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Evaluation of the Market Responsibility Programme put forward by the European Milk Board taking 2014 as a test year

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It does not represent the official views of the Committee of the Regions.

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Table of contents

List of acronyms

AHDB	Agriculture and Horticulture Development Board
BDM	*Bundesverband Deutscher Milchviehhalter*
CAP	Common Agricultural Policy
CMO	Common Market Organisation
COGECA	General Confederation of Agricultural Cooperatives
COMAGRI	European Parliament Committee on Agriculture and Rural Development
COPA	Committee of Professional Agricultural Organisations)
COR	Committee of the Regions
DMSP	Dairy Market Stabilisation Programme
DPMPP	Dairy Production Margin Protection Program
EC	European Commission
EDA	European Dairy Association
EMB	European Milk Board
EP	European Parliament
EESC	European Economic and Social Committee
EU	European Union
EUR	Euro
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organization of the United Nations
ME	Milk Equivalent
MMO	Milk Market Observatory
MS	Member States
NMFP	National Milk Producers Federation (in the US)
MRP	Market Responsibility Programme
OECD	Organisation for Economic Co-operation and Development
RDPs	Rural Development Programmes
US	United States
USD	United States Dollar
USDA	United States Department of Agriculture
WTO	World Trade Organization

Summary

The EU dairy sector crisis is still on the agenda of policy makers as protests by farmers and farmers' representative organisations on low farm-gate milk prices continue. The farm aid package of EUR 500 million proposed by the European Commission (EC) and endorsed by the Council of Agriculture Ministers on 15 September 2015 did not halt the raising of concerns, including at the institutional level. In response to these concerns expressed by some national delegations, the Presidency of the Council of the European Union decided to have a formal discussion on the market situation in the dairy sector at the March 2016 Council of Agriculture Ministers meeting. On that occasion, measures currently in place as part of the farm aid package agreed in September 2015 will also be assessed.

Proposals to overcome the crisis have included the introduction of effective milk supply management tools. The European Milk Board (EMB), an umbrella organisation of dairy farmer associations and farmers' lobbies from 14 Member States (MS), has advocated the idea of controlling supply to manage the milk market since it was founded in 2006. This idea formally took the form of a Market Responsibility Programme (MRP) in April 2014. Since then, the EMB has called on the EC to adopt the programme as a crisis instrument. On 16–17 April 2015, the Committee of the Regions adopted an opinion on 'The future of the dairy sector' where the EMB proposal for a MRP was positively acknowledged and considered worthy of further analysis with regard to its feasibility and effectiveness. This study commissioned by the Committee of the Regions is conducted to assess the MRP taking 2014 as a test year.

Part 1 describes the concept behind the MRP and initial stakeholder reactions as well as the US debate around similar schemes. It also identifies some operational issues which would need to be clarified if the MRP were to be further developed. The EMB proposal conceptualises a dairy market stabilisation programme combining monitoring and response phases, but leaves many details unanswered. Some of the grey areas of the proposal relate to the index which is at the basis of the triggering of the programme. Other aspects needing further definition and clarification relate to the operationalization of the programme.

Part 2 reports on the simulation of the operation of the MRP in 2014, supposing the programme would have been triggered in that year. The focus is on the programme's likely effectiveness in raising milk prices/margins and the costs associated with the instrument. The estimation of both effects is accompanied by great uncertainty. In testing how the scheme might have worked in 2014, it is

necessary to assume particular rules or methodologies for the issues left unclear in the EMB proposal in order to have a workable model. In addition to these assumptions, other sources of uncertainty include the behaviour of market actors in response to the implementation of the MRP (captured by the so-called price 'elasticities' of supply and demand), as well as the relative size of the group of expanding milk producers whose additional milk would be restricted under the proposal.

The index used in the simulation is an adapted version of the Milk Margin Index developed by the FADN unit in DG AGRI and which is updated quarterly on the Milk Monitoring Observatory website. The testing is carried out through a simplified model developed in Excel of the EU raw milk market which distinguishes between two sources of supply and three demand destinations for raw milk. To test the impact of the MRP, three different scenarios are simulated, to take account of uncertainty around the values of key parameters. The 'Default' scenario is intended to represent the most likely outcome given the data available. In the 'High elasticity' scenario, the assumed elasticities of demand for liquid milk, processed dairy products on the EU market, and exported dairy products are doubled, relative to the Default scenario. In the 'High share of expanding producers' scenario, the share of the additional milk supplied by expanding producers in total milk deliveries is doubled compared to the Default scenario.

Common to all scenarios is the removal of a relatively high share of total milk deliveries, ranging from 6% in the Default scenario to almost 9% in the High share of expanding producers' scenario. By far the more important contribution to the reduction in milk output is made by the milk responsibility levy in restricting milk deliveries from expanding producers, while the voluntary suspension scheme plays a relatively limited role in reducing supplies. The comparison of the High elasticity scenario with the Default scenario highlights the importance of the elasticity assumptions. The High share of expanding producers' scenario shows the greatest response in terms of milk prices, given that the amount of milk removed by the MRP is almost 50% more than in the Default scenario. In all scenarios, there is a net gain to producers under the stated assumptions. Because of the higher milk price, this gain to producers is a transfer from consumers and those downstream in the dairy supply chain who would pay a higher price for milk than in the baseline. Overall, the policy intervention would lead to an economic cost for the economy as a whole at market prices of between EUR 0.5 billion and EUR 1.3 billion.

Part 3 of the report evaluates the feasibility and efficacy of the MRP in the light of the results of the simulations. The results point to contradictory aspects on the adequacy of supply management measures to influence the supply/demand

balance. On the one hand there is evidence that supply management measures can influence the EU market price; on the other hand the simulations provide evidence that the EU milk market is not so sensitive to supply reductions and that in order to have a worthwhile effect on the milk price and farmer's margins, much more than the 2-3% of milk supplies suggested in the EMB proposal would need to be withdrawn. The proposal is also questionable in terms of its capacity to address the heterogeneous situation of producers across the EU and to drive supply reduction mainly through the voluntary suspension of deliveries. The empirical test of the MRP points to the importance of the supply reductions by expanding producers due to the punitive market responsibility levy if a meaningful lift in EU prices is to be achieved.

In terms of the feasibility of the MRP, there would be high administrative requirements for the agency that would be called upon to implement and monitor the programme. In addition, the simulations assume an idealised response by the authorities to changes in the Market Index and are likely to underestimate the time required for interventions to become effective. Another important issue that appears to be underestimated in the proposal put forward by the EMB relates to the data requirements, in terms of both timeliness and quality, towards the construction of a reliable margin index for policy purposes. Practical drawbacks such as delays or difficulties in adjusting production at the farm level may also limit the impact of the programme.

Given the importance of the mandatory supply limitation imposed on expanding producers to the overall effectiveness of the MRP, a major consideration is that benefits to one group of milk producers will be at the expense of another group of milk producers. There is good reason to believe that the latter will include the more efficient and entrepreneurial dairy farmers in the EU. Thus there would be a longer-term negative impact on the competitiveness of the EU dairy sector arising from the operation of the MRP. The mere fact that supply limitations could be triggered would make banks more cautious in lending to dairy farmers and would make dairy farmers more reluctant to consider expansion. These negative effects on farm-level competitiveness would be compounded by negative effects at the processing level. Supply reductions of the magnitude required to influence the Market Index would result in significant decreases in the availability of dairy products for export whenever the MRP would be in operation. This would make it more difficult for EU dairy companies to guarantee supplies to maintain market shares in third country markets and would strengthen the position of the EU's competitors in these markets, who would also benefit from the higher world market prices due to the EU's supply restraint, without themselves being required to limit production.

Part 4 includes the recommendations of the study. First, it is evident that further work is needed to clarify several operational aspects of the MRP which are left undefined in the current EMB proposal. Second, further empirical work to test the likely impacts of the proposal would be desirable, given the uncertainties there are around some of the parameter values used in the modelling. Third, given the drawbacks identified through the review of the concept and the simulation of its functioning, alternative policy instruments to assist dairy farmers to cope with price and margin volatility which would not have the negative consequences of temporary supply management for the longer-term competitiveness of and returns to the EU dairy sector should be investigated.

Part 1 Overview of the Market Responsibility Programme

1.1 Introduction

For the last year or so, European dairy farmers have protested over the steady fall in farm-gate milk prices. Protests have occurred throughout the European Union (EU) as well as in Brussels, as the EU dairy policy is considered to be amongst the main causes, if not 'the' main cause, for the difficult situation they are facing. More precisely, the European Commission (EC) was expected to support dairy farmers' falling income by increasing the prices for public intervention, a circumstance that the Commission strongly opposed because it would fly in the face of the market orientation of the Common Agriculture Policy (CAP) 2014–2020.

The end of the milk quota in March 2015 means that the EU milk market is now fully integrated into the global competition. Factors external to the EU drive price volatility and intensify the imbalance between supply and demand. In particular, in the last year, several overlapping circumstances have contributed to the fall of milk prices across Europe. These include the drop in demand from China, the banning by Russia of imports of European agricultural produce, and the increase in production in the United States and in New Zealand.

The European Milk Board (EMB), which is voicing in Brussels the protest of the dairy farmers, believes that an additional crisis instrument is required to address the effects of these overlapping circumstances. The Market Responsibility Programme (MRP) proposed by the EMB builds on its long-held conviction that voluntary production cuts are necessary to stabilise the market, prevent surpluses, and ensure a fair milk price. The MRP provides for an early warning system of crisis situations and for incentives to farmers to adjust milk volumes during a crisis period.

On 15 September 2015, the Council of Agriculture Ministers endorsed a farm aid package of some EUR 500 million proposed by the Commission and addressed to the dairy and other farm sectors facing similar crisis situations. The package is articulated and coherent with the new policy to deploy safety net provisions in a proactive manner. It includes direct aid but also a diversified set of support measures ranging, for example, from private storage aid to advance payment of direct payments, identification of suitable financial instruments, promotion programmes, distribution of EU dairy products through humanitarian assistance to third countries, and State aid provisions. The package also

envisages a better use of existing instruments, including the 2014–2020 Rural Development Programmes (RDPs) and the milk package, for which a report on its functioning is anticipated in 2016. Finally, a High Level Group will advise on specific issues such as credit, financial and risk hedging instruments (EC, 2015). On 16 October 2015 the legal acts following up the main elements of the package were published and entered into force a few days later (Council of the European Union, 2015). In spite of the above interventions, the crisis has worsened and, following concerns expressed by many MS, another formal discussion of the market situation including in the dairy sector is scheduled to take place at the March 2016 Council of Agriculture Ministers meeting. MS were invited to submit their suggestions for additional initiatives prior to this meeting, and the Dutch Presidency prepared a consolidated list of the suggested measures in advance of the meeting. Many MS supported proposals to reduce EU milk supply, although the proposals differed over whether this should be achieved by voluntary measures alone, with compensation, or whether, in addition, mandatory cutbacks should be imposed. Other MS explicitly rejected the idea.

On 16–17 April 2015, the Committee of the Regions (COR) adopted an opinion on 'The future of the dairy sector' (CDR 642/2015) where the MRP proposed by the EMB was explicitly acknowledged as "*a cheap and flexible proposal that should be examined and assessed as to its feasibility and effectiveness by taking 2014 as the test year*" (COR, 2015). Almost at the same time, Mr Nicholson, a Member of the European Parliament (EP), circulated a draft report 'on prospects for the EU dairy sector – review of the implementation of the Dairy Package', which was later adopted (8 June 2015) by the Parliament's Committee on Agriculture and Rural Development and then reflected in the EP resolution of 7 July 2015. The resolution does not refer to the MRP as such but explicitly calls on the Commission to implement more responsive provisions for the dairy sector in times of crisis, and to define a 'market index' to be used for warning and crisis anticipation purposes.

Alongside this evolving situation at the policy level, dairy farmers' protests continued throughout November and December 2015. On 12 November 2015, the EMB coordinated a Europe-wide 'day of action', calling for the adoption of the MRP as a crisis instrument.[1] On 23 November 2015, the EMB President addressed an open letter to the President of the EC, requesting the dismissal of the Agriculture Commissioner for his alleged failure to understand the serious problems facing milk producers. In January 2016, Mr Juncker replied to the EMB President, noting how the EMB "*point of view on a regulation of the milk*

[1] European Milk Board press release dated 11.11.2015

market is not shared by the main stakeholders of the dairy sector" and that "*it further goes against the decisions taken by the legislator during the reform of the Common Agricultural Policy in 2013*" (Juncker, 2016).

It is within this policy-sensitive frame that this report commissioned by the Committee of the Regions is developed. The report sets out to evaluate the proposed MRP taking 2014 as a test year to examine both its feasibility and likely efficacy.

1.2 Background and description of the MRP

The Market Responsibility Programme (MRP) has been proposed by the EMB (Box 1) and the German Dairy Farmers' Association (BDM) as a tool to be used to counteract looming market crises in the milk sector when there is a risk of a milk market imbalance. It is meant as an instrument to manage milk supply within the EU in order to offset demand fluctuations and to maintain milk prices stable at a level that covers the average production costs of producers.

Box 1. Who is who: the European Milk Board

The European Milk Board (EMB) is an umbrella organisation of dairy farmer associations and farmers' lobbies. Currently, the Board has 20 members in 14 EU countries plus Switzerland. More cooperation agreements with organisations in other countries are in place. Established in 2006, EMB reports to represent today some 100,000 milk producers. This is out of a total of 572,280 specialist dairying holdings in the EU and some 135,000 holdings having cattle-dairying combined with rearing and fattening (2013 Eurostat data). EMB EU members include: *IG-Milch*, Austria; Flemish Milk Board (FMB) and *Milcherzeuger Interessengemeinschaft* (MIG), Belgium; *Hrvatski Savez Udruga Proizvodaca Mlijeka* (HSUPM), Croatia; *Landsforeningen af Danske Mælkeproducenter* (LDM), Denmark; *Organisation des Producteurs de Lait* (OPL) and *Association des Producteurs de Lait Indépendants* (APLI), France; *Arbeitsgemeinschaft bäuerliche Landwirtschaft* (AbL) and *Bundesverband Deutscher Milchviehhalter* (BDM), Germany; Irish Creamery Milk Suppliers Association (ICMSA), Ireland; APL *della Pianura Padana*, Italy; Latvian Agricultural Organisation Cooperation Council (LOSP), Latvia; *Lietuvos pieno gamintoju asociacijos* (LPGA), Lithuania; *Lëtzebuerger Mëllechbaueren*, Luxembourg; Dutch Dairymen Board (DDB) and *Nederlandse Melkveehouders Vakbond*, the Netherlands; *Organización de Productores de Leche*, Spain; and *Sveriges Mjölkbönder*, Sweden. The EMB has an office location in Brussels. Its executive body is the Executive Committee which meets every 6-8 weeks. Within the Executive Committee are the representatives from seven member organisations. At the time of writing, the President of the Committee is from BDM, Germany, and the vice-president from the DDB, the Netherlands, while the five advisors are from member organisations in Belgium, Denmark, France, Ireland and Italy. *Source: EMB website.*

The EMB has advocated the basic idea of controlling supply to manage the milk market since it was founded in 2006 although its specific proposal for an instrument has evolved over time. In 2009 and 2010, the EMB proposed an earlier version of milk supply management in its evidence to the High Level Expert Group on Milk which was established on 5 October 2009 by the EC in the light of the then-difficult market situation for milk. The current MRP has evolved considerably from the original supply management ideas put forward by the EMB in 2009/2010 although common features are apparent. This report tests the MRP as proposed recently, but its antecedents are briefly charted in the next paragraphs to provide some additional background information.

The EMB submissions to the High Level Expert Group on Milk in 2009/2010

The basic objective of the proposal put forward by the EMB in its evidence to the High Level Group was "*[t]o make the position of the producers in the market stronger and to achieve cost-covering milk producer prices*" (EMB, 2009). The EMB called for "*a pooling of producers in large producer associations, independent of the downstream stage and legally empowered to alter the milk volume in line with the market situation*" (EMB, 2010). It called on the EU to adopt "*a directive exempting the milk producers from the cartel ban, allowing them to pool their resources on a national and European level and giving them the right to take volume-regulating measures to prevent surpluses*" (EMB, 2010).

For the EMB, the purpose of supply management was to limit milk supplies to internal market demand. "*So, from the outset Europe should only produce as much milk as can be sold on the internal market or high-price export markets. This requires a close observation of the market development, something the Monitoring Agency called for by the EMB could do*" (EMB, 2010). "*The configuration of the milk market should respect the principle of food sovereignty and with it the right of EU and of other countries to supply themselves with food*" (EMB, 2010a).

Linked to this was the EMB view that supply should be managed so that "*the prices [producers] are paid for their produce cover the costs…. What is necessary instead is to watch milk producer prices and production costs closely and to align them. To do so, it is crucial to* ***adapt the milk supply to demand*** *and to* ***enable producers to reduce or increase their milk volumes***" (emphasis in original) (EMB, 2010). This view was proposed in contrast to the view that prices should be determined by the market mechanism of supply and demand. "*What we have seen in recent years and decades proves that in the European milk market, which features substantially interchangeable qualities, it takes only*

relatively small surpluses of supply to produce disproportionate slumps in prices" (EMB, 2009).

The EMB pointed to the fact that "*In structural terms, the milk producers are the weakest link in the food chain*" (EMB, 2009). When dairy product markets are over-supplied and prices slump, the processing industry is protected because it can pass the lower prices of its products back in terms of lower prices paid for its raw material. According to the EMB, "*[This] asymmetry to which the European Commission refers in its latest communication*[2] *cannot be replaced or equalised by direct state payments, intervention or export subsidies. This asymmetry calls for structural changes to the basic legal framework*" (EMB, 2009).

The EMB argued that alternative measures to address temporary periods of over-supply and market imbalance, such as storage, the use of export refunds or improved contractual relations, are either not effective or not acceptable. In the case of intervention purchases or aids to private storage, the build-up of stocks inevitably has a depressing effect on market prices as long as the stocks persist. Export subsidies are unacceptable because "*such subsidies distort the markets in non-EU nations. In concrete terms this means that local structures of milk production in developing countries are destroyed because of EU-subsidised, imported products. To some extent this has caused an increase in hunger*" (EMB, 2010).

The EMB also argued that contractual relations cannot lead to an equitable outcome as long as the considerable bargaining asymmetry between producers and dairies exists. "*As long as they are not given any chance to react effectively in a co-ordinated, joint way to falling prices with reduced production, they will never be in a position to negotiate at all. It is not enough to refer to the possibilities of each individual milk producer to react, because the reactions of individuals have no effect on the market, as all experience shows. What is required instead is the real possibility for milk producers to act in unison or generally binding provisions, as they are part and parcel of regulating quotas*" (EMB, 2009). The EMB explained the problem of bargaining asymmetry in the following terms. "*The current asymmetry in bargaining positions on the market to the detriment of the producers is due to their being given no opportunity (i.e. they are even deprived of this possibility by eroding the quota) to adjust their milk supply actively and flexibly to demand. As long as they are not given the chance to react together in a co-ordinated and effective way to plummeting*

[2] COM(2009) 591 'A better functioning food supply chain in Europe', Provisional version, 29.10.2009.

prices by cutting production, they will never be in a position to bargain at all" (EMB, 2010a).

The EMB recognised that milk producers had to be in a position to reduce or increase the milk volume. "*That means restrictions on volumes are still needed on an individual farm level and that a general binding commitment enables producer associations to adjust supply with the aid of voluntary volume reductions*" (EMB, 2010).

The EMB proposal to the High Level Group in November 2009 consisted of four elements which it believed would only have the desired effect when taken together, and which continue to play a role in the proposed MRP.[3]

i) Monitoring Agency

According to the EMB: "*To analyse and estimate supply and demand, a European Monitoring Agency has to be set up in which every side of the milk market is represented: milk producers (EMB), the dairy industry, the retailers, consumer organisations and politicians. This agency would ascertain the costs of milk production on a regular basis. The corresponding cost-covering producer price would be the yardstick for stipulating the volume of milk and the use of various mechanisms by the Monitoring Agency*" (EMB, 2009). The requirement to have all those with an interest in the milk market represented on the agency was intended to prevent abuse and ensure that society's interest was respected.

ii) Producer-financed levy

The EMB proposed that "*A legal basis has to be created that allows for the introduction of a producer levy that is binding on every milk producer in the EU. This shall be used to finance demand-oriented supply control, i.e. enabling the volume to be adjusted depending on the development of demand*" (EMB, 2009).

iii) Universal applicability

According to the EMB, "*An EU-wide, legally enshrined limit on supply based on reference volumes for individual farms is required to enable market-shaping instruments to bite*" (EMB, 2009). A key role in the transmission mechanism

[3] The EMB November 2009 Position paper also included a fifth, transitional, element of measures to be implemented in the short term to raise producer prices. It called on politicians to implement a rapid reduction in milk so that dairies could pay cost-covering milk prices as quickly as possible.

between the volumes stipulated by the Monitoring Agency and the volumes produced at farm level was envisaged for producer associations at the national and EU level which were seen as the means by which volumes would be adjusted. "*The most important task of the producer associations will be to implement adjustments to volumes as stipulated by the milk market configuration agency. The European producer association will then pass the necessity of reducing or increasing the milk volume on to the national producer associations. The European producer association must also be able to respond to unavoidable slight surpluses in supply by resorting to a strategic stockpile reserve to stabilise the market*" (EMB, 2010a).

iv) Uniting the milk producers

The EMB finally proposed the creation of a legal basis "*that enables milk producers to unite on the level of the member states, and additionally into producer co-operatives that can operate independently of the dairies and are given the right to take effective measures for the flexible adjustment of supply to the actual market demand*" (EMB, 2009). The EMB envisaged that contractual negotiations would take place between milk producers and processors "*[s]pecifying a target price bracket based on the monitoring of production costs (Canadian model) [and] stipulating the milk volumes to be produced, geared to the achieved price level and in line with market demand*" (EMB, 2010a).

