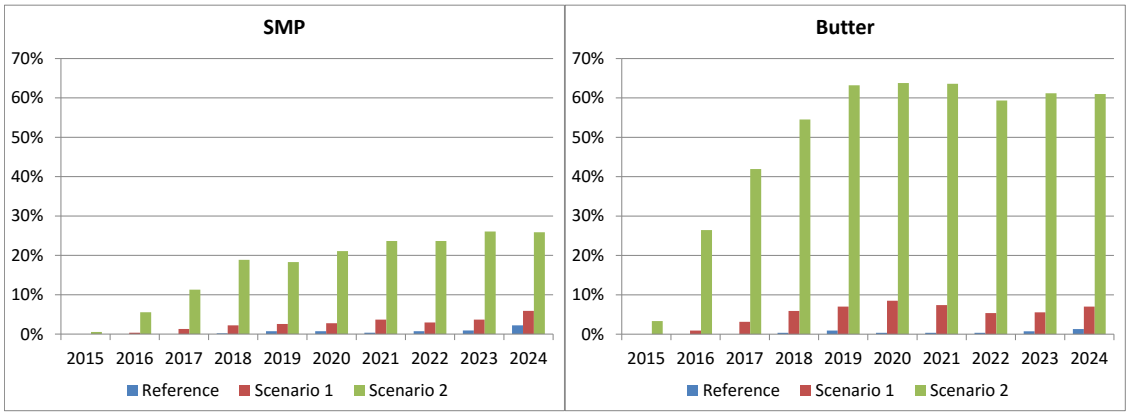
Figure 3 - Proportion of draws (%) with buying-in or sales operations for butter



Accumulated stocks are only partially cleared within the projection period. At the beginning of the projection period, there are not many cases where intervention stocks accumulate, but

with the increase in macroeconomic uncertainty over time, as well as in the number of draws with lower dairy prices, there are butter stocks in 60% of the cases in Scenario 2 after 2018. The number of cases with stocks in the reference scenario is negligible.

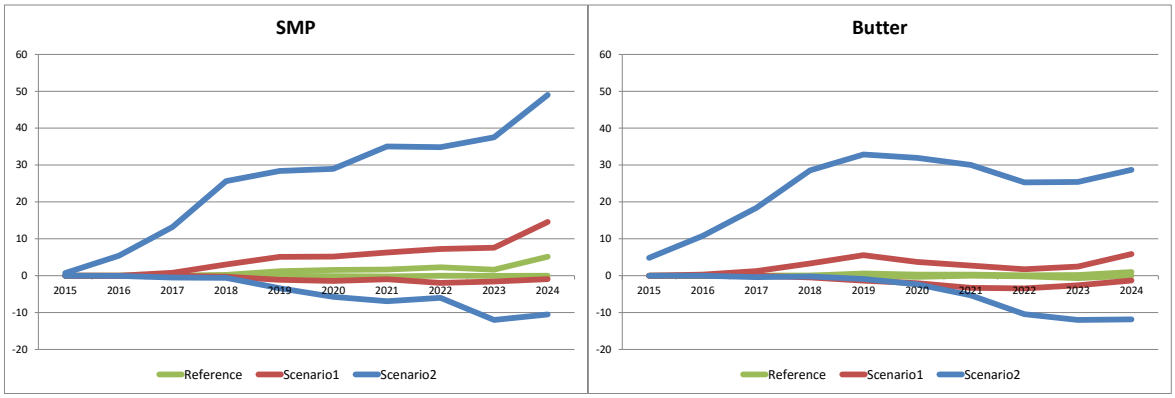
Figure 4 - Proportion of draws (%) with intervention stocks



To trigger intervention, both the macroeconomic and yield context have to differ from the baseline assumptions. For the purpose of comparing the impact on purchased quantities or commodities prices in the different scenarios, it is more accurate to restrict the comparison to a subset of draws where intervention is triggered both for SMP and butter in scenario 1 and 2. Therefore 48 individual and identified simulations answering to these conditions (9% of all the draws) were selected.

Average annual buying-in operations and sales are close to zero in the reference scenario. In the scenario 1, over the period 2018-24, SMP buying-in reaches 7 000 tonnes and sales 1 200 tonnes for SMP, while for butter, the quantities are more modest and balanced (3 500 tonnes of annual buying-in versus 2 000 tonnes of sales). In scenario 2, not surprisingly, the quantities concerned are significantly higher: 35 000 tonnes for SMP and 30 000 tonnes for butter yearly, with yearly sales of less than 10 000 tonnes. This means that in the case of scenario 2, intervention stocks are rapidly accumulating over time (see next section).

