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Prospects for the European Union and Hungarian dairy sectors after the abolition of the milk quota system

Our study determines the competitive positions of the dairy sectors of Hungary and the other European Union (EU) Member States in the light of the abolition of the milk quota. We analyse the recent market positions of the EU Member States, the changes in the relationships between global, EU and Hungarian milk procurement prices, and the medium-term forecasts for the international markets for milk and milk products, including the results of our own model. In most Member States, milk production is below the quota level, although the most competitive countries are paying substantial penalties for excess production. The medium-term projections and the price relationships underline the fact that, due to the liberalisation of the milk market and the rapid rise in global demand, the impacts of global market developments in the EU will be further enhanced. Owing to sustained international demand, the EU's export opportunities will improve, reducing the pressure on the internal market, and this will have a spill over effect on Hungarian milk prices. Although in terms of trade balance and quota utilisation Hungary is one of the least competitive Member States, the concentration, modernisation and selection processes that have taken place in the country's dairy sector in recent years could, taking into account the favourable medium-term market forecasts, result in a slight increase in milk production levels. Thus, in contrast to the European Commission's projection, according to our profitability based model projection the Hungarian dairy herd and milk production are expected to increase slightly during the period 2016-2020.

Keywords: quota abolition, international markets, liberalisation, price transmission, medium-term projections, competitiveness

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Introduction

The milk quota system that regulates cow milk production volumes in European Union (EU) Member States was introduced in 1984. The underlying reason for this measure was the financial problems caused by the increasing butter and milk powder reserves. The previous system provided a price guarantee and intervention for producers regardless of the quantity produced. Until the introduction of the direct milk supports in 2004, the milk quota system was the only measure that had a direct impact on EU milk production. The quotas that were defined both for the Member States and the producers also affected the processors, as the rules related to their raw material base and limited the processing quantity. The system has been, since its creation, constantly adjusted due the changes occurring in the market. In line with a decision of the European Commission (EC) in 2003, the quota system will remain in place until 31 March 2015, but the quotas have been raised by 1 per cent annually from 1 April 2009, with the last increase occurring on 1 April 2013 (EC, 2012).

Despite the growth in production of recent years, according to annual data sets submitted to the EU by individual Member States as specified by EC (2004), the quantity of milk bought and directly sold has continued to remain below the quota. The so-called 'lagging behind' started to become noticeable from 2009. The quantity of milk supplied grew by 2.9 per cent to 144 million tonnes (corrected by fat content) in the 2013/14 quota year but the quota itself increased by 1.4 per cent to 150 million tonnes, leading to the utilisation of the quota growing from 94.0 to 95.4 per cent in comparison with the previous quota year. The increase in the quantity of milk bought and in the quotas was partly explained by Croatia's accession to the EU. The quota use in the EU-15 stood at 96.8, and in the Eastern EU Member States, Malta and Cyprus at 88.7 per cent in the 2013/14 quota year. In most EU regions it was not the quantitative restrictions that hampered the increase in milk production during the phasing-out of the milk quota, but other factors such as the area of available agricultural land, the costs of financing, the environmental restrictions and the retail price war (EC, 2012).

A quota system was introduced in Hungary long before the country's accession to the EU. However, it initially differed from the EU system and approximated to it only gradually. The Hungarian quota system did not restrict production at national level, neither before nor after joining the EU, and the sector has used around 75-80 per cent of its limit in recent years. After a long spell of depressed prices and extreme weather, the period leading up to the abolition of the quota system was favourable for the sector, resulting in it becoming profitable. The buying price of raw milk has increased since the middle of 2009. The intense global demand has had a 'pull effect' on domestic prices. As a result of the high buying prices, the amount of raw material exported is significant, and Hungarian dairy product exports have also been increasing since 2011. The position of the domestic dairy products in Hungary, in terms of both the volume sold and the selling price, has improved over the past two years. EU reserves have sunk to very low levels and the expansion of exports as well as the decrease in the amount of imported products have eased the pressure on the internal market. In addition, the weak national currency (HUF) has contributed to the fall in the volume of imports (Szajner and Vőneki, 2013).