In summary, the basic idea of this proposal was that dairy producer super-levy fines and the expenditure used for export subsidies and intervention purchases would be used to pay for a voluntary and time-limited reduction in volumes during periods of impending low market prices. There was some uncertainty with regard to who would determine the relevant production volumes, whether producer associations alone (as in the January 2010 position paper) or the Monitoring Agency (as in the November 2009 and March 2010 – revised in April 2010 – position papers). Production volumes would be set with a view to supplying the EU market on a self-sufficiency basis (apart from small volumes required for the production of high-value cheese products where exports were still envisaged). Regardless of who would establish the production volumes, the objective would be to ensure a level of prices that would cover the production costs of normal producers (it being recognised that the higher costs of milk producers in marginal areas should more appropriately be borne by the taxpayer through direct payments if society wished to maintain milk production in these regions). The EMB recognised that the proposal, if implemented by producer associations, could be inconsistent with EU competition law and would require an exemption from the cartel ban in order to give producers the right to take volume-regulating measures to prevent surpluses.

Further development of the Monitoring Agency model

In 2011, the EMB produced a further iteration of its ideas on how EU milk supply could be geared to demand (EMB, 2011). The idea for a flexible supply management instrument for milk put forward in '*The European Dairy Market - Supply Management with the Aid of a Monitoring Body'* was further developed in Fink-Keßler (2013) in a report commissioned by the EMB. The 2011 EMB document discussed for the first time how the proposed 'Monitoring Body' might control milk volumes. At the time, milk quotas were still in place. The EMB system built on "*the continuation of an individual farm volume limit which is universally binding that ensures that each and every member of the national or regional dairy farmer organisations or every milk producer adheres to the stipulated volumes*"; however, the system would be made more flexible in the future as "*in future, volumes will be adjusted depending on the market situation*" (EMB, 2011). The monitoring body would be in charge of monitoring the market situation. The monitoring body would "*ascertain the full costs of milk production in Europe, and in line with a defined procedure stipulate the upper and lower limit of the target farm-gate price for 1 kg milk containing 3.7% fat, 3.4% protein. This produces a target range (target price bracket) … for the average European milk price…Should the average European farm-gate price exceed the upper price limit, the volume of milk will be successively increased until the average farm-gate price is back in the bracket. If the farm-gate price falls below the lower limit of the bracket, European milk production will be successively cut back until the farm-gate price is back in the bracket*" (EMB, 2011).

This adjustment in milk volumes would take place through a system of temporary 'delivery rights' or 'supply rights'. When demand is increasing and the European milk price approaches the upper price limit of the target range, additional (time-limited) delivery rights would be created. If there were a reduction in demand, "*these production rights can be withdrawn again promptly and without red tape*" (EMB, 2011).

The system was thus envisaged as a continuous system of market monitoring and intervention and not only applicable in a time of crisis (Fink-Keßler, 2013). At the introduction of this system, in order to create an initial mass of delivery rights, the EMB envisaged a remunerated voluntary buy-out scheme which would reduce the guaranteed quantities each milk producer had under the quota scheme. This would be operated on the basis of an invitation to tender funded either from public funds or from a producer-financed market management fund. These instruments would be backed up by the strategic storage of a limited quantity of butter and Skimmed Milk Powder (SMP) to balance seasonal

fluctuations, avoid supply bottlenecks, and prevent speculation on milk products.

The 2011 document also gives further insight into how the EMB envisaged this supply regulation working in practice. National milk boards would be responsible for implementing the monitoring body's stipulations. Under the 'universal applicability' principle, legislation would be introduced to ensure that every dairy farmer must adhere to the stipulations of these organisations, and the organisations would be able to impose sanctions in the event of non-compliance with their stipulations. An exemption clause in European competition law to allow producers to unite in large dairy farmer organisations would be required to enable this. However, an alternative implementation based on public mechanisms in which the EC would take decisions on the required market volumes and pass these on to the MS for implementation, monitoring and control was also put forward (Fink-Keßler, 2013). The monitoring body itself would be made up of one milk producer representative from each country, with consumers involved as observers while representatives of the dairy industry would contribute their expertise on market developments. The monitoring body would keep track of "*the development of production costs, demand, farm-gate and retail prices, calculate the target price bracket, and in conjunction with the European administration implement and monitor the measures adopted*" (EMB, 2011).

The EMB proposal is based on the assumption that the milk market is very sensitive to changes in EU milk supply. "*Since the milk price already reacts to changes in volume of 1 to 2%, only minor re-adjustments will ever be necessary*" (EMB, 2011). As a result, "*[b]y setting aside a reserve of 3-5 % of the delivery rights, a "reserve volume" can be created enabling changes in the market to be reacted to promptly and without red tape*" (EMB, 2011). The EMB recognised that this would require that the EU can limit volumes of imported milk and dairy products if its own producers are subject to supply controls and that it was important that existing levels of tariff protection would be maintained (Fink-Keßler, 2013).

The EMB Market Responsibility Programme: the concept

The most recent presentation of a flexible supply management instrument by the EMB takes the form of a Market Responsibility Programme (MRP). The MRP was adopted on 15 April 2014 by the EMB at their members' assembly. The proposal was explicitly presented in a press release in November 2014[4] and set

[4] EMB press release dated 21/11/2014.

out in the EMB's *Market Responsibility Programme* document, originally published in November 2014 and subsequently updated.[5]

The concept has evolved further from the previous ideas put forward by the EMB although common features are apparent. The **objective** of the instrument is to address periods of impending market crisis defined as a sharp fall in producer prices and thus to maintain a floor under producer prices at close to average costs of production. The **mechanism** of the instrument is to manage supply (specifically, to reduce supply when prices start to fall below average costs) initially through a quasi-voluntary bonus/malus scheme and, in more serious crises, through an obligatory cut-back for every producer. In contrast to earlier versions proposed by the EMB which would be managed by producer associations (and thus require an exemption from competition law), the **management** of the MRP would be conducted as a public intervention mandated under legislation, presumably as part of the single Common Market Organisation (CMO) Regulation.

According to the EMB, the MRP is a combination of monitoring and response to the market in which the response is elaborated as a three-phase programme: (1) Early warning (Market Index falls by 7.5%); (2) Crisis (Market Index falls by 15%); and (3) Obligatory cutback phase (Market Index falls by 25%).

On market monitoring, the EMB now proposes that the monitoring function would be undertaken by the European Milk Market Observatory (MMO) which would be developed "*into an effective central Monitoring Agency*" (EMB, 2015). The MMO was launched on 16 April 2014 and provides a single web interface with a wealth of raw data for stakeholders in the milk sector. It follows and analyses past and present trends in EU and world dairy markets, production, production costs, market perspectives, and balance between supply and demand. Based on these data, the EMB proposes that the MMO would construct a Market Index comprising the trend in product quotations, milk prices and production costs (margin) which would enable crises to be anticipated. If the index is over 100, milk prices are covering production costs and the market is stable, so no action needs to be taken. If the index falls below the 100 threshold, costs are not being covered. If the shortfall becomes too big, the MRP is started.

[5] This description is based on the EMB document *Market Responsibility Programme* (EMB, 2015), accessed on 20 December 2015, and on unpublished material made available for this report by the EMB (see 'Other material' in Annex II).

1. Early warning (Market Index falls by 7.5%)

Once the Market Index falls to 92.5, the MMO as the Monitoring Agency announces an 'early warning' and various measures are introduced to support the market. For example, private storage is opened and incentive programmes to increase consumption are put in place. These measures are continued until the Market Index returns to 100.

2. Crisis (Market Index falls by 15%)

If, however, the Market Index continues to fall and if it falls below 85, then the MMO would announce a 'crisis situation'. This would trigger the introduction of the core elements of the MRP, namely:

a) A reference period would be established for each individual milk producer. Although the EMB notes that there are several possibilities to define the reference period, it proposes the 12 months before the date the crisis is officially established. A farmer's milk production during this reference period becomes the reference quantity. The EMB notes that special provisions would have to be adopted for new entrants that could not demonstrate a full 12-month production period when a crisis is announced.

b) A call for tenders is issued to producers willing to reduce production in return for a suspension bonus. Specifically, an electronic bidding process is envisaged in which interested farms could register their intention to produce less for a fixed period (e.g. six months) and state the size of the suspension bonus that they would require. There would be a ceiling on the size of reduction an individual farm could offer. "*The level of the reduction per farm should be limited to between 5 and 30 %. Below this level, only deadweight loss effects are to be expected*" (EMB, 2015). In other words, if a farmer could offer to cease 100% of his or her production, there would be a danger that farmers contemplating to leave dairying in any event would apply to enter the scheme. The individual farm's production over the commitment period would be monitored to ensure the farmer complied with his or her obligations. If total production over the period was higher than the obligated quantity, then the farmer would be liable to a fine on the over-quota quantity.

c) The third element of the MRP during this crisis period would be a market responsibility levy on all farmers increasing their milk production above their reference quantities. The proposed level of this levy would amount to 110-120% of the milk price imposed on all milk above the reference

quantity. According to the EMB, "*Interventions relating to quantities must already be taken by producers* ***on an individual farm level according to the 'polluter pays' principle***" (EMB, 2015, bolding in original). The proposal further notes: "*This means that farms which still increase their production in a situation in which supply manifestly exceeds demand also have to bear co-responsibility for their anti-market behaviour. On the other hand, it is more than legitimate for farms that cut their production in a market crisis and thus help overcome the crisis swiftly to be compensated financially*" (EMB, 2015).

d) The MMO would declare the crisis to be over if the Market Index rises towards 100 points and its forecasts for the coming months are positive.

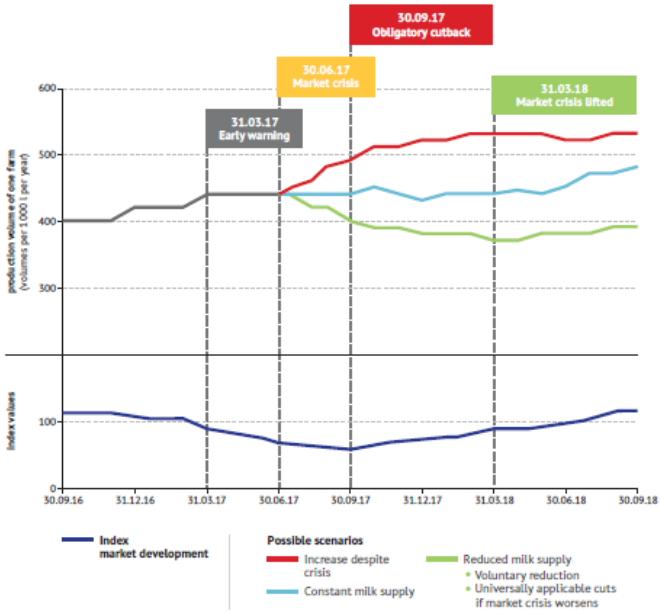
Funding for the suspension bonus would come from the market responsibility levy paid by expanding farmers, from the reserve for crises in the agricultural sector established by Article 25 of Regulation (EU) No 1306/2013 and, if necessary, from an additional producer levy as and when required, limited to the year of the crisis.

3. Obligatory cutback phase (Market Index falls by 25%)

It is possible that the Market Index continues to decline. If it falls to 75, then the third phase of the MRP would be activated requiring a compulsory reduction by all milk producers by 2-3% for a defined period, e.g. six months. This reduction would not be compensated directly, although the costs to producers would be offset by the higher milk price expected as a result of the supply reduction on their remaining milk volume.

The operation of these three stages is shown in the following graphic taken from the MRP proposal document (Figure 1). The evolution of the Market Index is shown in the bottom half of the graph. The top half shows the implementation of the three stages of the MRP as well as three possible paths for the evolution of EU milk production. In practice, only the green line is likely to be observed because production should already start to fall once the second phase of the MRP kicks in.

Figure 1: The three phases of the MRP proposal



Source: extracted from EMB, 2015.

An important assumption behind the EMB proposal is that the milk market is very sensitive to changes in EU milk supply and that the length of time in which the MRP would be in operation would be relatively short. In her expertise commissioned by the EMB, Fink-Keßler (2013) states that experience from the 2009 milk crisis shows that a reduction in the annual milk volume of between 1% and at most 2% is sufficient to stabilise the EU milk price. While these views refer to an earlier version of the EMB proposal, the assumption continues to underlie expectations of how the most recent version would work. In addressing the criticism that the operation of the MRP during a crisis period would block farm development, the EMB response is that "*This problem can be countered by implementing measures immediately and effectively to restrict volumes. The aim is to overcome the crisis as quickly as possible, making it no longer necessary to cap production*" (EMB, 2015).

Other experiences with temporary milk supply management

The US debate on flexible supply management

Although a number of countries have used supply management programmes to influence the dairy market and milk prices, we focus on insights from recent debates in the United States (US) as the US experience is the most relevant to the MRP proposal.

The US, unlike Canada and the EU, has never had a mandatory dairy supply management (quota) programme. However, since the mid-1980s the country has had two government-sponsored and one industry-sponsored voluntary supply management dairy programmes. All these programmes were funded in part through dairy producer levies.

The two government-sponsored programmes in the mid-1980s (the 1984-85 Milk Diversion Program, and the 1987 Dairy Termination Program - Whole Herd Buyout), were once-off programmes designed to limit the growth in milk production, in part to reduce government purchases of dairy products at the minimum support prices. The industry-sponsored voluntary supply management program - Cooperatives Working Together (CWT) - was initiated in 2003 by the National Milk Producers Federation (NMPF), the largest US dairy producer organisation. The purpose of this voluntary programme was to remove cows from the dairy herd in order to reduce supply as well as to provide export assistance to dairy products, although the herd retirement programme was the largest element until it was terminated in 2010. In its 2010 document *Foundation for the Future* (NMPF, 2010) another proposal for a dairy market stabilisation programme was put forward by the NMPF. The programme would be initiated if a defined milk price less feed cost margin fell below certain trigger prices. Once initiated, producers who delivered more than a certain percentage of their base (between 92% and 98%, depending on the severity of the crisis) would receive no payment for that milk, i.e. a super-levy of 100% of the milk price. The funds collected from super-levy fines would be used to purchase cheese for storage to further support the milk price.

Dairy supply management figured prominently in the negotiations leading up to the 2012 US Farm Bill which, in turn, led to the current Agriculture Act of 2014. The financial stress among dairy farmers due to sharply lower milk prices in 2009 (as in the EU) led to renewed interest in ways to deal with fluctuations in milk prices and dairy farm incomes. The United States Department of Agriculture (USDA) established the Dairy Industry Advisory Committee in August 2009 to suggest solutions to price and income volatility in the industry. While a majority of the Committee saw merit in a new Federal programme to

manage growth in milk supplies in line with demand, the Committee as a whole was not prepared to endorse a specific plan (USDA, 2011).

The 2014 Agricultural Act led to a major overhaul of US dairy farm support. The main change was the replacement of the previous dairy programmes (the Dairy Product Price Support Programme and the Milk Income Loss Contract programme) by the Dairy Production Margin Protection Program (DPMPP) - a new income-support program based on the margin between the national average all-milk farm price and a formula-derived estimate of feed costs. In earlier versions of the bill, participation in the DPMPP had been linked to a Dairy Market Stabilisation Programme (DMSP) designed to limit fluctuations in dairy commodity prices. Under the proposed DMSP, milk payments for farmers who produced more than their average seasonal output would have been scaled back to avoid an oversupply of milk on the market thus further decreasing commodity prices. The DMSP would have been triggered when the dairy margin (calculated according to a predefined formula) fell below specific levels using monthly data. Once triggered, dairy farmers enrolled in the DPMPP/DMSP might not receive full payment on their milk deliveries. Milk purchasers would be required to split their payments to milk producers with an increasing portion of payments (ranging from 2% to 8%, depending on the severity of the crisis) going to the USDA and a declining portion of payments (ranging from 98% to 92%) going to the milk producers. The money diverted to USDA would be used to finance promotion programmes for milk products. If dairy producers supplied less milk than some proportion of their DMSP base (ranging from 98% to 96%, depending on the severity of the crisis), no payment reduction would be made. For producers with deliveries above these levels, the payment reduction would be made on all milk delivered.

The DMSP proposal was not included in the final 2014 Agriculture Act, but it generated considerable interest as a dairy supply management program. It was supported by dairy producer groups but opposed by dairy processors. Empirical studies of the version of the dairy market stabilisation programme first proposed by the NMPF in 2010 suggested that the programme would be effective in raising dairy producer prices. The NMPF's own analysis showed that the US milk price would have been USD 1.90/cwt.[6] higher during calendar year 2009, and USD 1.35/cwt. higher during the period January 2009 - July 2010, as a result of the operation of the programme, compared with the baseline of actual prices. This would represent an increase of USD 3 billion for producer income (Vitaliano, 2011). Brown (2011) used the FAPRI monthly dairy model to simulate the effect of the NMPF's version of the dairy market stabilisation

[6] Cwt. stands for hundredweight. It is a unit of measurement for weight and is equal to 100 pounds.

programme assuming that it had been operational in 2009. Brown concluded that its operation in 2009 would have raised milk prices and thus margins leading to an increase in dairy cash receipts of USD 3.4 billion over the March through December 2009 period (the months in which the programme would have been triggered).

There are similarities between the EMB's MRP and the proposed US Dairy Market Stabilisation Programme. The DMSP would have been voluntary in that producers could elect to enrol in the programme, but it was mandatory for those who did enrol in the DPMPP. The programme was triggered by a margin-related index, and the response was to penalise farmers who increased milk production during a crisis period. The instruments triggered by the crisis are slightly different in the two proposals. In the proposed DMSP, the levy on expanding producers would have been used to expand demand through disposals to food banks and promotion programmes. In the proposed MRP, the levy on expanding producers would be used to incentivise other producers to reduce production. Also, in the MRP, if voluntary measures in phase 2 were insufficient to halt the decline in the milk margin, a phase 3 with compulsory cut-backs on all producers could be initiated.

Other recent developments in temporary supply management

In Switzerland, milk prices are under pressure because of the strong Swiss franc and a growing tendency among consumers to purchase milk and milk products across the Swiss border, in addition to the difficulties caused for exports by low world market prices. In January 2016, the *Schweizer Milchproduzenten* organisation called for a supply reduction of 3% in order to strengthen prices on the domestic market.[7] In February 2016, the largest Swiss milk processor *Emmi* offered its direct suppliers a bonus of SFr 0.1/kg (EUR 0.094/kg) for each kg less of milk they delivered compared to the same month 12 months previously.[8] The measure is limited to the months of March and April 2016 (more precisely, the 60-day period from 2 March to 30 April 2016). No compensation is paid to a producer who is exiting production and the maximum amount of bonus that *Emmi* will pay is limited to 50% of the producer's delivery in the same month in the previous year.

At the end of 2015, the Dutch dairy *FrieslandCampina* cooperative introduced a voluntary scheme paying its farmer members to limit dairy output to the same level or lower from January 1, 2016. Producers were paid an extra EUR 0.02/kg of milk if during the period from 1 January to 11 February 2016 they did not

[7] Schweizer Agrarmedien GmbH press release 'SMP: Rund 3 Prozent zu viel Milch' dated 27.01.2016.
[8] Schweizer Agrarmedien GmbH press release 'Emmi belohnt Lieferverzicht finanziell' dated 16.02.2016.

increase their milk deliveries over and above a reference volume, specified as the average daily supply during the 13–27 December 2015 reference period.[9] The dairy group found it could no longer handle the rapidly increasing volume of milk being delivered, and it was forced to dispose of milk it could not process at a spot market price which had slumped to below EUR 0.015/kg. According to the cooperative, around 60% of producers accepted the offer. In six weeks around 35 million kg less milk was delivered and EUR 14.1 million was paid in bonus payments to milk producers, which works out as a bonus of just over EUR 0.40/kg.[10] The scheme ended after six weeks when the cooperative announced that it now had sufficient processing capacity available.

1.3 Positions on the proposed MRP or other production management approaches

EU institutions

Already during the 2009 milk crisis, in response to an invitation from the 18/19 June 2009 Presidency Conclusions of the Council, the EC reviewed various options to stabilise the milk market, including some of the US experiences.[11] However, in COM(2009) 385 the Commission concluded that "*The catalogue of measures shows that the Member States have a considerable number of instruments available to them to alleviate the situation, to assist in the restructuring process and contribute to a soft landing for the dairy sector in light of the disappearance of quotas on 1 April 2015*". In 2010, the Commission, in its first soft landing report for the smooth phasing out of the milk quota system, explicitly envisaged the use of a stabilisation tool in case of serious imbalance of supply and demand. More specifically, "*if other measures available under the single CMO appeared insufficient, the Commission could consider a system based on Article 186 of the single CMO ("disturbance clause") that would allow milk producers, on a voluntary basis, to reduce their deliveries against compensation*" (COM(2010) 727). Nevertheless, the 2015 farm aid package demonstrates that the EC still prioritises existing tools coherent with the new agricultural policy before considering new systems.