Figure 5 - Average annual buying-in and sales (1000 t)



In summary, the years with buying-in operations are more numerous than the years with sales, particularly in scenario 2 (the situation is more balanced for the reference and scenario 1). In addition, the quantities bought-in are significantly higher on average than the ones sold back on the market. This leads to an increase of the quantities in public storage over the whole projection period, reaching roughly for scenario 2, 80 000 tonnes of SMP and 80 000 tonnes of butter on average in 2024. The average intervention stocks in the reference scenario and scenario 1 are more modest and rely on a much smaller number of simulations.

In addition, some simulations in which intervention occurs correspond to extreme macroeconomic conditions. Therefore, by reflecting these most extreme macroeconomic conditions, the average might overestimate stocks levels, as for SMP in Scenario 1 and 2 where the median level of stocks is much lower. For butter, the average and the median stocks are closer.

It has to be noted that in this simulation, export refunds, which in the past have allowed increasing exports, have not been modelled.

Figure 6 - Development of SMP intervention stocks in the three scenarios (1 000 t)

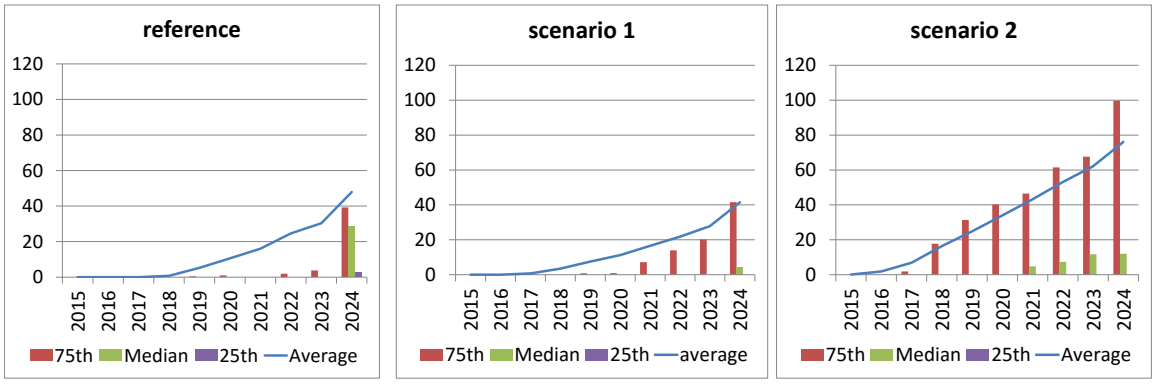
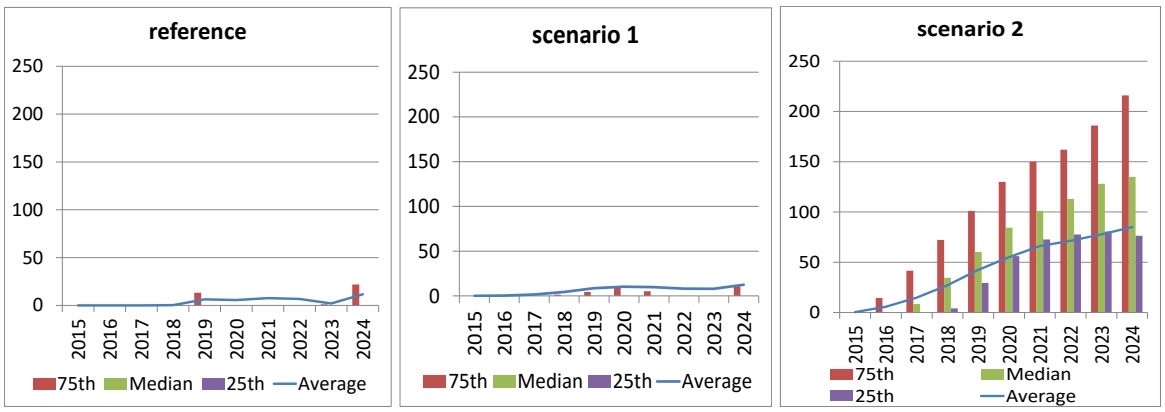


Figure 7 - Development of butter intervention stocks in the three scenarios (1 000 t)