Scenarios on the evolution of the EU milk sector after quota abolition are based on the findings of earlier studies in terms of the expected evolution of various aspects of production, processing and distribution of dairy products. Most of the studies we surveyed provide results of changes in the quantities and prices of dairy products based on the use of economic models (Chevalier *et al*., 2013). Academic contributions on the impact of removing quotas in 2015 provide scenarios of responses in the price of dairy products and quantities supplied and demanded. The results are often presented according to EU Member States and sometimes also at the regional level (e.g. Fellman, 2009). Some studies

also report the fluctuations in herd sizes and yields, and in some cases these are also accompanied by scenarios on the environmental impact (Kempen *et al*. 2011). All the studies considered present scenarios following the removal of milk quotas and their produced effects after 2015: Binfield (2009) takes 2017 as the last year of the time horizon; Fellman (2009) has a longer horizon (to 2020), while Réquillart *et al*. (2008) view 2016 as the last year of the time horizon. The results of these works tend to be in line with each other. In addition to academic contributions, there are also market studies providing projections on the dairy sector. For instance, Lafougère (2012), which is based mainly on market expertise and provides projections on production of dairy products such as butter, cheese, skimmed milk powder and whole milk powder; EC (2013), which includes medium-term projections for major EU agricultural commodity markets and agricultural income until 2023; and the projections contained in OECD-FAO (2013). Also of note is the study by Chevalier *et al*. (2013), which proposes a prospective vision of the future of the European milk market after quota abolition.

Our study determines the competitive positions of the dairy sectors of Hungary and the other European Union (EU) Member States in the light of the abolition of the milk quota. We analyse the recent market positions of the EU Member States, the changes in the relationships between global, EU and Hungarian milk procurement prices, and the medium-term forecasts for the international markets for milk and milk products, including the results from our own profitability-centred model.

Methodology

The comparison of the overall market positions of the EU Member States was based on EC data for imports and exports expressed in milk equivalent, and the milk quota utilisation. Market positions comparisons between Member States for liquid milk, cheese and butter used EC and International Dairy Federation data.

To determine the relationship between raw milk market prices in Hungary, and those in the EU, Germany and globally for the two EU programming periods 2000-2006 and 2007-2013, regression analysis was carried out using monthly data and the methodology of Thiele *et al*. (2013). Most data sets were supplied in EUR per kilogramme, and the Hungarian data were converted from HUF to EUR using monthly exchange rate data supplied by the Hungarian Central Bank.

The medium term EU and global outlooks according to OECD and EC projections are described. EC (2013) analyses the effects of quota abolition on the purchase of milk using the European Simulation Model (ESIM). The model attempts to determine the competitiveness of the Member States, taking into account the profit from milk production and the reactions to the changes in the buying prices in the period 2007-2012 (which includes part of the phasing out period characterised by increasing quotas). ESIM is a comparative static partial equilibrium multi-country model of agricultural production, consumption of agricultural products and some first-stage processing activities. Projections are made for a period of 11 years after the base period.

The medium-term milk production of Hungary was projected by a new simulation model developed by the Research Institute of Agricultural Economics (AKI). This model aims to forecast the average livestock numbers in the different sectors, taking into consideration the Common Agricultural Policy (CAP) support system between 2012 and 2020. The calculations focusing on the examination of the sectors are based on the AKI database of direct payments in 2013 and the moving average prices stemming from the Farm Accountancy Data Network (FADN). The model itself belongs to that group of linear optimisation methods that requires no derivation (Powell, 2007). This method is often used when there is not enough information regarding the gradient vector when searching for the optimum. The actors of the model are heterogeneous, their decisions are modelled at micro level, and then macro level changes are derived. This way the results of a linear programming model can be interpreted as equilibria of a well-defined economy/farm. The inputs of the model are divided into three groups: inputs related to FADN (FADN DATABASE), to the support system (SUPPORT) and to independent external sources (Hungarian Central Statistical Office data from 2014, OECD data from 2013 and EC data from 2013). Forecasts of the model embrace 15 sectors: wheat, barley, maize, sunflower, rapeseed, dairy cow, beef cattle (female), beef cattle for fattening (male), ewe, swine for fattening, sow, broiler, duck, turkey and goose. The change in the livestock numbers was modelled using a representative sample of 1900 farms from the Hungarian FADN database, supplemented with external sources. The five steps of the schematic model are as follows:

- DATA PROCESS: enter the necessary data such as the average livestock number per farm, the estimated variable and total costs, revenues of the sectors, the value of the inputs defined by the new support system of the CAP. An allocation table is then initialised to the farms;
- OPTIM: each farm decides how to allocate the animals and crops between the sectors. Decision are always made based on own preferences, taking into account the costs, revenues, the structure of the support system and other natural limitations for all 15 sectors. Then an objective function is set that represents the profit function. The optimum with respect to the allocation vector is found when maximising this function. The basis of the maximising process is an optimisation process, namely the COBYLA algorithm (Powell, 2007);
- AGGREGATION: the optimum values of the farms are rescaled and aggregated in order to obtain the change for a certain period at national levels. As the sample used is a representative sample, it is suitable for examining projections globally;
- ITERATION: the projections of the coming periods are forecast and recalculated through the change of costs, revenues and the supports system. The results are then adjusted by the independent outlooks of the OECD and the EU;
- OUTPUT: involves the saving of the optimised allocation vectors and the related tables, as well as compiling of the relevant statistics and figures. Cod-

ing and the base of the program was done using the programming language Python 3.4.1 (Python Software Foundation, Delaware, USA), supplementing calculations and costs fitting were done using the statistical programming language R 3.1.1 (Rogue Wave Software, Boulder CO, USA).

Results

The market positions of the EU Member States

Based on the EU's trade balance of milk and dairy products expressed in milk equivalent and the use of the quotas the Member States can be divided into four groups (Table 1):

- **Group 1** is composed of the most competitive Member States that are characterised by positive trade balance and fully or nearly fully used quotas. Within this group Germany and the Netherlands have very high export volumes, while with respect to self-sufficiency Luxemburg, Denmark, Ireland and the Netherlands are the leaders. Between the 2010/11 and 2012/13 quota years the quota use of two Eastern EU Member States, namely Poland and Latvia, significantly increased. After the end of the quota system the increase in the exports of these countries are expected to exceed that of the production, easing the pressure on the internal market of the EU;
- **Group 2** includes Member States with positive trade balance, quota use well below their potential and high self-sufficiency. From this group France, whose trade balance is the third largest in the EU after Germany and the Netherlands, clearly stands out. Notable growth in the production and the export are not foreseen for these countries;
- **Group 3** consists of Member States with negative trade balance, high level of quota use and low self-sufficiency. These countries are expected to raise their

Table 1: Grouping of the EU Member States according to their trade balance in 2010 and 2012 and the quota utilisation in the 2010/11 and 2012/13 quota years.