Earlier in 2012, a dairy crisis supply management proposal was also conceived by the European Parliament (EP) Committee on Agriculture and Rural Development (COMAGRI) following the 'Dantin report' related to the reform of the Common Organisation of the Agricultural Markets. The proposal,

[9] EMB press release 'Big European dairy introduces voluntary restraint on delivery', 05.01.2016.
[10] See Topagrar.com article 'FrieslandCampina: 35 Mio. kg Milch weniger', 11 Feb 2016.
[11] Accompanying technical annex (SEC(2009) 1050) to the Communication COM(2009) 385 final.

endorsed in plenary by the EP in 2013, envisaged the granting of aid to those farmers who were willing to voluntarily cut their production by at least 5% compared with the same period in the previous year, as well as the possibility to impose a levy on those farmers who, on the contrary, were increasing their production. This proposal was not agreed by either the Council or the Commission and was not included in the eventual reform of the CMO as outlined in Regulation (EU) No 1308/2013. More recently, the EP resolution of 7 July 2015 called for the Commission to implement more responsive provisions for the dairy sector in times of crisis, including a realistic intervention price and an index-based mechanism for warning and crisis anticipation purposes managed by the MMO. The resolution "*Reminds the Commission of its obligation under Article 219 of Regulation (EU) No 1308/2013 not only to address actual market disturbance, but also to take immediate action to prevent it….*" It also calls on the Commission "*to implement more responsive and realistic safety-net provisions, and for the intervention price to better reflect real production costs and real market prices, and to be adapted as the market changes*", and "*to define a market index comprising the trend in product quotations, milk prices and production costs*" (EP, 2015). The latter is part of a demanded overall strengthening of the MMO in the analysis and use of data, including for warning and crisis anticipation purposes.

The Committee of the Regions is the only EU institution having referred explicitly to the MRP in an opinion adopted in plenary in April 2015. The COR positively noted the EMB proposal and considered it worthy of further analysis with regard to its feasibility and effectiveness. The Committee further recommended to "*put in place flexible and effective additional instruments so as to stabilise the milk market and dairy producers' incomes in times of crisis, not least by improving the efficiency of risk management measures, in particular those designed to stabilise incomes, combat market price volatility and guarantee milk prices*" (COR, 2015).

In its own-initiative opinion of July 2015 on the 'Situation after the expiry of the milk-quota system in 2015', the European Economic and Social Committee (EESC) considered the abolition of the quota system a fundamental change. The EESC recognised that the main challenge for dairy farmers is "*the massive income variations related to the volatility of both dairy commodity prices (and hence producer milk prices) and input costs*' and calls on the Commission to '*facilitate the development by Member States and industry of taxation solutions and simple hedging instruments, such as fixed-margin contracts, easily accessible by farmer*" (EESC, 2015). It also recognised the inadequate level of the safety net provisions built into the CAP and urged that these provisions be kept related to actual production costs. However, in terms of production management, the position of the EESC diverged from the position of both the

EP and the COR. In its July 2015 opinion, the EESC explicitly rejected the EP supply management proposal of 2103, endorsing the outcomes of an external review of the proposal by Keane and O'Connor (2013), commissioned by the European Dairy Association (EDA), and of a market and competitiveness study by Ernst and Young (2013). The EESC highlighted that "*Both studies pointed out that production management/quotas were no longer effective in sustaining and stabilising milk prices and incomes. Both studies also pointed out that the proposed 'buy out', or other similar production management measures, would be difficult to implement across the entire EU, as the level of price which can cause an income crisis varies vastly from country to country; it would also be ineffectual because very slow to take effect; and expensive because of the level of compensation producers would need to encourage them to reduce production voluntarily*" (EESC, 2015). The EESC also underlined the studies' findings that the proposal is unlikely to be compatible with an open economy and that if introduced unilaterally would only affect EU milk producers' competitiveness.

Sectorial organisations

The AHDB (Agriculture and Horticulture Development Board) Dairy, UK, is the only independent organisation active in the dairy sector having published a brief review of the MRP. Overall, AHDB Dairy does not consider the proposal a viable option, especially in the light of the market orientation of the sector. Concerns relate also to the practicalities implied by the programme and to the differentiated impact the programme may have on various types of dairy farmers. More in detail, AHDB Dairy expects competitiveness to be affected as, among other side-effects, the programme is likely to limit the efforts of producers towards efficiency and to require the application of import tariffs in order to avoid that what is not produced domestically is simply replaced by increasing supplies from outside the EU. Among the practicalities, the MRP is seen as driving changes in the way retailers are organised, meaning that retailers will interact with a higher number of producers to get the quantities they require, and this will cause some of these producers to be left aside in supply when the cut period ends. On the differentiated impact, AHDB Dairy fears that those farmers having invested in their business in the previous 12 months will see their production cut not only by a share of their original production level but also by the increase of production achieved through their expansion. In addition, AHDB Dairy argues that there are a wide range of production costs across the EU and across producers. Those dairy farmers able to still earn a positive margin also in times of crisis - because particularly efficient - will be unfairly penalized by a reduction of production (AHDB, 2015).

There are no other direct references to the MRP by sectorial organisations which are not part of the EMB but a few farmers' organisations have expressed a

position with regard to the capacity to respond to milk price volatility through dairy supply management instruments in times of crisis or to the necessity to effectively deal with price volatility. COPA and COGECA, representing some 76 organisations of farmers from the EU, noted in September 2015 that the aid package put forward by the EC includes "*very few measures to help manage the market or deal with the increasing volatility and short term problems*".[12] Besides strong measures, COPA and COGECA also required the re-assessment of the milk intervention prices. This latter request was reiterated in mid-November, when they urged "*for a reflection on the value of the EU safety net price level in these very difficult times*".[13] The European Dairy Association (EDA), representing the European milk processing industry, has objected to the introduction of supply management tools since the COMAGRI proposal in 2013 (see above). At that time, the EDA was part of a wide coalition - gathering EU national farmers' organisations, the European dairy industry, and the European dairy traders - which opposed supply management in the dairy sector after quotas expired (EDA, 2013). The EDA reiterated in a press release dated 1 September 2015 that the market orientation of the dairy sector is crucial. Nevertheless, it also recognised that "*Increased short term price fluctuations ('volatility') will inevitably continue in the future. Therefore, it is appropriate to take the political decision toward policy stability and to keep a residual arsenal of market support tools available for the EU Commission to address the extremes of price volatility. And this residual arsenal must also be kept efficient with – for instance – intervention price levels that reflect todays' realities*".[14] According to EurActiv.com, the EDA does not agree with the recurring demonstrations by dairy farmers and opposes the capping of production put forward by the chairman of BDM. In particular, the EDA Secretary General noted that "*Implementing the system would require a massive bureaucratic effort. High milk production is not limited to Europe, but is a worldwide phenomenon, with the likes of New Zealand and Australia also affected*".[15]

[12] COPA & COGECA press release dated 15/9/15
[13] COPA & COGECA press release dated 16/11/15
[14] EDA (2105), press release dated 1. 9.2015
[15] EurActiv (2015), Disputes reignited over milk prices ahead of EU crisis meeting, press release dated 2.9.2015

1.4 The MRP's operational functioning

The EMB proposal sets out a concept for a dairy market stabilisation programme but leaves many details unanswered. The practical implementation of the MRP in addressing a critical market imbalance raises several issues which require further analysis and which are not addressed specifically in the proposal. In testing how the scheme might have worked in 2014, it will be necessary to assume particular rules or methodologies for some of these issues in order to have a workable model. Similarly, other issues would need to be defined or clarified before the scheme could be practically implemented. In particular, the following questions arise.

Who would construct the Market Index?

The EMB envisages that the Market Index would be developed by the MMO as its suggested Monitoring Agency. It suggests to use for a first assessment already existing indices "*....until a realistic "market development index" has been developed in cooperation with academics, representatives of the industry, market analysts and politicians.*"[16] The MMO already has an expert board but the EMB proposal seems to point to a separate committee with the sole function of designing the Market Index.

How to define the Market Index?

The first task facing such a committee would be how to define the Market Index which is envisaged as a margin index, as it takes both prices and input costs into account. The intention is to track the evolution of the dairy farm margin rather than just producer prices alone.

One question to be answered is the range of costs which should be deducted in arriving at the dairy margin. Costs include operating costs, depreciation, and external costs (see Box 2). For practical purposes, only costs for which there are EU-wide data on (at least) a monthly frequency could be considered. In constructing the index, the treatment of decoupled payments as well as receipts from cull cows and calves would need to be decided. The MMO currently constructs a gross margin index in which operating costs are subtracted from producer revenues ignoring decoupled payments. An alternative, following the US lead, would be to devise a simpler index which might be just the margin over feed costs. The EMB concept is that the MRP would ensure that the farmer's total costs of production would be covered, but this would not preclude that the

[16] EMB (2015), *Market Responsibility Programme – Market index,* unpublished document.

MRP could be triggered by a Market Index based on a narrower set of costs, assumed closely correlated with the development of total costs, particularly if this meant the data requirements would be more manageable. If a broader index is favoured, the issue of how to allocate fixed costs at farm level between the dairy and other enterprises on the farm must be addressed. The MMO has devised a particular allocation formula (the model is described in detail in EC 2014, Annex I) but any formula can be criticised as arbitrary. The choice of the allocation formula will obviously influence the size of the calculated dairy farm margin.

How to address the variation in production costs and margins across the EU in the Market Index?

The Market Index is proposed as an EU-wide index intended to track the average prices and costs of production of a dairy farm over time. It will be necessary to decide on the cost structure and margin for the 'average' EU dairy farm in order to calibrate the index. However, both milk prices and production costs on dairy farms vary greatly across the EU, depending on country, scale of production and management factors. Fink-Keßler (2013) noted that the great diversity of European dairy farmers could create difficulties for the Monitoring Body "*to ensure a fair balance of interests between Europe's dairy farmers*" and would require further studies and deliberations.

Would the choice of a 'representative farm' for calibration purposes be based on average prices and costs for all specialist dairy farms in the EU or for some sub-set of specialist dairy farms only, such as economically viable farms? The choice of the representative farm plays an important role in setting the original benchmark for the Market Index. It will also influence the dynamic behaviour of the index over time because it will determine the breakdown of total revenues into the different cost elements and the residual margin. The variation of producer prices and production costs across MS in the EU is discussed in Box 2.

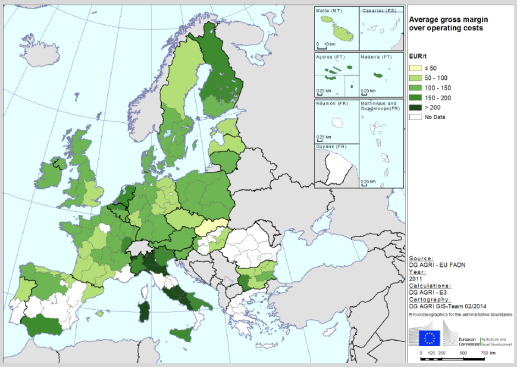
What about data sources, availability and timeliness, for the Market Index?

Key to the successful operation of a Market Index would be the timeliness of data to enable the Monitoring Agency (assumed to be the MMO) to identify the onset of an impending market crisis. The EMB does not explicitly state the frequency of the Market Index but it is likely that it would be a monthly index. The milk margin index tool published by the MMO is based on FADN data and price-trend information from DG Agriculture and Eurostat. Given the delay in the availability of some information, the tool "*provides estimates within two months of the end of the reporting quarter*" (EC, 2011). The latest milk margin estimate of the MMO at the time of writing (end-February 2016) was uploaded

on 24 November 2015 and provided quarterly margin estimates up to the 3rd quarter of 2015, implying a five-month delay. These margin estimates are presented for the EU as a whole but not for individual MS. In fact, there are still gaps in the data provided by MS on input costs despite the efforts to date of the MMO.

Box 2. Variation of producer prices and production costs across the EU

The map below, extracted from EC (2014), shows the average gross margin per tonne with coupled payments by region. As noted by the Commission, "*The best performing regions are those with high average milk prices (e.g. in Italy), coupled support (e.g. in Finland) or low costs (e.g. in Spain)*" (EC, 2014).



The variation shown in the map is the result of variation in both producer prices (available through the MMO website) and production costs across MS. In 2014, the average weighted milk price for the EU as a whole was 37.16 EUR/100kg. However, the price varied from a low of 28.68 EUR/100kg in Lithuania, to average prices of 44.27 EUR/100kg in Finland and 43.18 EUR/100kg in Greece (the price of 46.94 EUR/100kg paid in Malta is a clear outlier). Data on production costs are not published on the MMO website but collected annually by the Farm Accountancy Data Network (FADN) on specialist dairy farms. The share of milk production covered by specialised farms in the FADN is 94% in the EU15 and 70% in the EU10 and the EU2, although there are big differences in coverage among MS. Globally, the FADN sample covers 86% of EU dairy cows, and the production costs are valid for 90% of EU27 milk production. FADN contains information on output and subsidies per enterprise but, as regards costs, it only provides information referring to the farm as a whole. Therefore, production costs per enterprise have to be estimated. Total costs in the FADN database include:

- *Operating costs*, which include *specific costs* (for milk production, they cover purchased concentrates, purchased coarse fodder, farm use of non-fodder crops, specific forage costs, milk herd renewal costs, the milk levy and other specific livestock costs (veterinary etc.); and *non-specific costs* (upkeep of machinery and buildings, power (fuel and electricity), contract work, taxes and other dues (excluding the milk levy), taxes on land and buildings, insurance for farm buildings and other direct costs (including water as regards the model for milk)).
- *Depreciation.*
- *External factors*: i.e. wages, rent, and interest.
- *Imputed family factors*, which cover: family labour cost and own capital cost (own land cost + estimated cost for own capital except land – interest paid).

The results for total costs (in EUR/tonnes of milk) are obtained by dividing the average costs in each MS by the average quantity of milk produced in that MS (and not by the weighted average of the individual ratio by farm). These average figures by MS do not take into account variability of production costs *within MS*. The variation of production costs across *farms* is thus even higher than the variability across *Member States*. The great diversity in milk prices and margins among the MS emphasises the difficulty in introducing any margin-based trigger as a basis for an EU wide safety-net policy.

How to design a forward-looking Market Index?

Linked to the questions of data availability and timeliness is the fact that the EMB envisages that the index should be forward-looking to anticipate crises in EU producer prices and margins. It assumes there is a tight relationship between world market prices for dairy products and EU milk producer prices, with a time lag (four months is suggested). This would allow replacement of the actual EU producer price for milk in the Market Index with a derived price estimated from the movement in world market prices for dairy products. This might be possible for the price component of the Market Index either because there are well-established lags between world market dairy product prices and EU producer prices, or because of the availability of a futures market for dairy products which could be used to predict the EU producer price for inclusion in a forward-looking Market Index. The EMB's idea is that the use of global quoted prices for dairy products "*would allow the time needed for adequate crisis management with a timely effect*".[17] However, it would be more difficult to find reliable predictors for the prices EU farmers might pay for inputs which are also needed for a forward-looking margin index.

To which year should the Market Index be calibrated?

The Market Index will have to be calibrated to a particular year or set of years. Given the volatility in prices and margins in recent years, this choice of base period will be crucial in determining the periods when the index might be triggered.

How to update the Market Index?

The construction of the Market Index has many similarities to the 'objective method' used by the Commission to set intervention prices in the CAP in the 1970s. The 'objective method' was used to determine the annual CAP price increases which would be necessary to give economically viable farms an increase in net income comparable with non-farm incomes and thus maintain their economic viability. Year-on-year changes in farm costs and the movement in non-farm earnings were combined to calculate the 'necessary' change in farm prices, assuming that the volume and input structure remained unchanged (Bowler, 1985).

There is no mention of the treatment of inflation in the EMB proposal so we assume that the Market Index would be constructed in nominal terms. This

[17] EMB (2015), *Market Responsibility Programme – Market index,* unpublished document.

would imply - assuming the existence of inflation - that the value of the support provided by the instrument would gradually diminish in real terms. More important is how technical progress in milk production might be taken into account. Without this, the Market Index could quickly get out of touch with the longer-term trend in milk market prices if, because of technical progress, the real market price of milk steadily declined. In the 'objective method', a 1.5% annual deduction was made to account for the increased productivity assumed to result from technical progress. Despite this deduction, EU intervention prices calculated according to the 'objective method' quickly became detached from market prices. Recalibrating the Market Index on a rolling three-year basis might be one way to avoid this outcome. It would also allow for periods (such as 2008-2013) which global supply and demand factors led to a sharp upward swing in market prices, although the time lag built into a 'rolling basis' model would inevitably lead to the possibility of market distorting interventions using an index trigger.

How to define the trigger points?

Trigger points are set when the Market Index reaches levels such as 92.5, 85 or 75. How rigid are these thresholds? Is a fall below these thresholds for a single month sufficient to trigger a response or should a longer period be required? The proposed US DMSP would have used prices in successive two-month windows to determine interventions. What about the suggestion that the Monitoring Agency should also take future trends into consideration when deciding on its response to changes in the index?

How to define the reference period and quantities for dairy farmers?

In order to implement the supply cutbacks in stages 2 and 3 of the MRP, the authorities would have to assign each farmer a reference quantity, which would be the amount of milk produced (or delivered) in a reference period. The precise way in which the reference period and reference quantity would be defined has great significance both for those producers who would be affected and for the effectiveness of the MRP. A variety of different reference periods are suggested in the EMB documents, including the possibility that reference periods would be defined differently for producers offering voluntary suspension and for those undertaking expansion during a crisis period.

The first proposal is that "*the reference period encompasses the 12 months before the date the crisis is officially established*" (EMB, 2015). The advantage seen for this option is that "*In this way even the individual farm supply curves are taken into consideration. This seems particularly appropriate in view of the very different individual farm strategies, e. g. seasonal calving.*" It is recognised

that special arrangements would need to be made for newcomers to dairy production who would be unable to show a 12-month reference period. A second option, in the case of farmers increasing production, is that the reference period would be the months corresponding to the duration of the crisis period in the previous 12 month period. This is explained as follows. "*The supply behaviour of individual farms can be worked out easily after the crisis is over by making a comparison with the reference period. For example: The crisis lasts from 1 October 2014 to 28 February 2015. In this case the reference period is from 1 October 2013 to 28 February 2014*" (EMB, 2015). As the length of the crisis cannot be known in advance, this way of setting a producer's reference quantity would create a huge amount of uncertainty as to the cutback required from those dairy farmers who might otherwise intend to expand. A third proposed option would seem to suggest that the reference period could be the production in the month when the MRP is announced, or some virtual or hypothetical level of assumed 12-month production centred on that month. For example, the EMB proposes that the penalty payment would apply to farmers "*who produce more after the crisis has been announced*"[18]. This seems to hint that the reference quantity would be defined as the level of production in the month preceding the announcement of the crisis. This interpretation is supported by the example given of the farm that wants to grow by 50 cows, and by the time the crisis is announced already has 25 more cows stabled. Here the EMB proposal is that "*Then the volume produced in the reference period plus the **expected** production of the 25 cows already stabled would apply*" (bolding added)[19]. This alternative signals that it would not be the quantities produced in the previous 12-month period that would determine the farm's reference quantity, but rather the expected quantities that would be produced given the number of dairy cows producing in the month when the MRP is introduced. How this expected production quantity would be determined is not further explained.

There are other issues that would need to be clarified in determining a farm's reference quantity. The MRP is envisaged as being in place for a relatively short period, usually less than one year. The reference quantity is based on a farm's 12-month average production (whether historical or expected). But because of seasonality actual production does not take place evenly across all months of the year. Actual production in any 6-month period, for example, is not necessarily representative of a producer's 12-month production if there are seasonal patterns in production. So it is not obvious how the Monitoring Agency would determine

[18] EMB (2015), *Questions and Answers Relating to the Market Responsibility Programme (MRP),* unpublished document.
[19] *Ibid*.

if a producer's actual production during the crisis months represented additional production or not.

Another technical question to be clarified in defining the reference period is the month from which it would be calculated. The EMB proposal is that "*If the crisis is announced and the MRP applied, the volume of the reference period applies*"[20]. This seems to indicate that the reference period would apply from the announcement of stage 2 of the MRP (the crisis period). An alternative is that the reference quantities would be calculated from the moment of the announcement of stage 1 of the MRP (the early warning monitoring period).

A final unclear issue relates to the administration of the defined quantities and concerns the nature of the contract which would be offered to those farmers willing voluntarily to reduce supply in return for a suspension bonus. It is anticipated in the EMB proposal that these contracts would be for the period of the crisis plus an additional three months, but it is not specified if producers would be required to meet their reduction targets on a month-by-month basis or cumulatively over the period. In the latter case, one could envisage that the reductions would be back-loaded and would occur mainly in the second half of the period (e.g. as cows are dried off a little earlier). This latter option would be more attractive to producers, but it would mean that the immediate impact on the EU market balance would be much less than if the reductions were to take place in the first month of the contract.

The way in which the reference period is defined and administered is obviously crucial in evaluating how the MRP will impact on individual producers and on the EU milk market. The assumptions we make in the simulation analysis are described later in Part 2 of this report.

How would the Monitoring Agency implement the voluntary reduction programme?

There are two possible mechanisms proposed whereby the Monitoring Agency might select those producers who would be paid the suspension bonus in return for reducing production during a market crisis. One approach would set a quantity target and invite bids from producers to suspend production stating the bonus they would require. Producers might indicate that they would be prepared to reduce different volumes of milk at different levels of the bonus. The Monitoring Agency would then accept bids starting from the lowest suspension bonus offered by farmers, until the target reduction is achieved.

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[20] *Ibid*.

The EMB also appears to envisage a second approach which would offer particular levels of suspension bonus on a declining scale over time, leaving it up to producers to decide how many would find it attractive to offer to reduce supply at those bonus levels. "*It could begin with a high level of remuneration, which is then reduced over the course of time: for instance, 30 cents/kg for tenders submitted by milk producers in the first week, 20 cents/kg for tenders in the second week and 10 cents/kg in the third week. This ensures a quick take-up from those interested*" (EMB, 2015). However, under this approach, the Monitoring Agency would not know the precise level of take-up in response to the offered suspension bonus until after the offer was made, risking that the reduced volume of production is too high in proportion to total production or not high enough to make a difference to the market.