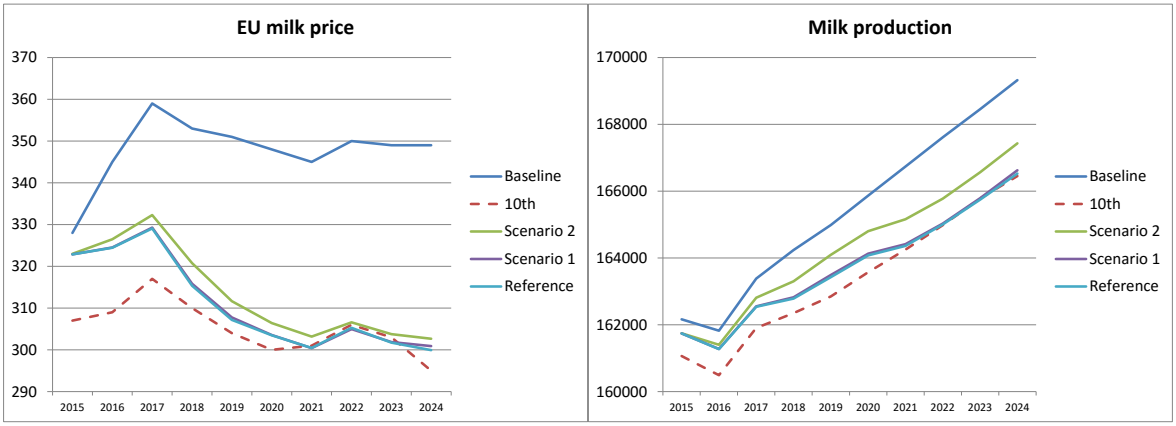
3. Discussion : consequences and milk market conditions

The present section examines the EU market conditions in place in terms of price and production when in each of the three scenarios, the intervention is triggered. Intervention is triggered when EU milk prices are within the lower bounds, i.e. when the macroeconomic conditions imply a reduction in milk prices compared to the baseline. Lower milk prices provide lower incentives to produce, therefore milk production is significantly lower than in the baseline too. The model used for this analysis underestimates the possibility of over-supply in the EU due to favourable climatic conditions that could also imply lower EU prices. It also shows that with higher intervention prices, intervention could become more a structural tool than a mechanism activated for short-term market disturbances.

Thus to better understand whether a change in intervention price affects the EU average milk price, we have a closer look at the set of 48 draws above mentioned (9% of the total draws

when both SMP and butter intervention is triggered). The following graphs show the average EU price for milk in the subset concerned for the three scenarios, compared with the baseline and the 10th percentile.

Figure 8 - Domestic EU milk prices (EUR/t) and milk production (1000 t) comparing the different scenarios to the baseline



The difference between the three scenarios is minimal: both reference and scenario 1 show the same average EU domestic milk price over the full period. This means that, in a similar macroeconomic context, increasing by 8 to 12 % intervention prices for SMP and butter has a small impact on the milk price level, but does not avoid a moderate risk of accumulation of public stocks, particularly for SMP.

A stronger increase in intervention prices to pre-reform levels leads to a marginal increase in average EU prices (+1% on average over the period 2018-24), while the accumulation of stocks would be substantial and frequent.

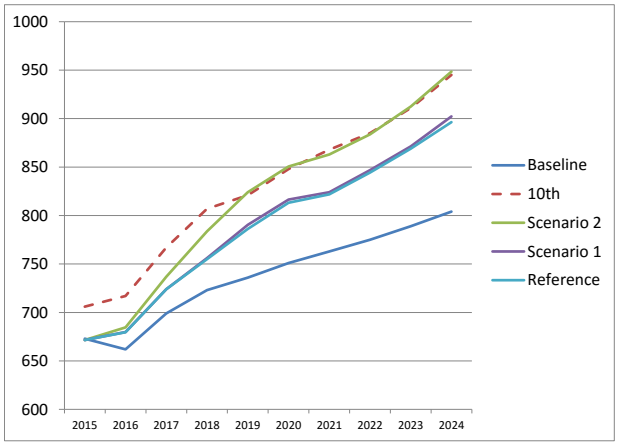
Similarly with prices, both the reference and moderate scenario are not showing any difference in terms of EU milk production: in both cases, milk production increases year after year but to a lower extent than in the baseline.

In the stronger increase scenario, there is a lower production decrease relative to baseline than in the two other scenarios (+0.5% in average over the period 2018-24), which indicates that a strong increase in intervention price might slow down the needed adjustment of the EU production (and therefore does not allow prices to improve as shown above).

When looking at the EU trade still within these 48 draws, intervention occurs in a situation when EU exports are above baseline (thanks to lower EU prices, and also lower world prices fostering global consumption - see below). Similarly to prices and production, the moderate increase in intervention price does not change at all the trade position of the EU.

In the case of a stronger increase of intervention price, with a higher EU production and only a moderate price increase, part of the pressure on EU dairy markets can only be relieved with additional exports, a development that could lead to strong reactions from competitors (as in the past).