The two approaches would likely have very different outcomes in practice, so it would be important to clarify the precise mechanism the Monitoring Agency would use to select those farmers to whom the suspension bonus would be paid.

How would the Monitoring Agency decide on the quantity of milk to be withheld?

An assumption behind the EMB proposal is that the removal of relatively small quantities of milk would be sufficient to correct temporary market imbalances. During the obligatory cut-back phase of the MRP, the EMB proposes compulsory reductions of 2-3%, implying that the target reductions in the earlier crisis stage 2 using the voluntary buy-out scheme would be smaller than this, in the range 1-2%.

If the voluntary mechanism was insufficient to halt a slide in milk margins, then the compulsory reduction mechanism would kick in. It is unclear what would happen if, for whatever reason, a reduction of 2-3% proved insufficient to return the Market Index to a level close to 100. One possibility, in this case, is that the Monitoring Agency would announce a further tightening of the compulsory reduction, increasing it to 4-5%. The impact of uncertainty around the scale of these compulsory cutbacks on producers who might have borrowed money to fund expansion would need further deliberation.

Another issue with implementation is whether account would be taken of regional considerations in the selection of suspension bids. One consequence of the very different production costs and margins across and within MS is that the incentive provided by a particular suspension bonus will have very different attractiveness to producers in different countries. Given a uniform suspension bonus paid across the EU, it is very likely that producers offering to reduce

production would be concentrated in particular countries or even regions. This could cause difficulties for processors in those regions. However, if the Monitoring Agency selected participants with a view to evening out the geographical spread, this would imply that producers in different MS would be offered different levels of suspension bonus which may be difficult to justify on legal and other grounds.

What would be the length of the commitment period for producers signing up to the voluntary reduction programme?

The MRP proposal notes that "*The commitment period must be contractually stipulated and should encompass the crisis period plus three months*" (EMB, 2015). As it would be impossible to foresee in advance how long a crisis period might last, it is unclear how the contractual commitment would in practice be determined. The commitment period would more likely be for a fixed length (for example, six months) which might then be renewable if the crisis situation continued.

What about the financing of the MRP?

The EMB envisages that the cost of the suspension bonus in stage 2 will be funded from three sources: the market responsibility levy on producers who expand production during the low-margin periods; a contribution from the crisis reserve; and the balance, if required, from an 'additional producer levy' limited to the year of the crisis.

The market responsibility levy envisaged would equal to 110% of the revenue from additional milk above a producer's reference quantity during a crisis period. How will expanding producers react to such a levy? One assumption would be 100% compliance given that it would be totally unprofitable to deliver milk beyond the reference quantity. Another assumption is that compliance would be gradually phased in, as these producers may not be able to adjust their production levels immediately. Also, some producers may choose to deliver above their reference quantities to build these reference quantities for the following year or to be prepared for larger deliveries later in the year if they think the triggering of the MRP will be short-lived.[21] There is an inverse relationship between the effectiveness of the market responsibility levy in restraining production (which is the objective of the MRP) and raising funds to

[21] Brown (2011) in his analysis of the NMPF proposal for a dairy market stabilisation programme in the US assumed that a zero price for additional milk would cut deliveries by 50% below their level otherwise. A higher reduction percentage would lead to greater milk supply reductions but also to a smaller market responsibility levy fund to finance the voluntary buyout scheme in stage 2, and vice versa.

finance the payment of the suspension bonus to those farmers voluntarily reducing deliveries. To the extent that the market responsibility levy is effective in restraining production, the funds it will contribute to the financing of the suspension bonus will be limited.

This puts greater focus on the 'additional producer levy' limited to the year of the crisis required to make up the balance. The nature of this additional producer levy is not spelled out. Would it be a uniform levy on all milk deliveries over a specified period? Would it be differentiated by the size of milk deliveries, with larger producers facing a higher levy? Is the year of the crisis defined as the calendar year or as the 12 months starting from the 'early warning' announcement by the MMO, or is it the 12 months starting when the crisis production disincentive scheme is introduced? In any event, given the uncertainties, the likely size of any producer levy required to be collected over a period of 4-8 months (depending on the length of the crisis period) cannot be known in advance.

What should be the legal basis for the MRP?

As mentioned earlier, the Commission in its first soft landing report raised the possibility, in case of serious imbalance, to consider a system based on Article 186 of the single CMO ('disturbance clause') that would allow milk producers, on a voluntary basis, to reduce their deliveries against compensation (COM(2010) 727). The updated market disturbance clause in the revised common market Regulation (EU) No 1308/2013 (Article 219) reads: "*In order to react efficiently and effectively against threats of market disturbance caused by significant price rises or falls on internal or external markets or other events and circumstances significantly disturbing or threatening to disturb the market, where that situation, or its effects on the market, is likely to continue or deteriorate, the Commission shall be empowered to adopt delegated acts in accordance with Article 227 to take the measures necessary to address that market situation, while respecting any obligations resulting from international agreements concluded in accordance with the TFEU and provided that any other measures available under this Regulation appear to be insufficient*". The question is whether such a far-reaching programme as the MRP could be legitimised under this Article. Our view is that this is not the case, as intervention would be triggered even if it might be the case that the other instruments available in Regulation (EU) No 1308/2013 might be sufficient to address the crisis. Also, the Commission proposed the use of the disturbance clause in the context of a voluntary cut-back by producers against compensation, but stage 2 of the MRP requires a punitive levy on expanding producers and stage 3 of the MRP requires a compulsory reduction by all producers. It is thus

very likely that a separate legal basis for the MRP would be required within the single CMO Regulation.

Part 2 Simulating the operation of the MRP in 2014

2.1 Conceptual framework

The objective of this report is to evaluate the effectiveness and feasibility of the MRP described in Part 1 taking 2014 as a test year, making use of existing and publicly available input data. The evaluation of the MRP is divided into two parts:

- An examination of the likely **effectiveness** of the MRP in raising milk prices/margins and the costs associated with this instrument. We define effectiveness as the ability of the scheme to lift the milk price and improve dairy farmer incomes at a reasonable cost. This examination is undertaken in this Part 2 of the report.

- The examination of the **feasibility** of the scheme. This examination is undertaken in Part 3 of the report and will take a broader range of factors into consideration. These factors include, for example, the ability of the authorities to make the relevant decisions in a timely manner, the practicality of implementing these decisions, and the likelihood that the scheme would work without negative side-effects for other EU dairy stakeholders or put at risk the longer-term health of the EU dairy industry.

To test the effectiveness of the MRP in 2014 (and into 2015) requires us to answer **four questions**:

1. Which phases of the MRP would be triggered in 2014 and 2015 and for which months?

2. How much milk would be removed from the market each month during the operation of the MRP?

3. How would the milk price received by dairy farmers (also called the raw milk price or the producer price) respond to the removal of this milk?

4. What would be the impact on dairy farmer incomes as well as the likely cost of these interventions?

The estimation of these effects is accompanied by great **uncertainty**, due to the lack of precise information on the behaviour of market actors in response to the

implementation of the MRP. Two particular sources of uncertainty can be highlighted. First, the extent of the increase in EU milk prices following any reduction in supply due to the MRP depends on the reactions and behaviour of farmers and processors to changes in the milk price. This behaviour is captured in what economists call price 'elasticities' of supply and demand. The effectiveness of a supply reduction scheme in raising milk prices will depend on the values assumed for the price elasticity of demand among processors for both domestic use and exports and the price elasticity of supply among producers and importers. Because we assume that the MRP works on a monthly basis, we need short-run estimates of the value of these price elasticities at the level of the raw milk market. Such estimates are not readily available. A second source of uncertainty is the relative size of the group of expanding milk producers whose production would be restricted by the market responsibility levy. The greater the volume of additional milk delivered by these producers, the more effective will be the MRP in lifting overall milk prices. Again, information on the dynamics of milk production at farm level for the EU as a whole is not readily available. Our approach, therefore, is to provide a range of estimates based on plausible assumptions for these input values, leaving it to further work to improve these critical parameters.

Our **methodology** can be summarised as follows:

(1) The gross margin index developed by the FADN unit in DG AGRI, and updated on the MMO website, is used as the 'Market Index' although the base period is adjusted in order to trigger the MRP in 2014.

(2) The amount of milk that might be removed under the two stages of the MRP is estimated separately for stage 2 (voluntary buyout plus market responsibility levy on expanding producers) and stage 3 (universally applicable reduction in milk supply by all producers). The simulations are performed using a range of different assumptions as there is a large range of uncertainty around the required parameter estimates.

(3) A simple supply-and-demand model of the EU market for raw milk is used to estimate the likely impact of the milk removed on the evolution of milk prices in 2014. The analysis is done on a month-by-month basis in order to construct a counterfactual MRP path for milk prices and margins to compare to the actual baseline evolution. The key parameters needed for this exercise are various elasticities of supply and demand. 'Best-guess' estimates of these elasticity values based on a literature review are adopted but note that there is a lot of uncertainty about the appropriate values. Sensitivity analysis using different values is undertaken to take account of this uncertainty.

(4) Based on the outcome of (2) and (3), the likely impact on dairy farmer incomes under a range of possible assumptions as well as the possible costs and their distribution among producers are estimated.

The analysis is based on certain **assumptions** which are set out below:

- Monthly data on milk deliveries and prices during 2014 and the first three quarters of 2015 (which were the latest data available at the time of undertaking the analysis) are used.

- Stages 2 and 3 of the MRP are implemented on the back of measures introduced in stage 1 such as private storage aid and measures to expand consumption. We assume that the measures undertaken by the authorities to strengthen the milk market during 2014 correspond to stage 1 and that their impact is already reflected in the actual prices observed in 2014. We therefore do not further consider stage 1 in the analysis.

- The EU is assumed to observe its WTO commitments. Specifically, import tariffs and import quotas for dairy products are assumed to remain unchanged.

- The MRP is assumed to have an impact on milk prices but not on input costs. Thus changes in milk prices are directly reflected on a one-for-one basis in changes in dairy farmer gross margins.

- Perfect competition in the market for raw milk is assumed such that the price gains from restricting milk supplies are fully reflected back in higher raw milk prices. Margins in the processing, wholesale and retail sectors are assumed to remain unchanged.

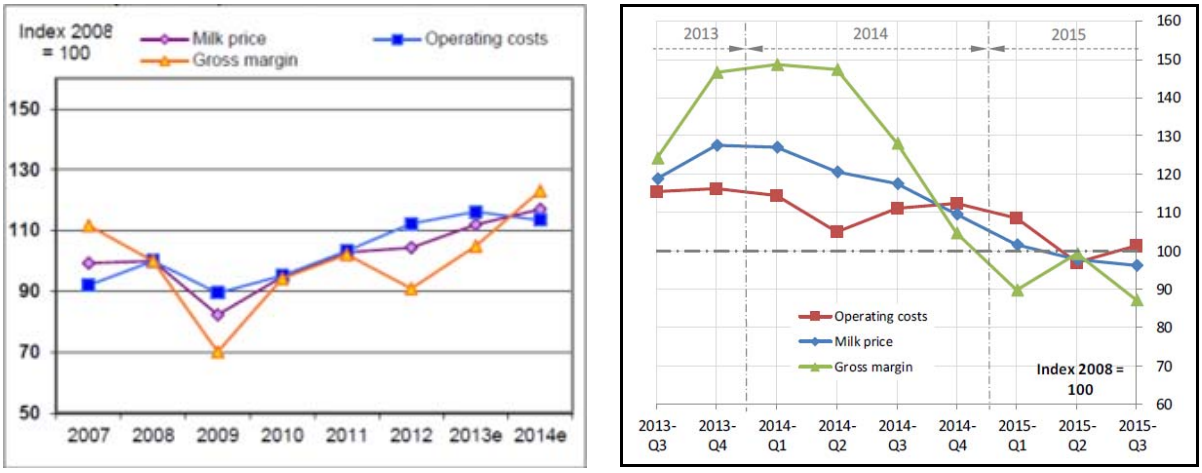
- The introduction of the MRP is assumed not to affect the storage behaviour of processors which are required to store dairy products given the seasonal nature of milk production and the relatively even demand for dairy products throughout the year. In practice, the simplifying assumption that monthly supplies and demand for milk are evenly spread throughout the year has been adopted.

- Any difficulties of implementation or enforcement in this idealised model, either on behalf of the authorities initiating the scheme or on behalf of the farmers required to find ways of reducing milk deliveries at relatively short notice, are assumed away. Further exploration of these questions of administration and feasibility is left to Part 3 of this report.

2.2 Calculation of the Market Index

The MRP is triggered when the Market Index falls below certain thresholds. As discussed in Part 1, an agreed Market Index does not yet exist. For the purposes of this examination, we adapt the Milk Margin Index developed by the FADN unit in DG AGRI and which is updated quarterly on the MMO website (which we will refer to as the 'MMO index').[22] The development of this index (annually between 2007 and 2014 and quarterly from 2013Q3 to 2015Q3) is shown in the charts below (Figure 2). The charts also give the trend in both milk prices and operating costs from which the gross margin index is derived. Both charts refer to the same index with the year 2008 set as the base = 100, but the data in the left-hand chart are annual while those in the right-hand chart are quarterly.

Figure 2. Evolution of the MMO Index of milk margins, annual data (left) and quarterly data (right)



Source: Left hand pane, DG AGRI, EU Milk Margin Estimate up to 2014, June 2015; right hand pane, MMO estimates, November 2015.

The thresholds which would trigger the MRP are those adopted by the EMB. When the Market Index has a value of 100, then production costs are being covered. For the early warning phase 1, the threshold is a fall in the Market Index of 7.5%, i.e. the index falls to a value of 92.5. For the crisis phase 2, the threshold is a fall in the Market Index of 15%, i.e. the index falls to a value of 85. For the obligatory cutback phase 3, the Market Index falls by 25%, i.e. the index falls to a value of 75. It can be seen that, using the MMO index with the base year 2008=100, the MRP would not have been triggered in 2014. For the purposes of examining the impact of the MRP in 2014, therefore, **the base**

[22] The version used is dated 24.11.2015. The MMO index on the website is a quarterly index and is only shown in index form. For the purpose of the simulations in this report, the index has been converted to monthly absolute values as described in the text.

period of the index is adjusted to the first month in 2014 (referred to as 2014M1). This change is made, not to suggest that 2008 is not an appropriate base year or that the milk price achieved in 2014M1 was the price that just enabled dairy farmers' average production costs in the EU to be covered. Rather, this base period is chosen to allow an examination of the consequences of the MRP in 2014 and into 2015 *if* it had been triggered. Indeed, the new base period 2014M1 was the month in which dairy farmers had their highest margin *ever* during the period since 2007. Choosing *any* other base period would simply mean a further delay in triggering the MRP beyond September 2014 and into 2015.

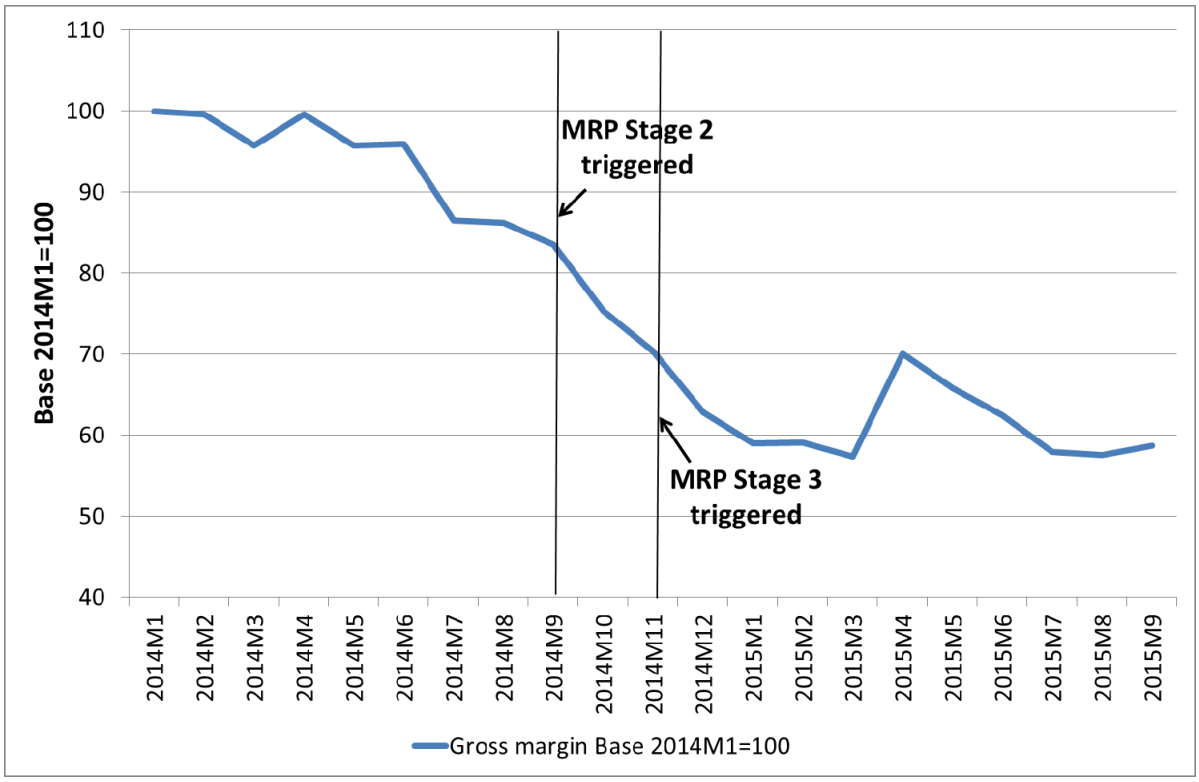
It is assumed that just one month below the threshold is sufficient to trigger the appropriate phase of the MRP, and that the relevant actions under the MRP are implemented fully during the following month, i.e. we assume a one-month lag between triggering a stage of the MRP and its impact on the EU milk supply. The feasibility of this timeline is discussed further in Part 3.

Two further issues should be noted. First, the MMO index is a quarterly index. It is converted into a monthly index by interpolating the monthly values using the development in the EU monthly milk price (thus assuming that input costs remain constant for each month in each quarter). Second, the MMO index is an *ex post* index. In practice, the value of the index for, say, June 2014 is not known to the authorities until some months later. However, we postulate that the values can be derived from some *ex ante* forecasting model such that the observed June value of the index is assumed to be known by the authorities in June so that they act immediately on this information without a time lag. This approach allows a derivation of the observed monthly development in the milk margin in 2014 and 2015, which is then used to compare with the simulated development assuming the MRP had been activated in 2014 (Figure 3).

Based on this approach, the adjusted MMO index to base 2014M1=100 is shown in Figure 3 up to 2015M9 (which was the latest data available on the MMO website when the analysis was completed). In addition, the chart shows when stages 2 and 3 of the MRP would have been implemented based on the observed trend in milk margins through 2014 and into 2015. The second stage of the MRP would have been triggered in September when the index fell below 85 for the first time, with implementation beginning the following month. However, given the continued sharp fall in the index in the remaining months of 2014, the index fell below 75 in November and would have triggered stage 3 of the MRP in that month with implementation beginning in December (though the date for triggering stage 3 would be likely to change if stage 2 had already been implemented). As under the EMB proposal, a number of producers would have entered into six-month contracts to voluntarily reduce deliveries in return for the

suspension bonus at the beginning of stage 2, these contracts are assumed to run their course. In addition, it is assumed that these producers would also have to further reduce their deliveries by the obligatory universally applicable reduction which would be implemented from December 2014.

Figure 3. Evolution of adjusted MMO Index in 2014 and 2015



Source: Authors' computations.

2.3 Determining the quantities of milk to be removed

The amount of milk removed differs under stages 2 and 3 of the MRP. As the MRP proposes universal compulsory reductions of 2-3% of producers' reference quantities in stage 3, the target reductions in stage 2 are assumed to be smaller than this, in the range 1-2%. Specifically, in the simulation, a 2% reduction in domestic milk deliveries is targeted under the voluntary suspension scheme in stage 2, and a 3% universal compulsory reduction is targeted in stage 3. These values are thus at the maximum end of the values envisaged by the EMB.

The reduction in the milk supply in stage 2 comes about through three channels:

- Channel 1: a reduction in milk supplies due to the voluntary reduction by suppliers who are paid the suspension bonus.

- Channel 2: a reduction in milk supplies due to the deterrent effect of the milk responsibility levy applied to the additional milk beyond their reference quantities that would otherwise be delivered by expanding suppliers.

These reductions will be somewhat offset by a third channel, namely:

- Channel 3: the additional incentive to produce among those producers whose production in 2014 and 2015 is lower than their reference quantities, because of the higher prices that would result from the implementation of the MRP. For example, if the milk price in the second half of 2014 was on average 10% higher than the actual milk price due to the MRP, some of those producers with the flexibility to respond (i.e. all those producers who, following the announcement of the crisis, had production lower than their reference quantity) would have produced more milk than they actually did in 2014. A higher internal EU price would also attract more imports than actually observed in 2014.

The effectiveness and costs of the voluntary supply reduction and market responsibility levy are very dependent on the structural evolution and dynamics of changing milk volumes across individual farms. Even where overall milk production at the national or EU level is constant from one year to the next, some dairy farmers will be expanding production and others will be contracting. There will be some new entrants, and some exits. For the EU28, between 2007 and 2013 the annual *average* increase in milk deliveries per dairy farm was 5.4% per annum. This figure varied between a fall of –2.3% in average deliveries per farm per annum in Greece to an increase of +16.6% in average deliveries per farm per annum in Estonia.[23] If the share of total milk deliveries on expanding farms was one-half, then even if milk deliveries remained constant on those farms responsible for the remaining half of output, the average rate of expansion on expanding farms in the EU would be almost 11% per annum. If milk output on the non-expanding farms was on average contracting, then the average rate of annual expansion on the remaining farms would be even higher.

Understanding these dynamics is important for two reasons: (i) it is necessary in order to estimate the potential contribution to the supply reduction in the MRP from preventing those farmers who would otherwise be expanding production from doing so; and (ii) it helps to give an estimate of the **slippage** inherent in

[23] The figures are derived by dividing the change in cows' milk deliveries between 2007 and 2013 by the change in the number of specialist dairy farms over the same period in each country and weighting by milk deliveries by country in 2013. Milk production also takes place on non-specialist dairy farms, so the calculation implicitly assumes that the number of non-specialist dairy farms with dairy cows is changing at the same rate as specialist dairy farms. Data are from Eurostat domains [ef_kvftaa] and [apro_mk_cola].

any supply management programme. 'Slippage' refers to the fact that some dairy farmers who would apply to receive the suspension bonus to reduce milk supplies would have reduced their supplies in any case during 2014.[24] This reduction is already taken into account in the trend in milk volumes, so if these farmers enrol in the supply reduction programme it has no effect. This means that not all of the quantity reduction decided upon by the Monitoring Agency and funded under the MRP will be 'additional' reductions from 'new' contracting producers. The size of this 'slippage' (or 'deadweight') will be a 'best guess', but it is likely to be quite high (why would a dairy farmer who was anyway thinking of reducing production not apply for the suspension bonus?). In the following analysis, a slippage rate of 50% in administering the voluntary suspension programme is assumed.[25] This will influence the effectiveness of **Channel 1** above in the supply reduction programme.

To calculate the quantity of milk removed under **Channel 2** above, the effect of the deterrent of the market responsibility levy on deliveries of milk from expanding producers must be calculated. There are three elements to this calculation:

- The amount of milk produced in 2014 which is delivered from expanding producers and the rate of growth in these deliveries. This gives an estimate of the volume of milk which potentially might be removed.
- The way in which the reference quantities for these producers will be calculated, as this determines the baseline beyond which additional deliveries will be penalised.
- How producers' deliveries will respond to the imposition of the market responsibility levy when it is applied.

EU-wide data to derive information on the shares of expanding producers in each country and their rate of expansion do not readily exist. When the previous milk quota legislation was in force, Member States were required to collect information on deliveries from individual dairy farms but this information was never assembled on a systematic basis across the EU. FADN, which is the only source of consistent farm-level data for the EU as a whole, does not track individual farms from one year to the next. Hence the estimates of the role played by expanding producers in the simulations is based on information from

[24] Some other farmers will have exited milk production in 2014, but under the MRP proposal farmers who are exiting entirely from milk production would not be eligible to apply for the suspension bonus. The MRP caps the maximum reduction from any one producer at 30%.

[25] For the concept of slippage, see McCay (2011). McCay concludes that every 100 cows removed by the CWT herd retirement programme in the US (see Part 1) reduced the US herd by approximately 50 cows in the same quarter (although she found larger longer-term effects). As there is no empirical evidence on which to base an estimate of the slippage rate in applying an EU supply management programme, we opt to apply this 50% figure.

one Member State only (i.e. Ireland), derived both from quota records and from a matched sample of dairy farms in the national farm survey over a number of years.[26] The estimates do not include growth in deliveries from new producers as the EMB proposal recognises that special arrangements would be made for this group.

The Irish data indicate that the share of additional milk from expanding producers in total deliveries varies from year to year (Table 1). The share is positively related to the overall increase in milk deliveries in any year: the higher the growth in overall deliveries, then the greater the contribution of additional milk from expanding suppliers. Expanding suppliers in both data sets are defined as those whose deliveries have increased by 5% or more within a year. The fact that average growth on expanding farms is around 20% per annum is worth underlining when considering the possible effect of the punitive market responsibility levy on expanding suppliers.

Table 1: Farm-level milk dynamics in Ireland

Variable	NFS 2011	NFS 2012	NFS 2013	NFS 2014	DAFM 2013/14	DAFM 2014/15
Increase in total milk deliveries from previous year	7%	–3%	6%	1%	5%	3%
Share of expanding farms in total milk deliveries	42%	18%	54%	38%	50%.	38%
Share of expanding farms in total dairy farms	49%	20%	54%	46%	47%	45%
Average percentage growth in deliveries on expanding farms	25%	21%	18%	18%	18%	16%
Additional milk on expanding farms as percentage of total milk deliveries	**10.5%**	**3.8%**	**9.8%**	**6.8%**	**7.7%**	**5.2%**

Sources: Teagasc, National Farm Survey (NFS) and Department of Agriculture, Food and the Marine (DAFM), Ireland. DAFM figures refer to the milk quota years ending 31 March. Expanding farms are defined as those increasing deliveries by 5% or more compared to previous year.

The key variable for the simulation is the additional milk produced on expanding farms as a share of total milk deliveries (in bold in Table 1). Here the results from the two data sources are broadly in line with each other. The share of additional milk on expanding farms varies between 4% and 10%, with the higher values observed in years when there is a significant growth in overall milk production. These estimates are derived from just one country. However, they are consistent with the *a priori* expectations derived from the Eurostat data previously discussed. In any case, historical information on volume dynamics from EU sources will be derived from the quota period which implies some 'dampening' of the expansion effect because often individual farms had to

[26] The authors are grateful to Dr. Thia Hennessy, Teagasc and Mr John Downey, Department of Agriculture, Food and the Marine, Ireland for making this information available.

purchase or lease additional quota in order to expand. Therefore, milk production dynamics observed during the EU quota period may not apply in the post-quota period. To address these uncertainties, alternative assumptions are made in the simulations. In the default scenario, it is assumed that the additional milk delivered by expanding producers accounts for 5% of milk deliveries in 2014. To test the robustness of the MRP to this assumption, an alternative scenario assuming that this share is 10% is also simulated.

As mentioned above, the second issue which will determine the effectiveness of the market responsibility levy is the way in which each expanding farm's reference quantity is calculated (see the discussion in Part 1 for the different proposals put forward by the EMB). The proposal that the reference quantity would be defined as the volume of milk produced by each farm during the twelve-month period just prior to the announcement of the crisis is adopted as the reference period in the simulations. Milk supplies on expanding farms, when aggregated to the EU level, are assumed to grow month-by-month on a smooth upward trajectory. The immediate effect of the levy in the first month of stage 2 of the MRP is therefore to reduce milk supplies from these producers by half of their annual contribution of additional milk, with the effect then growing month by month as long as the MRP is in place. The feasibility of controlling milk deliveries from expanding producers in this way is discussed further in Part 3. If, as an alternative, the reference quantity was defined as production in the month in which the MRP stage 2 was announced, then the impact of the MRP shown in the simulations would be delayed by up to four-five months.

The third relevant issue to be considered is the way in which expanding producers would react to a market responsibility levy equal to 110-120% of the revenue from their milk. Possible reactions have already been discussed in Part 1 (see 'What about the financing of the MRP?' in section 1.5). The simulations in this work assume that the levy will deter 100% of additional milk supplies above the reference quantity. In these circumstances, we assume that the cost of the voluntary suspension scheme is met entirely by taxpayers, although the MRP does hold open the possibility that the cost might be borne by a producer levy imposed during the year of the crisis.

Finally, as discussed above, the increase in prices arising from the voluntary suspension of supplies and the deterrent effect of the market responsibility levy in reducing supplies from expanding producers will result in some offsetting increase in production and imports in the following months (**Channel 3**). These offsetting effects are taken into account by the choices made for the price elasticity of domestic supply and the price elasticity of import supplies in the supply-demand model. While large reactions are not expected, the reactions will not be zero.

In the case of stage 3, the MRP suggests a compulsory cut of 2-3% on all milk deliveries relative to each farm's reference quantity. Expanding farmers are already subject to a market responsibility levy of 110-120% of the milk price for additional milk above their reference quantity arising from stage 2. In addition, in stage 3 all farmers face a universally applicable reduction in the supply of milk by 2–3 % for a defined period, e. g. 6 months. This is assumed to operate on top of the existing stage 2 constraint on expanding producers, who would thus be required to reduce deliveries further by the announced reduction. If this were not the case, and expanding producers were allowed to resume their expansion, then the impact of the supply reduction due to the universally applicable reduction on the EU market balance would be negated and the objective of the MRP would be undermined. In addition, producers whose production was stable relative to their reference quantities would also be required to reduce deliveries. On the other hand, for farms that reduced production in any case in 2014 by at least the universally required reduction or who exited from dairying, the required reduction would not have any additional constraining effect. Thus, to calculate the overall outcome of the stage 3 intervention, information on how milk deliveries change at farm level is again needed. Based on Irish data, it is assumed that 20% of milk deliveries would not be affected by the universally applicable reduction, so this announced reduction is applied to 80% of 2014 milk deliveries in the simulations.

2.4 Supply-demand model of raw milk market

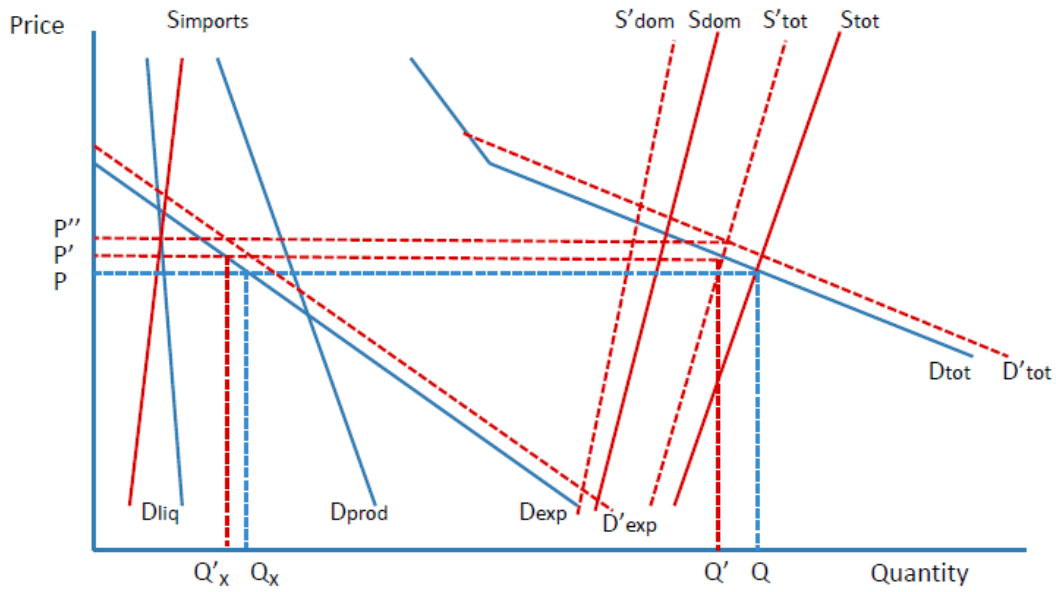
To carry out the test of the effectiveness of the MRP, a simplified model of the EU raw milk market which distinguishes between two sources of supply and three demand destinations for raw milk has been developed. This also takes into account that changes in EU production and exports affect the world market price (known as the 'large open economy' assumption).

On the supply side, raw milk availability comes mainly from domestic production but also from imports. On the demand side, raw milk is demanded for the domestic liquid milk market, for dairy products for domestic consumption, and for dairy products for export. The reason for separately distinguishing these markets is that the price elasticities of demand (i.e. the sensitivity of the quantities demanded to a change in the raw milk price) are very different. For example, we expect that the demand for raw milk for the liquid milk market is rather inelastic, it is more elastic for raw milk demanded for dairy products for domestic consumption, and it is most elastic for dairy products for export.

The EU milk price is determined as that price which ensures equilibrium between the total quantities of raw milk supplied and demanded (see Figure 4). Abstracting from storage behaviour and demand, the simplifying assumption that monthly supplies and demand are evenly spread throughout the calendar year is adopted. Total EU supply of raw milk (S_{tot}) is the sum of the supplies contained in imports of dairy products ($S_{imports}$) and from domestic production of raw milk (S_{dom}). These supply curves are drawn relatively steeply to indicate that, in the short-run, a relatively low response to changes in the milk price is expected. Total demand (D_{tot}) is shown as the sum of the demand for raw milk for use as liquid milk (D_{liq}), for use in domestically-consumed dairy products (D_{prod}) and for use in exported dairy products (D_{exp}) (for simplicity, the export demand for liquid milk is assumed to be zero). These are drawn with progressively flatter demand curves to indicate the relative elasticities of these different sources of demand. In the case of the demand for raw milk for exported dairy products, there is likely to be a certain price above which the EU would become so uncompetitive on world markets that export demand would fall to zero. This would give rise to a kink in the total demand curve, although this part of the demand curve is not relevant to the subsequent analysis. The equilibrium market price and quantity are shown as P and Q, respectively.

The diagram below can be used to show the impact of a supply reduction programme such as stage 2 or 3 of the MRP. For any given market price for raw milk, the domestic supply curve would be rotated to the left by an amount $\Delta Q\%$ (the new domestic supply curve is shown as S'_{dom}). This would imply a similar leftward rotation in the total supply curve to S'_{tot}. As a result, the domestic price for raw milk would rise from P to P' and the quantity supplied (and demanded) would fall from Q to Q'. Note how, in the new equilibrium, the EU has become a less competitive exporter and the demand for raw milk for exported dairy products falls (from Q_x to Q'_x).

Figure 4. Supply-demand diagram of EU milk market assuming a large open economy



Source: Authors' computation.

Because the EU is a large player in what is a relatively thin world market for dairy products, the reduction in EU exports (from Qx to Q'x) has a knock-on effect on world prices. Because global export quantities are now smaller due to the operation of the MRP in the EU, world market prices will rise.[27] This effect diminishes, though it does not offset, the loss in EU competitiveness as it would allow the EU to export more at the higher internal price than would be the case if the world market price remained unchanged.[28] Both the demand curve for export milk and the total demand curve for milk shift to the right (D'_{tot}) and the ultimate price increase in equilibrium, P'', as a result of the MRP is a little higher than P'.

The extent to which the domestic milk price will increase in response to a reduction in domestic supply $\Delta Q\%$ will depend on: the elasticity of import supply $S_{imports}$; the elasticity of domestic supply S_{dom}; the elasticity of demand for liquid milk $D_{liq.}$; the elasticity of demand for milk for domestic dairy products D_{prod}; the elasticity of demand for milk for exported dairy products D_{exp}; and the importance of the feedback effect from the world market. Given information on these five elasticities, the size of the world market feedback effect and the size

[27] This world market price effect is also underlined in the EMB (2015) unpublished document *Questions and Answers Relating to the Market Responsibility Programme (MRP)* – see Annex II.

[28] In principle, the world market feedback effect would also shift the supply curve of imported milk to the left. To avoid cluttering the diagrams too much, we ignore this effect in the diagrammatic analysis but it is included in the numerical calculations.

of the domestic supply shift ΔQ%, it is possible to estimate the change in the milk price (P'' – P = ΔP) due to the operation of the MRP.

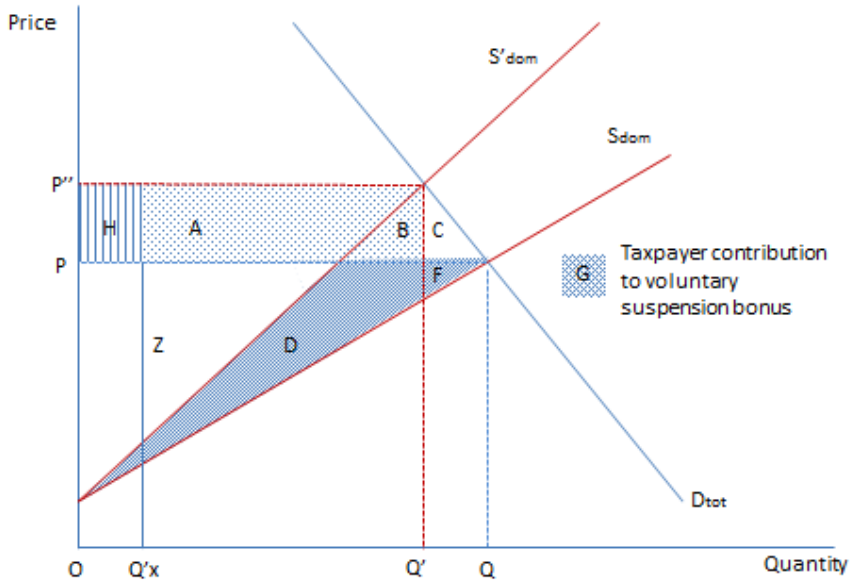
The values of the demand elasticities are particularly critical to the effectiveness of the MRP. The more inelastic is overall demand for milk (i.e. the less sensitive is demand for raw milk to changes in its price) the greater the impact of any given supply reduction on the EU milk price and on the milk margin. Conversely, the more elastic is the overall demand for milk, the less effective will be a reduction in EU milk deliveries in raising the overall EU milk price and the milk margin. Because the MRP is intended as a short-run market intervention, short-run values of these elasticities are required. Annex I discusses the data sources for the elasticities used in the simulations.

A model of the EU milk market was built in Excel in order to perform the simulations. For each month that the MRP is assumed to be in operation, the expected removal of supplies (as compared to the observed baseline which underlies the margin development shown in Figure 3) is projected, depending on the MRP stage in force (2 or 3). The expected impact on milk price and margin of this removal (expressed as a percentage of overall supplies) in that month is then calculated. This exercise is repeated for each month that the MRP is in effect. The output of the simulations is a set of 'MRP' monthly milk prices and margins which can be contrasted with the observed monthly prices and margins as calculated in Section 2.2. Reference is to Annex I for the specification of the milk market quantities' data sources used in the simulations.

2.5 Calculation of gains, costs and welfare effects

Based on the difference between 'MRP' and observed prices in 2014 and 2015, the gain in producer margins due to the higher prices induced by the MRP can be calculated. In addition, the cost to producers due to lost margin arising from the supply cutbacks in stages 2 and 3 are calculated. Some of this lost margin is compensated by the voluntary suspension bonus in stage 2 which is financed (under the simulation assumptions) by the taxpayer. Subtracting the net loss of producer margin from foregone output from the higher margins earned by dairy farmers as a whole from higher prices, gives an estimate of the net income gain to producers, conditional on a given set of input assumptions (elasticity values and structural change shares).These welfare effects are shown in Figure 5. This is a simplified version of the milk market diagram in Figure 4 where, for simplicity, the supply of dairy products from imports is ignored. The original market price is P and the market price following the MRP is P".

Figure 5. Welfare effects of the MRP



Source: Authors' computation.

The margin gain to producers from the higher price is shown by the shaded area (A + B + H), representing the additional price gained (P'' – P) on the total domestic supply after the supply management programme is put into effect (OQ'). The total margin received by producers before the MRP is the difference between the price they received and their marginal production costs, as measured by the supply curve, S_{dom}. This is the area (Z + D +F). Following the MRP, producers are required to reduce production, resulting in a loss of margin on the foregone output equal to (D + F). The overall gain to producers will depend on the difference between (A + B + H) and (D + F). The more inelastic the demand curve is, the more likely there will be a net gain to producers. Also, account must be taken that some of the lost margin due to reduced output is compensated by the voluntary suspension bonus, which in this model is assumed paid by the taxpayer. This is shown for illustrative purposes as area G in Figure 5. This payment reduces the producer loss of margin as a result of the supply management programme.

The total domestic production of milk is sold either for domestic use or for use in exported dairy products. The export quantity is given by OQ'_x, while the quantity for domestic use is given by Q'_xQ'. Because of the higher prices due to the MRP, there is a loss to consumers (here defined as all those in the dairy supply chain downstream of the farm gate) measured by the loss in *consumer surplus* (A+B+C). Finally, there will be a positive *terms of trade effect* because the MRP will reduce the quantity of EU exports and overseas buyers will pay

more for the residual EU dairy product exports. This higher price paid by overseas buyers makes up the terms of trade effect. It is shown as the area H in Figure 5. Reference is to Annex I for the specification of the cost data sources used in the simulations.

The economic effects of the MRP are summarised in Table 2. Overall, whether there is a net gain or cost due to the policy intervention depends on whether the size of the terms of trade effect outweighs the efficiency costs of restraining milk production and the cost to consumers of reducing their consumption of dairy products. The calculation assumes that market prices accurately reflect social values. One caveat is that milk production can give rise to unpriced externalities, including the political values of maintaining milk production and safeguarding dairy farmers' incomes. In that case, the economic calculus alone cannot show whether society as a whole feels it is better off or not with the policy intervention. The overall change in economic welfare shown in Table 2 can then be regarded as the gain/cost of achieving a desired political objective, and this gain/cost can be compared to the gain/cost of other policies aimed at achieving the same political objective.

Table 2: Gains and losses from implementing the MRP

Variable	EUR
Margin gain to producers from higher prices	+ A + B + H
Margin loss to producers from foregone production	– D – F + G
Taxpayer compensation to producers for reducing production	– G
Consumer surplus loss	– A – B – C
Net economic effect	**–D – F – C +H**

Source: Authors' tabulation.