Figure 9 - Evolution of EU SMP exports (1000 t) in the different scenarios

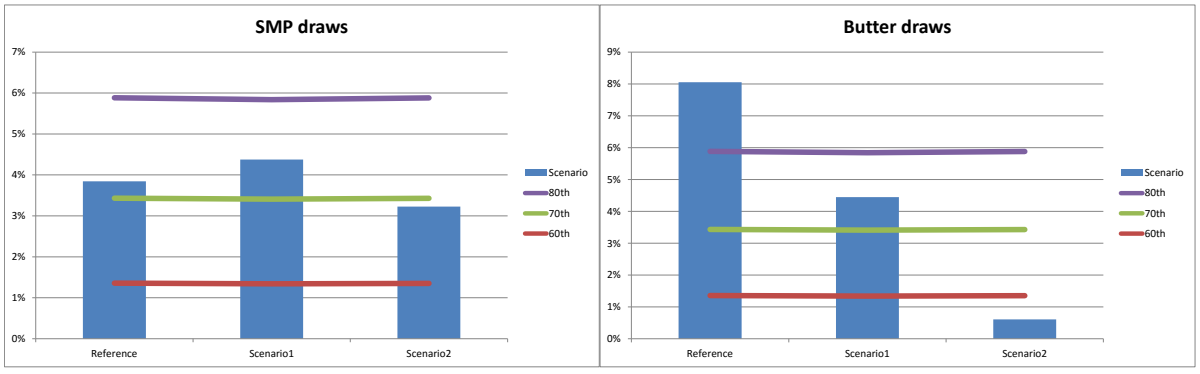


There is a strong connection between world market developments and EU dairy markets and, in all three scenarios, intervention is triggered when world prices are lower by the same order of magnitude as the reduction in the EU price.

Figure 10 - EU and world price levels when intervention is triggered (% difference to the baseline, 2018-24)

Intervention occurs in the EU when there is higher supply in other parts of the world, in particular in New Zealand. In these cases, milk production is driven by increased competitiveness on world markets thanks to a depreciated currency against USD. Intervention also corresponds to situations with lower consumptions in main export markets, when for example the Russian (but also the Chinese) GDP is below baseline.

Figure 11 - New Zealand milk production when intervention is activated (% to baseline)



In general, the macroeconomic set-up has to be extreme in the reference scenario to trigger intervention. On the contrary, in scenario 2 (where a very large number of draws contemplates some buying-in operations), the macroeconomic conditions are closer to baseline assumptions. This highlights again that with intervention prices back to prior levels, this

mechanism would become more of a structural tool rather than a safety-net for market disturbance.

Table 3: Average difference to baseline for selected macroeconomic variables for subsets of draws where intervention is triggered (2018-2024)

% diff	Oil price		Russian GDP		Feed cost index (EU)		NZ exchange rate	
	SMP	BT	SMP	BT	SMP	BT	SMP	BT
Reference	-28%	-47%	-12%	-11%	-11%	-11%	+15%	+23%
Scenario 1	-23%	-27%	-14%	-2%	-9%	-5%	+16%	+9%
Scenario 2	-14%	-4%	-5%	-1%	-4%	+2%	+7%	+1%

Finally, the macroeconomic conditions when intervention is triggered are also characterised by a lower oil price, therefore with a direct impact on energy related costs of production, and also indirectly on feed costs (lowering them). This implies that lower domestic prices for milk are partly compensated by lower costs in situations when intervention is triggered.

Conclusion

The potential impact of increasing dairy intervention prices was analysed based on 550 alternative sets of macroeconomic and yield conditions. Results indicate that increasing significantly intervention prices to their pre-reform level (between 21% and 33%) could lead to an important accumulation of stocks over time in a large proportion of cases, yet the increase in average EU prices would be minimal (+1% on average over the period 2018-24). This could lead to the frequent use of the intervention mechanism as a market management policy more than a safety-net approach, thus reversing the trend towards a market-oriented policy. A more moderate increase in intervention prices (8%-11%) leads to stock accumulation in fewer cases (more often for SMP than for butter), yet has literally no impact on the milk price level.

Setting an appropriate level of threshold prices is not an easy task given the differences price levels in between Member States. Increased intervention price levels would lead to more Member States facing commodity prices below intervention level, with several among them

having milk production costs below the support price in milk equivalent. This could increase the incentive for farmers to produce more instead of responding adequately to market signals.

The EU dairy market is very integrated in the world market; therefore higher intervention prices might result in triggering of intervention as a result of market imbalances driven by over-supply in other regions of the world than the EU. Intervention is more likely to occur not only when the EU market is over-supplied, but on the contrary when competitors have important production and competitive advantages for macroeconomic reasons (exchange rate in particular), or sometimes when milk prices are lower because of a reduction in production costs (without, consequently, a reduction in farmers' margins).

Beyond the cost for the EU budget and a setback in the 20-year old reform process towards market orientation, an additional "cost" stems from the fact that market support is classified as market distorting according to WTO rules, and therefore increasing intervention prices would lead to an increase of the EU support accounted for in the amber box.

Thus results confirm that the intervention mechanism should best function when meant to provide a safety-net to market developments, while direct payments provide for an element of stability in farmers' income. The Milk Package, enhancing contractual relations, should help adapting production to demand developments.

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