2.6 Scenarios

The baseline is given by the observed outcome with respect to milk deliveries, prices and margins during 2014 and 2015 and is represented in Figure 3. To test the impact of the MRP, three different scenarios are simulated, to take account of uncertainty around the values of key parameters. The 'Default' scenario is intended to represent the most likely outcome given the data available. But because the data are uncertain, two additional scenarios are considered to test the effectiveness of the MRP with respect to, in particular: (1) different assumed elasticities for the responsiveness of the demand for EU dairy products to changes in price, and: (2) different assumptions regarding the share of additional milk from expanding suppliers in total milk deliveries. More specifically, in the 'High elasticity' scenario, the assumed elasticities of demand for liquid milk, processed dairy products on the EU market, and exported dairy products are doubled, relative to the Default scenario. In the 'High share of expanding

producers' scenario, the share of the additional milk supplied by expanding producers in total milk deliveries is doubled compared to the Default scenario. The key parameter assumptions to calibrate the milk model and the three scenarios are shown in Tables 3 and 4, respectively. Further details on the derivation of these parameter assumptions are given in Annex I on data sources.

Table 3: Data used to calibrate the milk model

Variable	Tonnes (ME)
Total Supply/Demand	149,231,407
Domestic quantity supplied	148,486,629
Import quantity	744,778
Liquid milk quantity demanded	30,802,000
Domestic processing milk demanded	100,708,025
Export processing milk demanded	17,721,382
Variable	**Per cent**
Assumed compliance rate with market responsibility levy	100%
Assumed slippage rate	50%
Percentage of milk removed under MRP Stage 2	-2%
Percentage of milk removed under MRP Stage 3	-3%
Share deliveries from contracting producers	20%
EU price	371.6 EUR/tonne
Voluntary suspension bonus	20 EUR cents/litre removed
Income loss to producers from foregone supply	15 EUR cents/litre

Source: Authors' calculations. See also Annex I on data sources.

Table 4: Data used to calibrate the scenarios

Scenarios	Default	High elasticity	High share of expanding producers
Domestic supply elasticity	0.05	0.05	0.05
Import supply elasticity	0.10	0.10	0.10
Liquid milk demand elasticity	-0.15	**-0.37**	-0.15
Domestic processing elasticity	-0.16	**-0.38**	-0.16
Export processing elasticity	-2.00	**-4.00**	-2.00
Share removed milk from expanding producers	5%	5%	**10%**

Source: Authors' calculations. See also Annex I on data sources. Differences with the Default scenario are marked in bold.

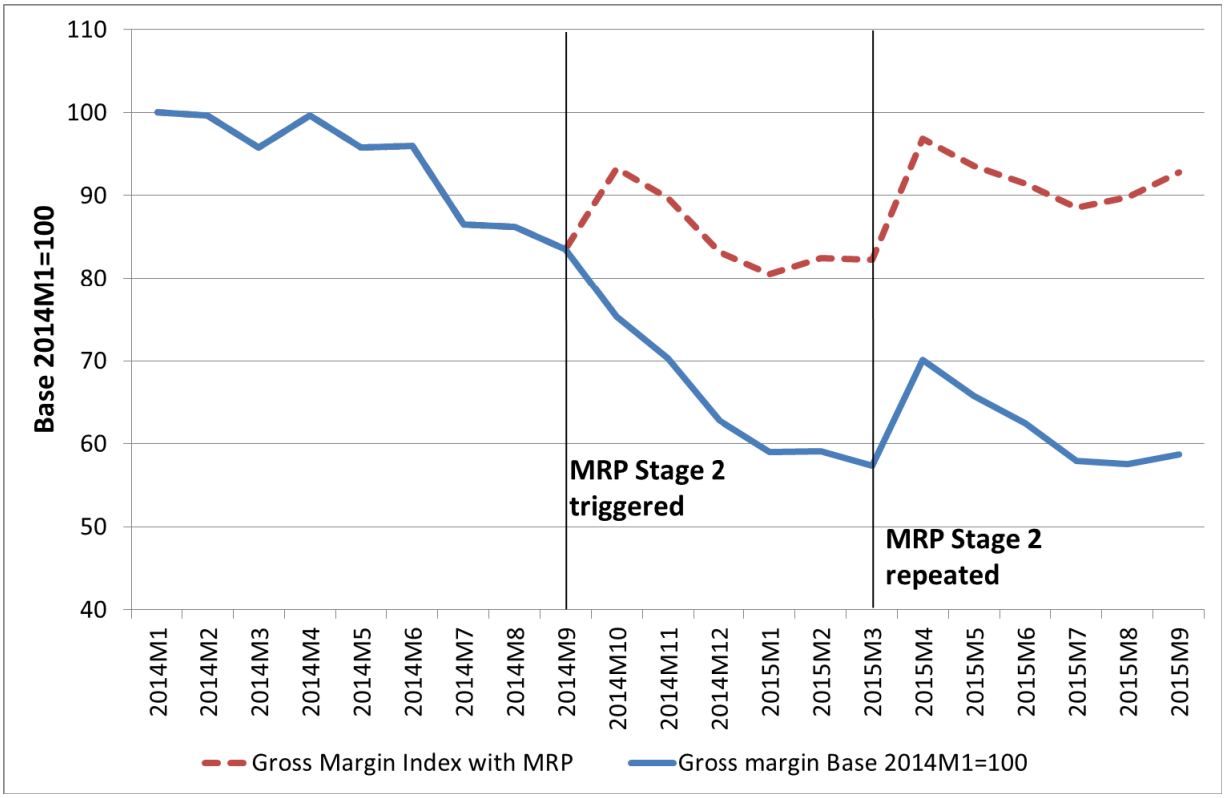
2.7 Simulation results

Default scenario

The main output from the simulation according to the 'Default scenario' is shown in Figure 6 which displays the evolution of the adjusted MMO margin index with the MRP in operation in 2014 and through 2015 (red line), compared to the evolution of the adjusted MMO index in the observed baseline scenario (blue line). The reason for including 2015 in the simulation is that stage 2 of the MRP is not triggered until September 2014 and is implemented from October 2014. In March 2015 the margin index is still below the crisis threshold (value

82.3) so it is assumed that the Monitoring Agency offers a second round of bidding to voluntarily suspend 2% of deliveries for a second 6-month period while the market responsibility levy on expanding producers remains in effect. The margin index briefly goes above 95 in April 2015 but it is assumed that the Monitoring Agency correctly anticipates that this is an unsustainable peak so does not terminate the MRP. The MRP continues in operation until at least September 2015 when the value of the margin index is 92.8, so still below the threshold when the MRP would be terminated.

Figure 6: Evolution of gross margin with and without MRP (default scenario)



Source: Authors' calculations.

Some of the key findings in the Default scenario include:

- The total volume of milk removed increases from 4% in the first month of MRP operation (October 2014) to 8.5% of total 2014 milk deliveries in September 2015. This includes the assumed 1% of milk supplies removed during the twelve months as a result of the voluntary suspension scheme. The average amount of milk removed as a proportion of 2014 milk deliveries is 6.2% over the twelve month period in which the MRP is active. The actual fall in production is somewhat lower because of the assumed positive supply response from producers who were contracting or exiting in the baseline.

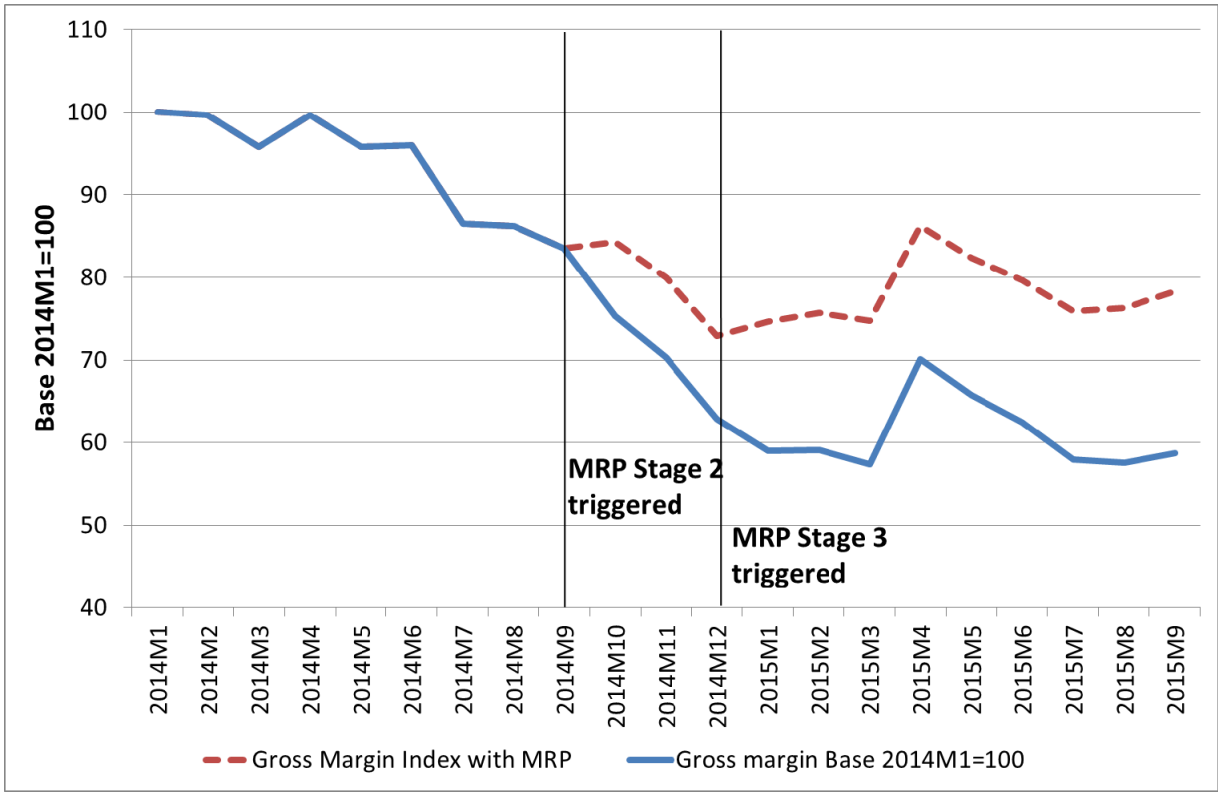
- Exports fall from an annual 17.7 million tonnes ME in October 2014 to 10.6 million tonnes ME in September 2015. The terms of trade gain due to higher export prices amounts to EUR 0.6 billion.
- Over the whole period when the MRP stage 2 is in operation, the average monthly milk price is 14.6% higher than in the baseline. There is a steady increase in the efficacy of the scheme each month as additional supplies from expanding producers are prevented from reaching the processors. In the first month of the scheme (October 2014) the milk price is increased by 9%; by September 2015, the milk price is increased by 20%.
- The milk margin increases in October 2014 by 24% over the baseline margin, increasing to 58% over the baseline margin by September 2015. As the margin is less than half of the milk price, the average increase in the milk margin over the period of the MRP is 38% compared to the average price increase of 14.6%.
- The value of the increased margin in terms of additional income to producers because of the higher prices as a result of the MRP (i.e. the sum of the gap each month between the solid blue and dotted red lines between October 2014 and September 2015) is EUR 7.0 billion.
- In Stage 2, milk volumes are restricted from expanding producers by the market responsibility levy. Valuing the margin foregone of the milk restricted at EUR 15 cents/litre, the margin loss to restricted producers amounts to EUR 1.1 billion, which must be set off against the margin gain to all producers resulting from the MRP. Thus, the overall gain to producers in this scenario is EUR 5.8 billion (taking rounding errors into account).
- The cost to the EU budget of the voluntary suspension programme would be EUR 0.6 billion (because of the assumed 100% compliance with the market responsibility levy, no budget contribution is expected from the expanding producers).
- Consumer losses in this scenario would be EUR 6.5 billion, and the net economic cost of the policy intervention would be EUR 0.6 billion. This is broadly the difference between the cost in terms of economic efficiency of restricting the production of expanding producers plus the cost of reduced consumption of dairy products to consumers, and the terms of trade gain on exports.

High elasticity scenario

The 'High elasticity' scenario differs from the Default scenario by assuming higher demand elasticities for milk used for dairy products for domestic

consumption and for export. Higher demand elasticities mean a lower response of EU milk prices to the reduced supply as a result of the MRP, and thus a smaller pay-off to producers from the programme. In this scenario, the measures adopted in Stage 2 of the MRP in September 2014 are not sufficient to prevent a further fall in the Margin Index. As a result, Stage 3 of the MRP is triggered in December 2014, implemented from January 2015 and continues in force through September 2015. The evolution of the adjusted MMO margin index with the MRP in operation in 2014 and 2015 (dotted red line) in the 'High elasticity' scenario is compared to its evolution in the baseline scenario (solid blue line) in Figure 7.

Figure 7: Evolution of gross margin with and without MRP (high elasticity scenario)



Source: Authors' calculations.

Some of the key findings in the 'High elasticity' scenario include:

- The total volume of milk removed increases from 4% in the first month of MRP operation (October 2014) to 10% of total 2014 milk deliveries in September 2015. The average amount of milk removed as a proportion of 2014 milk deliveries is 7.5% over the twelve month period in which the MRP is active. This is higher than the amount of milk removed in the Default Scenario which was 6.2%. The actual fall in production is somewhat lower because of the assumed positive supply response from producers who were contracting or exiting in the baseline.

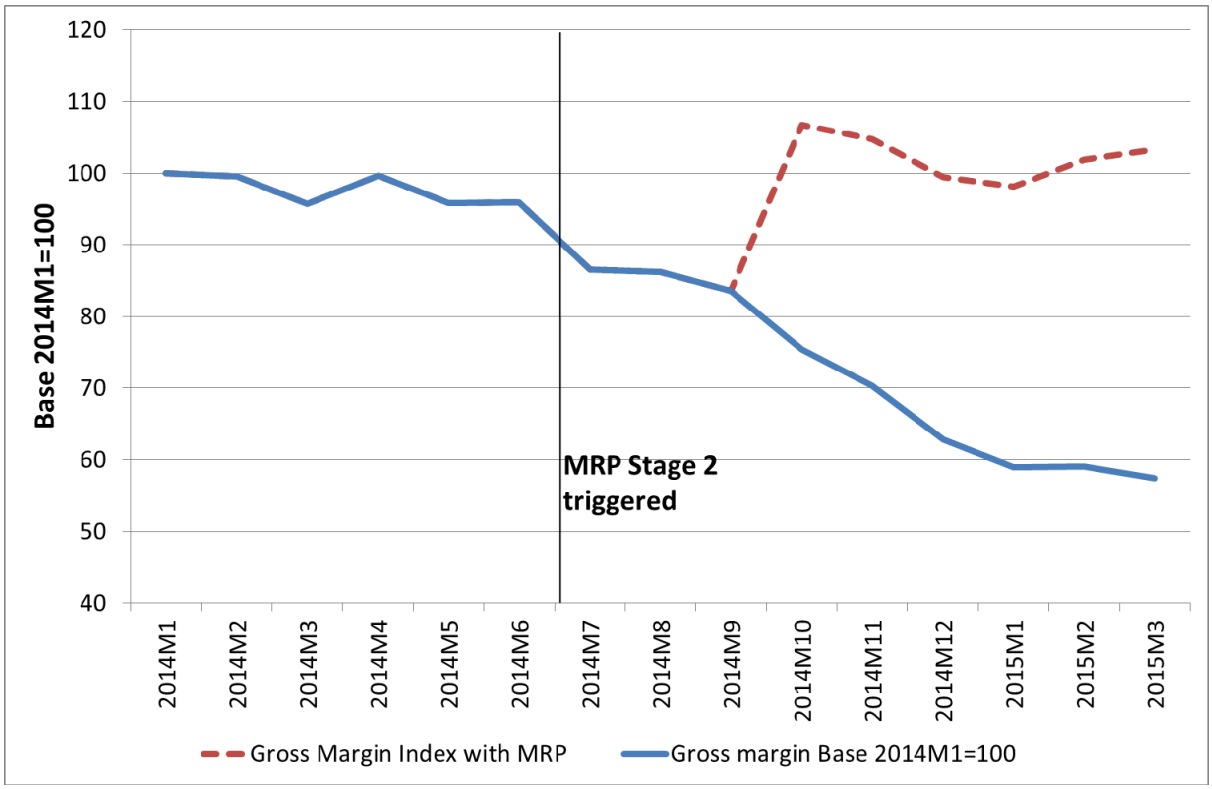
- Exports fall from an annual 17.7 million tonnes milk equivalent (ME) in October 2014 to 9.5 million tonnes ME in September 2015. The greater elasticity of domestic demand allows export volumes to be maintained to a greater extent in this scenario. The terms of trade gain due to higher export prices would amount to EUR 332 million.
- Prices react more slowly than in the Default scenario with a 4.6% increase in October 2014, increasing to 11.5% in September 2015. The average monthly price increase over the period the MRP is in operation is 8.7%, well below the 14.6% increase in the Default scenario.
- The milk margin increases in October 2014 by 12% over the baseline margin, increasing to 34% over the baseline margin by September 2015. The average increase in the milk margin over the period of the MRP is 25%.
- The value of the increased margin in terms of additional income to producers because of the higher prices as a result of the MRP (the gap between the solid blue and dotted red lines in Figure 7) is EUR 4.1 billion.
- In Stage 2, milk volumes are restricted from expanding producers while in Stage 3 all producers are obliged to reduce production. Valuing the margin foregone of the milk restricted at EUR 15 cents/litre, the margin loss to restricted producers amounts to EUR 1.5 billion, which must be set off against the margin gain to all producers resulting from the MRP. Thus, the overall gain to producers compared to the Default scenario is reduced from EUR 5.8 billion to EUR 2.6 billion.
- The cost to the EU budget of the voluntary suspension programme over six months would be EUR 0.3 billion (because of the assumed 100% compliance with the market responsibility levy, no budget contribution is expected from the expanding producers).
- Consumer losses in this scenario would be EUR 3.9 billion, and the net economic cost of the policy intervention would be EUR 1.3 billion.

High share of expanding producers scenario

This scenario assumes that the share of expanding producers in total milk deliveries is twice as important as in the Default scenario. As a result, the deterrent effect of the milk responsibility levy in stage 2 of the MRP is stronger, the size of the prevented milk production is greater, and there is a greater impact on milk prices and margins than in the Default scenario. In fact, the price response is sufficiently great that the margin index increases from its crisis level of 82.3 in September 2014 to 106.8 in October 2014 and remains around 100 in the following five months with Stage 2 of the MRP in effect. Although there would be scope for the Monitoring Agency to terminate the MRP during this period, because of uncertainty over how expanding producers would respond to

the cessation of the market responsibility level the simulation maintains this in place over the six months in which Stage 2 is in effect. The MRP is definitively terminated in March 2015. The trend in the adjusted MMO margin index with the MRP in operation in 2014 and 2015 (dotted red line) in the 'High share of expanding producers' scenario is compared to the evolution of the adjusted MMO index in the baseline scenario (solid blue line) in Figure 8.

Figure 8: Evolution of gross margin with and without MRP (High share of expanding producers scenario)



Source: Authors' calculations.

Some of the key findings in the 'High share of expanding producers' scenario include:

- The total volume of milk removed increases from 7% in the first month of MRP operation (October 2014) to 11% in March 2015 when the MRP is assumed terminated. The average amount of milk removed as a proportion of 2014 milk deliveries is just under 9% over the six-month period in which the MRP is active. The actual fall in production is somewhat lower because of the assumed positive supply response from producers who were contracting or exiting in the baseline.
- The cutback in production in this scenario means that exports fall from an annual 17.7 million tonnes ME in October 2014 to 8.5 million tonnes ME

in March 2015. The terms of trade gain due to higher world market prices amounts to EUR 0.4 billion.

- Prices react with a 16% increase in October 2014, increasing to 26% in March 2015. The average monthly price increase over the six-month period the MRP is in operation is 21%.
- The milk margin increases in October 2014 by 42% over the baseline margin, increasing to 80% over the baseline margin by March 2015. The average increase in the milk margin over the period of the MRP is 61% compared to the average price increase of 21%.
- The value of the increased margin in terms of additional income to producers because of the higher prices as a result of the MRP would be EUR 5.1 billion.
- In Stage 2, milk volumes are restricted from expanding producers. Valuing the margin foregone of the milk restricted at EUR 15 cents/litre, the margin loss to restricted producers amounts to EUR 0.9 billion, which must be set off against the margin gain to all producers resulting from the MRP. Thus, there is an overall gain to producers in this scenario of EUR 4.2 billion.
- The cost to the EU budget of the voluntary suspension programme is EUR 0.3 billion.
- Consumer losses in this scenario would be EUR 4.8 billion, and the net economic cost of the policy intervention would be EUR 0.5 billion.

2.8 Summary of assumptions and simulation results

Before discussing the main findings, the **assumptions behind these simulations must be underlined again**. The simulations are very much stylised in order to give an intuitive understanding of how the MRP might work in practice. The assumptions made are of two kinds: assumptions about how the MRP would work in practice, given the relatively limited details in the EMB proposal to date; and assumptions about the behaviour of the EU milk market in response to supply and price changes, summarised by the elasticity values used and the assumed extent of structural change underway among EU dairy farms.

The following are some of the main assumptions made in interpreting how the EMB proposal would be implemented in practice:

- The baseline used is an approximation of the trend in the MMO gross margin index over the years 2014 and 2015. This is not a crucial element

for the test. The interesting question is by how much the supply management measures can 'lift' the approximated trend line. So, for example, the test might show that the MRP would raise the margin index by 5% in January 2015 if introduced in December 2014. Whether the index in January 2015 is 81.0 or 82.0 is then a second-order issue, it is the 5% figure which is the important one.

- The simulations assume that the Monitoring Agency operates on a monthly timeline. They also assume an idealised situation in which the Monitoring Agency can make an accurate forecast of the milk margin in any month, and both the administration and farmers react within a four-week period to any changes in the estimated margin. They also assume that it is sufficient for the margin index to fall below a critical value for just one month in order to trigger a stage of the MRP; in practice a two-month average might be used to smooth out volatility. To the extent that it takes longer to make these adjustments and the resulting reduction in milk deliveries is postponed, then the increase in milk prices and milk margins estimated in the simulations will take longer to appear.
- The definition of the reference period and reference quantity when estimating the impact of the market responsibility levy is very important. The simulations have used a restrictive definition based on the average of a producer's production for the previous twelve months. If the reference quantity for expanding producers were based on the previous month's production, this would have a much more limited effect on reducing supplies. It would mean that it would take considerably longer before the simulated milk price and milk margin increases came about.
- In the EMB proposal, production is restrained in stage 2 by the market responsibility levy. The proposal does not indicate how production would be restrained in the obligatory cutback phase in stage 3, but a similar mechanism is assumed.
- Because the market responsibility levy is set at 110-120% of the milk price, the simulations assume 100% effectiveness in deterring additional production above the producer's reference quantity in stages 2 and 3. This means, in stage 2, that no levy is actually collected to contribute to the cost of the voluntary suspension bonus. To the extent that the levy is not fully effective in disciplining production, it would take longer to achieve the milk price and milk margin increases observed in the simulations.
- The length of contract for producers agreeing to voluntarily suspend production is assumed to be six months. It is assumed in the simulations that those farmers who enter into a voluntary contract to suspend production would also be required to reduce production in the obligatory

cutback phase in stage 3, even if this were triggered prior to the termination of the voluntary contracts.

- The model does not take account of seasonality in production. The model itself is based on annual data calibrated to the actual 2014 supply-demand balance 'domestic production + imports = domestic consumption + exports'. The model is used to derive monthly observations on prices and margins, partly by using short-run elasticities (producers and consumers may not respond too much to a change in price in the first month, but the response will be greater, the longer the period they have in which to make adjustments), mainly by applying different monthly shocks to generate the hypothetical price response in any month using deseasonalised annual data. In practice, monthly EU milk deliveries vary during the year. What this means is that, if the MRP were introduced during the months of peak production, it may have a somewhat larger effect than that estimated using the annual model; conversely, if it were introduced during the period of relatively low seasonal production, it would have a slightly smaller effect than that estimated using the annual model.

Conditional on these assumptions, the results of the simulation in the three scenarios are summarised in Table 5. Results refer to the period (in months) during which the MRP is implemented within each scenario. In the Default scenario only Stage 2 of the MRP is triggered but it is triggered twice over a twelve-month period. In the High elasticity scenario, Stage 3 of the MRP is triggered in addition but over a twelve-month period. In the High share of expanding producers scenario, only Stage 2 is required to be triggered for a six-month period. Thus the results for this scenario are not directly comparable to the other two.

Table 5: Summary of MRP simulation results for key indicators

Scenario (period during which MRP is implemented)	Default (12 months)	High elasticity (12 months)	High share of expanding producers (6 months)
Per cent of milk removed by MRP (%)	-6.2%	-7.5%	-8.9%
Average monthly reduction in production (%)	-5.5%	-7.1%	-8.0%
Average increase in milk price (%)	14.6%	8.7%	21.0%
Margin gain to producers from higher prices (EUR million)	6,956.6	4,087.6	5,075.8
Margin loss to producers from foregone production (EUR million)	-1,126.6	-1,515.9	-856.2
Overall change in producers' margin (EUR million)	5,830.0	2,571.7	4,219.6
Taxpayer compensation to producers for voluntarily reducing production (EUR million)	-576.8	-288.4	-288.4
Consumer surplus loss (EUR million)	-6,497.8	-3,868.8	-4,838.4
Terms of trade effect (EUR million)	612.3	332.0	376.5
Net economic cost (EUR million)	-632.3	-1,253.6	-530.6

Source: Authors' tabulation.

Common to all scenarios is the removal of a relatively high share of total milk deliveries, ranging from 6% in the Default scenario to almost 9% in the High share of expanding producers scenario. Whether it would be possible to reduce EU milk production so radically and so rapidly as has been assumed in these idealised simulations is considered further in Part 3. Actual production falls by slightly less because of the assumed supply response by those farmers who were contracting or exiting production in the baseline scenario. By far the more important contribution to the reduction in milk output is made by the milk responsibility levy in restricting milk deliveries from expanding producers. The voluntary suspension scheme plays a relatively limited role in reducing supplies in comparison.

The comparison of the High elasticity scenario with the Default scenario highlights the importance of the elasticity assumptions. Separate simulations (not reported here) underline that it is particularly the export demand elasticity which drives the differences in these results. As the value of this elasticity is also uncertain, there would be a high pay-off to further empirical work to better pin down the value of this elasticity.

The High share of expanding producers scenario shows the greatest response in terms of milk prices, given that the amount of milk removed by the MRP is almost 50% more than in the Default scenario. This sharp contraction in milk production occurs because it is assumed in these simulations that each producer's reference quantity is the average of his or her previous twelve months production. As production on expanding farms is on a steady upward curve, limiting production to each producer's reference quantity effectively reduces milk deliveries immediately by the equivalent of a half-year of additional milk output on these expanding farms. This reduction then increases month by month as long as the MRP (both Stages 2 and 3) is in operation. Because the share of additional milk from expanding producers in total deliveries in 2014 is assumed to be double the share in the Default scenario, the cutback in supplies is correspondingly greater.

In all scenarios, there is a net gain to producers under the stated assumptions. Because of the higher milk price, this gain to producers is a transfer from consumers who would pay a higher price for milk than in the baseline. Overall, the policy intervention would lead to an economic cost for the economy as a whole at market prices of between EUR 0.5 and EUR 1.3 billion euro.

Part 3 Efficacy, feasibility, and overall evaluation of the MRP

This part of the report examines the likely consequences of the operation of the MRP from a broader perspective. As noted in Part 1, the EMB proposal has met with a mixed reaction even within the dairy sector. In this Part, the strengths and weaknesses of the proposed MRP are analysed, drawing both on the simulation results in Part 2 and on the limited literature to date which has discussed the scheme (Keane and O'Connor, 2013; Weber, 2013; Weber and Hansen, 2014).

3.1 Contradictory aspects on the adequacy of supply management measures

- **Supply management measures can influence the EU market price**

The simulations show, conditional on the parameter values assumed, that managing the EU milk supply can influence the EU milk price. This empirical finding contrasts with the view sometimes expressed that the EU dairy market now follows the price trend in the world market, and that any regulation of production in the EU would be unlikely to be sufficient to affect global prices. "*In a globalised market place supply management by the EU would require the EU on its own to seek to manage the global supply/demand balance. This is potentially a futile exercise*" (EDA, 2013). The simulation shows that this is not strictly the case; supply management by the EU alone, at least in the short-run, can raise the EU market price.

- **The EU milk market is not so sensitive to supply reductions**

While the simulation study provides evidence that a temporary supply management programme can have a positive impact on EU internal milk prices, it also shows that this impact requires a significant volume of milk withdrawal. The simulations show that the volume of milk that should be withdrawn to have a worthwhile effect on the milk price and farmer's margins is much more than the 2-3% of milk supplies suggested in the EMB proposal. In the Default scenario, up to 9% of milk volumes would be withdrawn in September 2015 when the index had risen to 93 compared to 59 in the baseline. In the High elasticities scenario, a withdrawal of the same amount of milk would mean that the margin index had only reached 76 rather than 59. In other words, an even higher proportion of milk deliveries would have to be suppressed in this scenario to have an equivalent effect as in the Default scenario. In the High share of

expanding producers scenario, over 11% of total milk quantities would be withdrawn by March 2015 to return the margin index to over 100.

It takes 12 months in the Default scenario to restore the margin index to a value close to the 95 threshold when the MRP would be terminated. In the High elasticities scenario, the margin index remains well in the crisis region even after 12 months of MRP operation. Only in the High share of expanding producers scenario is there a quick response to the initial MRP intervention, because of the large volume of milk withdrawn. These periods all assume idealised implementation without delays both by the authorities and by producers. These findings contrast with the EMB assumption that the EU milk market is very sensitive to changes in EU milk supply and that the MRP would be in operation for only relatively short periods.

Whether this sensitivity is likely to increase or decrease in the coming decade is also an important question. The sensitivity of EU milk prices to a milk supply reduction is a function, *inter alia*, of two percentage shares: (i) the share of domestic production designed for export. Because export demand is more price-elastic than domestic demand, the greater the share of domestic production which goes for export, the less effective will be supply management measures undertaken by the EU alone; (ii) the share of EU exports in the world market supply. The smaller the share of the EU in world market export supply, the greater the price-elasticity of its export demand curve which, again, limits its ability to raise internal market prices.

How will developments in these two market shares evolve over the next decade? DG AGRI forecasts for the coming decade suggest a weak growth in the export share of dairy products.[29] At the same time, OECD-FAO projections suggest that the EU share of world markets will increase over the coming decade.[30] These two trends will have countervailing effects on the EU's ability to influence its internal market price in the future. It is not possible to say which will be the stronger effect, so on balance it seems the sensitivity of the EU milk price to milk withdrawals will not change that much over the coming decade.

[29] For example, over the period 2012-14 to 2023-25, the share of cheese exported is projected to grow from 7.8% to 9.0%; the share of butter exported from 5.7% to 8.1%; the share of SMP exported from 43.3% to 48.0%; and the share of WMP exported from 52.5% to 54.5% (EC-DG AGRI, 2015).

[30] Over the years 2014 to 2024, OECD-FAO projects the EU's share of world butter exports to increase from 15% to 20%; its share of world cheese exports to increase from 29% to 40%; its share of world SMP exports to increase from 28% to 32%; and its share of world WMP exports to increase from 16% to 19% (OECD-FAO, 2015).

- **The instrument is not well targeted**

  The MRP would operate by raising the overall milk price for all farmers in the EU. Yet during a cyclical downturn, not all producers face the same financial pressures. As noted in Part 1, there are significant cost differences between dairy farmers in different regions, and even between dairy farmers in the same region. As an example, Jongeneel *et al.* (2010) showed that in the years 2002-2007 some 10% of Dutch dairy farmers had a critical milk price lower than 25 cents per kg, while about 15% of the dairy farmers had a critical milk price higher than 40 cents per kg.[31] Not all dairy products, not all regions and not all dairy farmers in the EU will be equally affected by the impacts of a market crisis. This is seen in the current cyclical downturn where countries with a larger exposure to the Russian market have been hit harder as a result of the Russian embargo.

- **Compulsory cutbacks are the main drivers of supply reductions**

  The EMB proposal assumes that the heavy lifting in withdrawing milk from the market is done by the voluntary suspension of deliveries. The proposal for the market responsibility levy is introduced mainly with a view to raising funds to finance the payment of the suspension bonus to those producers undertaking voluntarily reduction of deliveries.[32] The empirical test of the MRP in Part 2 points to the crucial importance of the supply constraints on expanding producers due to the punitive market responsibility levy. The assumption underlying the simulations was that the market responsibility levy would be so punitive that the deterrent effect would be 100% effective. However, a less stringent assumption would simply postpone the date for the MRP to achieve a given increase in the margin, while hardly altering the relative importance of the supplies reduced through voluntary suspension and those compulsorily reduced. By running the Default scenario assuming only the voluntary suspension scheme, even by raising the voluntarily suspended deliveries from 2% to 3% of total 2014 supplies, the margin index remain well below 80 over the twelve-month period when the MRP is in operation.

[31] The critical milk price is equal to the milk price a farmer needs to cover his or her costs (including depreciation), cover the actual costs of living and ensure continuation in farming.

[32] Some EMB presentations of the MRP do not even mention the market responsibility levy (for example, Däberitz, 2015).

3.2 Actual feasibility is undermined by several aspects

High administration requirements for the Monitoring Agency

Although the MRP is presented as "*an extremely market-oriented instrument*" (EMB, 2015), it would require a very considerable investment by the public authorities at both the EU and MS levels: to monitor individual farmers' milk deliveries on a monthly basis and to establish individual farms' reference quantities; to set up an administration to manage the voluntary buy-out scheme, to monitor compliance and to pursue infringements; and to monitor compliance by farmers with their reference quantities during the crisis period and to pursue infringements. While data on deliveries could be acquired from cooperative and private processors, the Monitoring Agency (or its arms at the countries' level) would still need to make contact with each dairy farmer to inform him or her of the market interventions undertaken and of the implications of these interventions for the individual producer. These requirements would be more complicated than under the previous quota regime which operated on a fixed quota year basis. The MRP would be different because farmers' reference quantities would be continually updated on a month-to-month basis throughout the year.

Data issues are underestimated

The simulations performed in Part 2 assumed perfect foresight and perfect implementation. In practice, the implementation of the MRP would be much messier. One problem concerns data, both its adequacy and its timeliness. Writing about the MMO data on milk prices and margins, Weber and Hansen (2014) note: "*Experience gained to date shows that there is no uniform coverage of products from all relevant producer regions, nor is the information up-to-date. As a rule, the data is at least two months old. A market crisis can therefore only be established belatedly. By the time the proposed measures … take effect, the crisis may already be subsiding or be over*".

The MMO margin data are only available after a delay of at least two months but, in fact, the delay can be up to five months or more. These data also depend heavily on extrapolation from hard data from some years earlier. The EMB has suggested using global dairy products prices to construct the EU margin index, noting that there is often a 4-month delay between these quoted prices and farm gate milk prices. Whether a close relationship exists between global dairy prices and EU raw milk prices that can be relied on for policy purposes needs to be empirically established. For example, supply in the cheese market is effectively set 6-12 months in advance when the maturing period starts which means that the link between current cheese prices and current milk prices may be quite

loose. A more fundamental problem is that any relationship established between world market dairy product prices and EU milk prices on the basis of historical data in the absence of the MRP must inevitably break down once the MRP is in operation. This is because the intended purpose of the MRP is to alter the relationship between EU milk prices and world market levels. In other words, once the MRP is in effect, forecasting *ex ante* the milk margin in the following month using world market dairy prices from four months previously cannot give the correct answer no matter how good the empirical relationship that has been established. In any case, constructing the margin also requires information on input costs for which information to derive *ex ante* forecasts is scarcer.

There is a potential for implementation delays

For the simulations in Part 2, the assumption was made not only that the Monitoring Agency would be able to assess the evolution of the Market Index in real time (based on price quotations for global dairy products on world markets), but also that, once the MRP stages 2 or 3 were triggered, supply reductions would occur during the following month. This timetable may not be achievable in practice. First, the uncertainties around the estimation of the Market Index might mean that the Monitoring Agency would need to wait for two or three months before declaring that a crisis period had occurred. Second, it could take the Monitoring Agency longer than four weeks (in stage 2) to conduct an electronic auction for voluntary suspension bids, evaluate the bids, inform those successful, and enter into binding contracts with them. Third, depending on the design of the voluntary suspension contracts, it may be a further couple of months before the contracted supply reductions are observed. If the voluntary supply reduction contracts specify that the reductions simply have to be met over the contract period as a whole rather than month-by-month, farmers would be likely to use the flexibility to back-load their reduction commitments, reducing the immediate impact on the EU market balance. Fourth, it is assumed that the market responsibility levy would begin to bite for expanding producers already in the month after the Monitoring Agency had declared a crisis in stage 2. This may not be possible if it takes longer to notify producers of their reference quantity limits. All of these possible sources of delay make it less likely that the MRP would be a rapid-response instrument that could quickly choke off an impending market crisis.

Implementation at farm level can be questioned

The MRP depends for its effectiveness on an immediate response by dairy farmers when a crisis is announced. Some farmers must be willing to offer to immediately reduce production, while those farmers in expansion mode must either halt this expansion or find an alternative outlet for their surplus milk

which would otherwise attract the high market responsibility levy if delivered to a processor. However, milk production is a biological and not a mechanical process, and it is also characterised by long-term planning. It is not clear how easy it would be for dairy farmers to make adjustments to their production from one month to the next.

In her expertise commissioned by the EMB, Fink-Keßler (2013) identifies a number of possible measures to reduce supply in the short term: reducing use of concentrated feed; feeding calves using full milk instead of milk replacers; extending the dry period for cows; inseminating heifers at a later stage; and selling older dairy cattle earlier than planned.

For farmers who are losing money by producing milk during a crisis (when the milk price does not even cover variable costs of production), a voluntary suspension scheme could prove attractive by offering the incentive of a positive cash flow. This will be particularly the case for those who had planned to reduce production in any case (the issue of slippage addressed in Part 2). Feeding milk to calves and reducing concentrate feed intake could have an immediate effect on milk deliveries (although the animal welfare implications of a sudden reduction in feed intake have been queried, see Weber and Hansen, 2014). However, the other measures would take time to implement and, in the case of inseminating heifers at a later stage, would not have a noticeable impact on production for at least 9 months given the length of the cow's gestation period. There is also a danger that, if the final option of culling cows earlier than planned were adopted, then any crisis in the milk market would spill over into the beef market which would be hit with an unexpected increase in supply. For those farmers in the middle of an expansion phase and who would be expected to reduce production to the pre-crisis level, the difficulties in reducing production quickly would be even more significant.

It is not only biological constraints which might limit the ability of producers to quickly respond to the MRP signals. Many dairy farmers will have milk contracts which require a certain supply to be delivered. Others may have evergreen contracts that state "*all milk produced will be collected*". As the duration of a possible MRP policy intervention is unknown, this may further complicate contract terms.

3.3 Undesired side effects

The potential for perverse effects

Some observers have worried about the mistiming of policy intervention, believing that it is highly unlikely that the timing and magnitude of any intervention would actually generate the intended effect. "*By the time sufficient political will had been generated to compel the EU to intervene, circumstances would probably have moved on*" (Keane and O'Connor, 2013). Having pre-fixed rules under the MRP on the trigger points for intervention would avoid delays induced by problems of political decision-making. However, whether it is reasonable that such a major intervention in dairy markets should be triggered solely by the level of an index based on inevitably uncertain data over one, two or more months might be questioned. One example in the simulations occurred during the Default scenario when the margin index briefly went above 95 in April 2015 with the MRP in operation, only to fall again in subsequent months. The Monitoring Agency will want to take into account its assessment of the near-term future outlook and whether it felt the market would recover within a short space of time when intervening with market measures (as is foreseen by the EMB when it comes to evaluating whether the time has come to end the operation of the MRP).

Related to this is the danger that the MRP might create perverse incentives which would tend to deepen a cyclical crisis at least in the initial stages (Keane and O'Connor, 2013). This describes a situation where, instead of reducing their production in times of falling prices as normal market dynamics would require, producers decide to wait until a decision is taken by the Monitoring Agency to announce a 'crisis situation'. They therefore continue to produce in the expectation of receiving compensation when the MRP is introduced. This would have the perverse result that any market supply/demand imbalance would be prolonged, and could result in overall producer income being lower over an entire price cycle than would be the case without supply management.

Disproportionate impact on farm competitiveness

A feature of the EMB proposal which is confirmed by the simulations is that it redistributes income from expanding suppliers to stable and contracting suppliers in the short term. Some commentators (e.g. Keane and O'Connnor, 2013) have highlighted that there are likely to be important differences in the characteristics of these two groups. Expanding suppliers are more likely to be younger, more productive and innovative, while in contrast, suppliers with static or declining output are more likely to be less efficient, older suppliers. The MRP proposal would thus have a significant impact on the future competitiveness of

the EU dairy industry, because it would penalise the more productive suppliers while rewarding the less productive by transferring income from the former to the latter. This also has a spatial or regional dimension as regions that have a disproportionate number of expanding producers will in effect be penalised to the benefit of regions with a larger number of stable or contracting suppliers.

The proposal adds a considerable amount of policy risk for individual farmers even if might help to mitigate market risk. This additional policy risk will also impact on the future competitiveness of the EU dairy sector. The possibility for an expanding farmer that he or she might be required to forego the revenue from additional milk over and above a reference quantity will add to the risk of expanding and make expansion less attractive. Expanding farmers are more likely to have invested money in expanding their business so they will be dependent on the additional income from the additional milk produced to finance their bank loans. This policy risk will be taken into account by lending agencies when considering loans to dairy farmers. Lending to dairy farmers will be a less attractive proposition, loans will be more difficult to obtain, and the investments needed to help maintain the competitiveness of the sector and to reduce costs will be more difficult to finance. All in all, the expected impacts on the competitiveness of the dairy farm sector would be negative.

Negative impacts would also be felt downstream in the processing chain. As noted in Part 1, there is a strong likelihood that voluntary supply reductions would be concentrated in higher-cost production regions. These are more likely to be less-favoured areas for milk production. An overall voluntary reduction in milk volumes of 2% at the EU level could be several times greater in those regions where voluntary supply reductions are concentrated. This could lead to even higher costs and possible closure of dairy plants in some regions. In other regions, processors may have invested in expanded capacity to process an anticipated additional supply of milk which is no longer available when the MRP is in operation.

The main beneficiaries would be the EU's international competitors

Assuming that it could be successfully implemented both at farm level and by the Monitoring Agency, the MRP would increase internal EU milk prices. Nonetheless, it can be argued that the main beneficiaries would not be EU farmers but international competitors. Under the proposal the EU would effectively be supporting the world market price to the benefit of producers in competing countries. This argument is well explained in their discussion of temporary supply management by Keane and O'Connor (2013): "*The consequences in economic terms … are that an attempt to reduce production internally in the EU, while raising EU prices somewhat, would also raise world*

prices in an open economy context. Furthermore international competitors with no supply constraints would thus be encouraged to maintain or increase production which would limit the price increase, not just on the world market but internally in the EU as well. Thus the clear winners from such a policy would be the EU's international competitors who would achieve both a higher price and increased production. This would increase their total revenue earnings and their world market share, a clear win-win outcome for them. For the EU itself however the outcome is considerably more ambiguous. There would be a more limited price increase internally than would be the case with a closed economy and this would be combined with reduced production. While there would be a likely increase in sales revenues for commodities in the internal market it would be constrained, while revenue earnings on the export market would likely decrease due to a combination of significantly lower export sales volumes combined with moderately higher prices. EU market share on the growing world market would decrease and the overall outcome for EU producers would at best be just modestly positive…" (p. 13).

The prediction of lower export sales volumes as a result of the MRP is borne out by the simulations. In some cases, export volumes fall by up to one-half when the MRP is in operation. Hence, there would be consequences of this policy intervention for the competitiveness of the overall EU dairy sector in the medium-term. The EU would emerge from each downturn in the dairy cycle relatively weakened, with a reduced ability to take advantage of growing global dairy export markets because of its policy of curtailing production. Its supply reductions leading to lower export supplies would allow its competitors to strengthen their position on export markets and make it more difficult for the EU to regain these markets when dairy markets strengthened again.

3.4 The MRP is a relatively costly instrument

Gains to milk producers are partially paid by other milk producers

If sufficient milk is withdrawn from the EU milk market, both the EU milk price and milk margin would increase. However, the aggregate gains to dairy farmers from the higher milk price are reduced by the losses which would be borne by expanding producers (in stages 2 and 3 of the MRP) and by most producers under the obligatory cutbacks in stage 3 of the MRP. The size of these losses varies in each of the simulations, from 11% of the aggregate producer gain in the High share of expanding producers scenario, to 16% in the Default scenario to as high as 37% in the High elasticities scenario. The more elastic is the demand for dairy products the greater is the share of the aggregate gain to producers which would be paid for by other producers. In the simulations, it is

assumed that the cost of the voluntary suspension bonus is borne by the EU budget. In some of the simulations, this budget cost would exceed the size of the agricultural crisis reserve in the budget, although the sums are not large and could be covered by unused expenditure under other headings of the agricultural budget. If some or all of these were financed by a producer levy instead (as proposed by the EMB) then the aggregate producer gain would be further reduced.

Net gains to producers may come at a high economic cost

Operating the MRP would involve some economic cost. This is not, in itself, an argument not to proceed with it, because it may be decided that the value of supporting dairy farm incomes in periods of market crisis justifies this cost. Using the simulation outcomes, it is possible to calculate a 'cost-effectiveness ratio', which can be defined as the net gain to producers from the operation of the MRP divided by the cost to society (equal to the net economic cost in Table 5). This ratio takes a purely static view of costs and benefits. It does not take into account longer-term costs such as the potential loss of competitiveness or the potential lower average price over the milk price cycle. The ratio is also very sensitive to the assumptions used in the scenarios. In the Default scenario, it would cost society one euro to transfer 9 euros to dairy farmers through the MRP, in the High expanding share of producers it would cost one euro to transfer 8 euros to dairy farmers through the MRP, and in the High elasticities scenario, it would cost one euro to transfer just 2 euros to dairy farmers through the MRP. In none of these estimates are the administration and transactions costs taken into account. Including those costs would reduce the cost-effectiveness ratios in each case. Even if the High elasticities scenario result is put to one side, economic costs are equivalent to 11-12% of the value of the transfer made to dairy farmers through the MRP. These are high figures and underline the value of comparing this method of supporting dairy farm margins with alternative policy instruments to achieve the same goal.

Part 4 Recommendations

According to the study' terms of reference, Part 4 focuses on suggestions to overcome the drawbacks identified in the EMB proposal for a MRP and on the discussion of possible alternatives to achieve the objectives of the MRP. Given the results of the simulations and the significant drawbacks of the EMB proposal discussed above, this Part 4 focuses on suggestions for further work and briefly outlines the main alternatives potentially available to achieve objectives similar to the ones of the MRP.

4.1 Further work on some main drawbacks of the MRP proposal

The operational aspects of the MRP need greater clarification

The EMB proposal for a MRP is presented as a concept for temporary supply management of the EU dairy market. However, many details would need to be fleshed out before this concept could be operationalised. Some of the questions which need to be addressed were listed in Part 1 of this report, and some assumptions were made about how these might be answered in the simulations in Part 2 of this report. Additional aspects to be clarified or considered further include:

- The relative weight given to the voluntary suspension programme versus compulsory mandated reductions during a milk crisis.
- Examine, with respect to compulsory mandated reductions, if the model in stage 2 of the MRP should be maintained (where the burden of cutbacks is borne by expanding producers) or if the MRP should move directly to stage 3 (in which all producers are cut back by a similar amount). It would be possible to offer a voluntary suspension bonus scheme on top of a compulsory generalised cutback scheme for producers who wanted to offer a larger reduction if this were thought desirable.
- The exact way in which producers' reference periods and reference quantities would be defined.
- The nature of the contracts to be offered to producers willing to have a voluntary suspension of deliveries. Would compliance with the reduction over the contract period as a whole be sufficient (in which case producers might leave the bulk of their reduction to the end of the contract period) or would producers be obliged to spread the cutbacks evenly month-by-month over the contract period?

- Is it intended that those producers who have entered contracts for voluntary suspension would also be obliged to follow the obligatory cutback introduced in stage 3 of the MRP in addition? If they were exempt until the conclusion of their contracts, the option value of avoiding a potential universally applicable reduction would increase the attraction of participating in the voluntary buyout scheme.
- Is it intended that the voluntary buyout scheme would be applied uniformly across the EU without regard to the spatial consequences of any concentration of contracts in particular regions? Would it be possible under EU legislation to modify the outcome of the auction process so as to avoid any regional concentration of the buyout contracts?
- How would the Monitoring Agency actually operate in practice?

The definition of the Market Index needs further elaboration

The Market Index is a key element in the MRP proposal because developments in this index trigger when and how the MRP is implemented. Questions have been raised in this report over the feasibility of developing an accurate and timely Market Index for this purpose. There is a trade-off between the inputs it would cover and its ease of construction. For example, defining the Market Index as the margin of milk prices over feed costs would simplify its construction and enable quicker and more timely transmission of data, without sacrificing its accuracy as an indicator of the trend in dairy farm incomes.

The MRP needs a stronger analytical foundation and evidence base

The simulations in Part 2, and particularly the sensitivity analysis undertaken with alternative scenarios, show a range of potential outcomes of the MRP depending on the assumptions made with respect to key parameter values. In particular, the simulations show how dependent the expected outcomes are on the assumed values of the price elasticities of demand for dairy products and on the nature of the structural changes taking place in dairy farming. The single most important parameter value in determining the effectiveness of the MRP in raising EU milk prices is the value chosen for the export elasticity of demand for EU dairy products. Depending on the value of this parameter, it is even possible that supply management would make EU producers worse off. To our knowledge, there is no published empirical study of the value of this parameter for EU export demand, and yet it is critically important in evaluating whether a temporary supply management programme can be effective in raising EU milk prices or not. The simulations in this report rely mainly on estimates derived from Oceania (see Annex I) which is not a satisfactory situation. The parameter

values used in the simulations in this report should be thoroughly tested and validated before policy decisions are made.

4.2 Brief considerations on alternatives to achieve the objectives of the MRP

Greater market transparency and awareness of market actors

Volatility in milk prices and margins is, and will continue to be, something with which dairy farmers must cope. There is therefore a need to look at ways to reduce the volatility experienced and to help farmers cope better with the volatility that they face. A necessary ingredient is better information on which dairy farmers can make decisions. Milk price cycles arise because when prices are trending up farmers assume this upward trend will continue and they make investment decisions with respect to cow numbers and production levels based on these assumptions. When these market expectations are not fulfilled, and it turns out that the market is over-supplied, then milk prices crash. While it is impossible to predict all future events that will affect the milk market, the regularity of the milk price cycle suggests that there would be substantial gains from investing in better market information and ensuring that this is disseminated to producers. The work of the MMO in bringing greater transparency to market developments and ensuring greater awareness by market actors including farmers of market trends should be supported and extended.

Contract-based alternatives to reduce volatility

Contracts between dairy farmers and their processors could play a much bigger role within the EU in smoothing out the milk price returns farmers receive, thus helping to mute cycles of excessive optimism and pessimism. In the US, dairy farmers can lock in a fixed price for up to two years in advance, thus enabling them to concentrate on their primary business of producing milk. For this to happen in the EU, dairy processors need access to financial instruments which will enable them to hedge the risk that they take in offering fixed price contracts to their suppliers. Futures markets to facilitate this kind of risk management are very underdeveloped in the EU. Much more needs to be done to ensure that dairy farmers have access to fixed price contracts and can decide on a voluntary basis how much of their price risk they wish to hedge.

Dairy margin protection scheme

Recent market volatility has underlined that dairy farm incomes can be affected not only by fluctuations in milk prices but also in input costs. This has led to a greater interest in ways to protect and safeguard dairy farmers' margins and not just prices over time. The US Agricultural Act of 2014 creates a new 'margin insurance' program effective through December 31, 2018 under which dairy farmers can receive indemnity payments from the US government if a margin (defined as the difference between milk prices paid to farmers and feed ration value) falls below the insured level.[33]

The Dairy Production Margin Protection Program (DPMPP) offers dairy producers: catastrophic coverage, at no cost to the producer other than an annual USD 100 administrative fee; and various levels of buy-up coverage. Catastrophic coverage provides payments to participating producers when the national dairy production margin is less than USD 4 per hundredweight (cwt) (i.e. approximately EUR 0.08 per kg of milk). Producers may purchase buy-up coverage that provides payments when margins are between USD 4 and USD 8 per cwt. To participate in buy-up coverage, a producer must pay a premium that varies with the level of protection the producer elects. If average margins for two consecutive months become lower than the level covered by the margin insurance, the government pays farmers an indemnity based on the difference between the observed margin and their protected margin. In the initial sign-up for DPMPP for 2015, over 50% of US dairy farms elected to participate. Of these, 55% elected to purchase coverage at levels above the USD 4 minimum margin.

The DPMPP is heavily subsidised by the US government. It also has several design features that could result in the program being less effective at supporting farm incomes and more costly than expected. For example, farmers can decide for individual years whether to insure and how much, rather than making a decision to participate over the five-year life of the program. Premiums are also fixed regardless of market conditions. These features mean that farmers are likely to purchase insurance or to increase their cover only when payments are likely to be made, increasing government costs. Also, the payments that are made when margins are low will help to sustain farm income, but this is likely to prolong the periods of low prices because milk production adjustments in response to market conditions will be muted. The structure of EU dairy production is not the same as in the US. Nonetheless, an examination of the

[33] Details of the scheme can be found on the USDA website.

feasibility and design of a margin insurance programme to help EU dairy farmers cope with volatility could be supported.

Insurance stabilisation schemes

An alternative to a specific dairy margin insurance scheme are schemes to stabilise farm income more generally. Income insurance schemes (as distinct from insurance against climatic events or diseases) are not widespread in the EU, and are often rather costly in terms of the premiums required. The existence of the EU basic payment scheme (topped up by the greening element) also plays an important role in stabilising EU farm incomes and may reduce the attraction of insurance-based products.

The last CAP reform included the possibility for Member States to support a risk management toolkit in their RDPs, including an income stabilisation tool which allows MS to pay contributions to mutual funds to provide farmers with compensation for a severe drop in their income. However, apart from Italy and, to a lesser extent, France, there was little take-up of these schemes in the 2014-2020 RDPs. To the extent that public agencies take on the responsibility to manage risks, there will be a crowding-out of private market participants who might otherwise be interested to offer risk transfer products.

Annex I – Data sources for quantities, elasticities and costs

Milk market quantities

To simulate with the milk model, data is needed on the supply-demand balance on the raw milk market (imports, domestic production, domestic uses, exports) in 2014 and the EU producer milk price in that year. There is no official source for a supply and use table for raw milk because, although production takes place in the form of milk, consumption and trade take the form of dairy products. These dairy products need to be converted back into 'milk equivalent' (ME) in order to derive a supply and demand balance for milk. There are many suggested ways to do this, and no correct way (see Hemme and Blarr, 2004, for a brief discussion of different approaches).

The supply-demand balances in ME prepared by CLAL, an Italian dairy economic consulting firm that analyses the dairy market, are used in the simulations.[34] The 2014 data used in the model are shown in Table 3 in the main text. These data show the EU milk market as less open to international trade than other sources. For example, Ernst & Young (2013) calculated that the milk equivalent of EU dairy exports, using IFCN conversion factors, increased from 17.3 million tonnes in 2008 to 22.4 million tonnes in 2011 (compared to the CLAL estimate of 17.7 million tonnes in 2014). Its estimate of the milk equivalent of EU imports showed a reduction from 1.8 million tonnes in 2008 to 1.4 million tonnes in 2011, compared to the CLAL estimate of 0.7 million tonnes in 2014. Because they show a smaller reliance on international trade, testing the MRP using the CLAL data will tend to show larger effects than extrapolating from the Ernst & Young figures. The EU milk price is the unweighted monthly average price for 2014 taken from the historical EU country-weighted average price series for cow's raw milk published on the MMO website.[35]

Milk market elasticities

The elasticity of demand values used are derived from cited estimates in the literature. These refer to the price elasticity of demand for specific dairy

[34] The data are presented on the company's website clal.it.
[35] Reference is to the following MMO webpage.

products and need to be modified for use in the simulations. Three issues are important to keep in mind:[36]

- Demand elasticities will be higher for disaggregated dairy products than for dairy products as a whole, because of the additional substitution possibilities within the category of dairy products.
- Demand elasticities will be higher in the medium- and longer- term than in the short-term, because adapting purchasing habits to changes in prices takes time.
- Demand elasticities will be higher for processed dairy products than for raw milk because of the role played by the marketing margin (made up of processing and distribution costs).

The last point needs further elaboration. The exact relationship between the price elasticities of demand for processed products and for raw milk depends on how the marketing margin behaves. The two extreme assumptions are percentage or constant margins. If the marketing margin is determined by a percentage mark-up (i.e. the marketing margin increases or decreases in line with the price of raw milk) then the price elasticity of demand for raw milk will be the same as for processed dairy products. If the marketing margin is assumed to be a constant, absolute amount, then the elasticity for raw milk is related to the elasticity for processed dairy products by the following relationship (Tomek and Robinson, 1972):

$$E_f = E_r\left(\frac{P_f}{P_r}\right)$$

where subscript *f* stands for the farm-level price and subscript *r* for the retail or consumer price. The second term on the right hand side is the farm share of the final retail price which is always < 1. Thus, the elasticity for raw milk will always be smaller than the elasticity for processed dairy products with a constant marketing margin.

As both extreme assumptions are unlikely, the elasticities of demand for this simulation have been derived assuming that 50% of the marketing margin behaves as a percentage margin and the remaining 50% as an absolute margin.

[36] Other issues which influence the calculation of demand elasticities are: whether the elasticities are calculated only for households or also include the catering sector and the food industry; whether the elasticities are calculated using market or consumer scanner data; and the type of elasticity (compensated or uncompensated, conditional or unconditional) being calculated.

Elasticity values for dairy products have been collected from the Food and Agricultural Policy Research Institute (FAPRI) elasticities database (http://www.fapri.iastate.edu/tools/elasticity.aspx), from the European Simulation Model (ESIM) database (Balkhausen and Banse, 2005), and from a survey article by Bouamra-Mechemache *et al.* (2008). The latter study presents elasticities averaged from a survey of previous studies, between 2 and 10 depending on the product. The results are presented in Table A. The FAPRI and ESIM values are rather similar, while the literature averages cited in Bouamra-Mechemache *et al.* (2008) are more than twice as high. In two of the three sets of estimates (FAPRI is the exception) the elasticity value for liquid milk is not materially different to the average for other dairy products. To calculate the elasticity values for the simulation, default values of -0.21 for liquid milk and -0.23 for domestically-consumed dairy products are used, while values of -0.53 for liquid milk and -0.54 for domestically-consumed dairy products are chosen for the 'high elasticity' simulation.

Table A: Selected demand elasticity values for dairy products

Elasticity type	FAPRI	ESIM	FAPRI-ESIM average	Bouamra-Mechemache *et al.* (2008)
Liquid milk	-0.06	-0.35	-0.21	-0.53
Butter	-0.29	-0.25	-0.27	-0.47
Cheese	-0.18	-0.25	-0.22	-0.60
Powder	-0.27	-0.14	-0.21	-0.18*
All dairy products	-0.20**	-0.25**	-0.22	-0.57
All dairy products exc. liquid milk †	-0.25	-0.21	-0.23	-0.54

Notes: * This is the figure given for 'other dairy products' which may include products other than SMP and WMP. ** This is the simple average of the elasticity values for the five dairy product categories. † These figures are calculated as the simple average of the elasticity values for the four dairy products excluding liquid milk.

To convert these values to farm-level elasticities, information is required on the farm share in the consumer price for dairy products. The European Food Prices Monitoring Tool is one possible source of data but this tool only calculates price indices and it is not envisaged as a tool to measure margins directly. Another source of information could be input-output tables, but the Eurostat input-output table only gives data for the food, drink and tobacco industry as a whole and not for the dairy industry alone. As a result, the farm share was estimated from scattered data on the shares for individual products in specific countries, including from the UK DairyCo website (which gives quarterly data on the farm share in the retail price of mild cheddar cheese) and the French '*L'Observatoire de la formation des prix et des marges des produits alimentaires*' which gives farm-retail price spreads for a number of dairy products (see the observatory' s website). In the US, the USDA calculates the farm share of the US consumer's dollar for various dairy products which are a little lower than in Europe: 37% for

butter, 46% for milk powder and 25% for cheddar cheese (see USDA website). Based on these limited observations, an average farm share in dairy products in the EU of 40% is assumed. With these assumptions, the farm-level elasticities of milk demand for various uses for the Default and 'High elasticity' scenarios are shown in Table B.

Table B: Elasticity data used to calibrate the scenarios

Scenarios	Default	High elasticity	High share of expanding producers
Domestic supply elasticity	0.05	0.05	0.05
Import supply elasticity	0.10	0.10	0.10
Liquid milk demand elasticity	-0.15	-0.37	-0.15
Domestic processing elasticity	-0.16	-0.38	-0.16
Export processing elasticity	-2.00	-4.00	-2.00
Share removed milk from expanding producers	5%	5%	10%

Source: Authors calculations.

The final demand elasticity required is the price elasticity of demand for EU dairy product exports. The export demand elasticity can be defined as the percentage change in foreign demand caused by a one percentage point increase in the EU f.o.b. ('free on board') price of dairy products. A value for this parameter is not easily found in the literature. The New Zealand Institute for Economic Research investigated this issue when undertaking a validation of its approach to economic modelling (NZIER, 2011). It took estimates empirically derived for Australia and adjusted these to take into account the relative importance of Australia and New Zealand in global trade. If New Zealand's share of global exports was significantly higher (lower) than Australia's, then the export elasticity for those commodities was halved (doubled). On the basis that New Zealand had a 10% share in global dairy trade, it derived an export demand elasticity for New Zealand dairy exports of -2.79. As the EU is a larger exporter, in value terms, than New Zealand, this implies that the EU export demand elasticity would be a little lower than the New Zealand one. For use in the simulations this elasticity has to be adjusted to a farm-level elasticity using the same approach as for domestically-consumed dairy products. The default value used is an export demand elasticity of -2, with a sensitivity analysis performed in the 'High elasticities' scenario using a value of -4.

Jongeneel and Tonini (2009) survey supply elasticities for milk used in three prominent agricultural sector models. According to them, the supply elasticity for milk in the AGMEMOD model is 0.63, in the CAPSIM model 0.27, and in the EDIM model 0.40. However, the supply curve shown in Figure 4 in the main text is not the 'true' supply curve. Instead, it represents the possible response of milk suppliers under the conditions when the MRP is operating.

Because supply quantities of expanding producers are strictly controlled by the market responsibility levy in this situation, only producers who are currently reducing production or those exiting dairying would be in a position to respond to a higher milk price induced by the MRP. To underline this limited supply response potential, a 'constrained' supply elasticity for domestic milk production of 0.05 is assumed.

Finally, the elasticity of the supply of imports with respect to the EU market price for milk is required. Tariffs on imports of dairy products into the EU are high; most dairy product imports enter under reduced duties under tariff rate quotas scheduled with the WTO or bilateral tariff rate quotas opened as part of free trade agreements with third countries. Given high out-of-quota tariffs, a large import response to an increase in EU milk prices would not be expected. Any response would be further attenuated by the increase in world market prices induced by the MRP programme. An import supply elasticity of 0.1 is assumed in the simulations.

Budget and other costs

To calculate the budget cost of the voluntary suspension programme in stage 2 the average cost (EUR cents/litre) which farmers are willing to bid to reduce supplies must be assumed. The EMB suggests that a figure of EUR 20 cents/litre would be sufficient to attract farmers to volunteer to reduce supplies by 2% of overall domestic production. This figure is used in the simulations.

It is also necessary to know the value to farmers of the income foregone because they are no longer allowed to produce as much milk as they did before. With lower milk prices and margins in a crisis period, the size of the income loss will be attenuated. The estimated average margin over the twelve months from October 2014 in the baseline scenario is just over EUR 12 cents/litre. However, this will be an underestimate of the income loss from the foregone production. First, on all farms the marginal cost of producing the last litre of milk is less than the average cost as some costs must be borne in any case. Second, those cut back in stage 2 will be expanding farmers who will have lower costs of production than the average farmer. For the purpose of the simulations, a figure of EUR 15 cents/litre figure is used.

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Other material

Unpublished materials made available in late 2015 for this report by the EMB include a *Questions and Answers Relating to the Market Responsibility Programme (MRP)* document, and a *Market Responsibility Programme – Market index* document.