Member State	Imports	Exports	Balance	Imports	Exports	Balance	Quota utilisation*, %		Degree of self-sufficiency, %
	thousand tonnes, milk equivalent						quota year		2012
	2010			2012			2010/11	2012/13	
EU-27	69,216	86,616	17,400	71,591	91,929	20,339	-6.2	-6.7	115.4
EU-15	63,088	78,128	15,040	64,942	81,965	17,022	-3.9	-4.9	115.9
Group 1. Positive trade balance and (near) utilised quota									
Germany	12,126	20,704	8,578	12,558	21,969	9,410	-0.8	0.0	144.3
Netherlands	6,659	14,272	7,613	7,575	14,953	7,378	1.2	-0.4	263.9
Denmark	1,443	5,110	3,668	1,209	4,681	3,473	0.7	0.4	326.4
Ireland	974	4,320	3,345	1,269	4,652	3,383	-0.4	-3.0	267.8
Poland	1,118	3,296	2,177	1,258	3,695	2,437	-5.8	-0.6	123.8
Austria	1,402	2,157	755	1,503	2,398	895	-0.1	2.7	136.0
Latvia	255	406	151	301	564	264	-11.9	-3.8	143.5
Luxembourg	625	839	215	663	887	224	1.3	-2.4	442.2
Belgium	6,543	7,084	541	7,169	7,215	47	-0.3	-3.6	101.5
Group 2. Positive trade balance and underutilised quota									
France	6,466	12,582	6,116	6,654	13,656	7,002	-5.2	-7.5	139.6
Lithuania	439	1,176	737	617	1,447	831	-23.9	-22.2	188.0
Czech Republic	1,179	1,347	167	1,253	1,631	378	-14.4	-12.1	115.5
Estonia	94	401	307	93	433	340	-11.7	-6.7	189.5
Finland	577	1,068	491	768	939	171	-11.1	-14.4	108.0
Slovenia	300	338	38	297	340	44	-11.0	-11.0	107.5
Group 3. Negative trade balance and (near) utilised quota									
Italy	9,360	3,572	-5,787	9,013	3,671	-5,342	-2.7	-0.5	68.1
Spain	4,188	1,499	-2,689	4,235	1,682	-2,553	-4.5	-3.0	71.8
Cyprus	168	81	-87	145	101	-44	1.2	0.7	77.7
Group 4. Negative trade balance and underutilised quota									
United Kingdom	6,985	2,915	-4,070	7,210	3,101	-4,109	-9.9	-13.9	77.1
Greece	3,131	480	-2,651	2,578	562	-2,016	-20.3	-26.5	27.5
Sweden	1,565	806	-760	1,507	871	-636	-19.8	-21.7	81.8
Romania	576	194	-381	706	246	-461	-43.3	-48.0	89.4
Portugal	1,043	720	-323	1,031	727	-304	-10.2	-11.9	86.4
Bulgaria	493	268	-225	575	293	-281	-52.5	-56.2	79.5
Croatia	288	83	-205	310	87	-223	-	-34.6**	74.7
Malta	84	0	-84	106	1	-105	-17.6	-17.5	27.6
Hungary	828	528	-299	671	606	-66	-29.5	-26.9	96.5
Slovakia	594	452	-142	627	606	-21	-23.6	-20.7	97.9

* Quotas for deliveries and direct sales
** Estimated data
Source: own calculation based on European Commission data

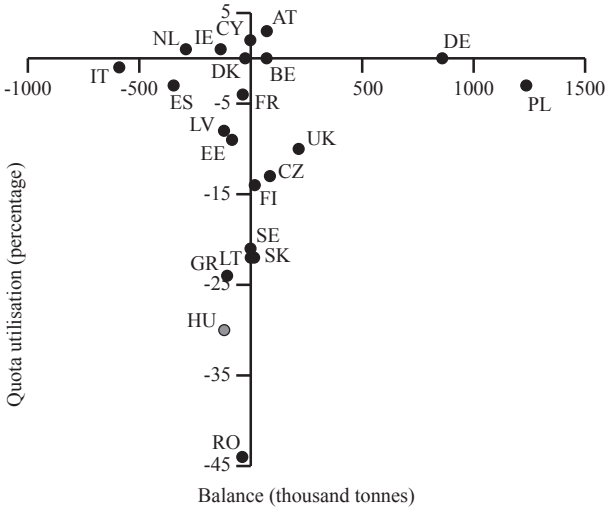

Figure 1: The trade balance of liquid milk in 2011 and the quota utilisation in the 2012/13 quota year by EU Member State.

Source: own calculation based on data from IDF (2013) and the European Commission

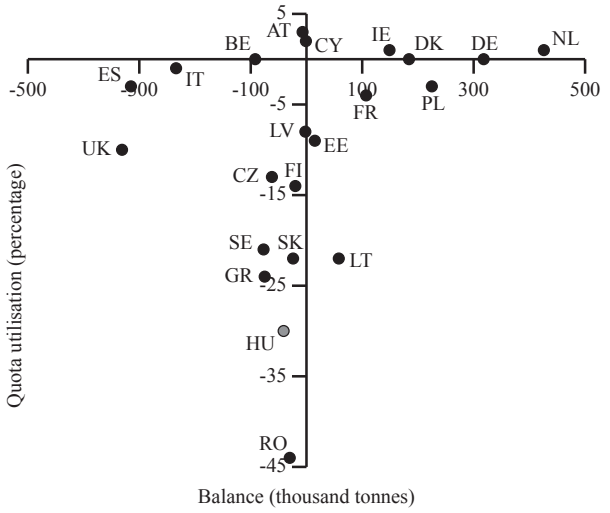

Figure 2: The trade balance of cheese in 2011 and the quota utilisation in the 2012/13 quota year by EU Member State.

Source: own calculation based on data from IDF (2013) and the European Commission

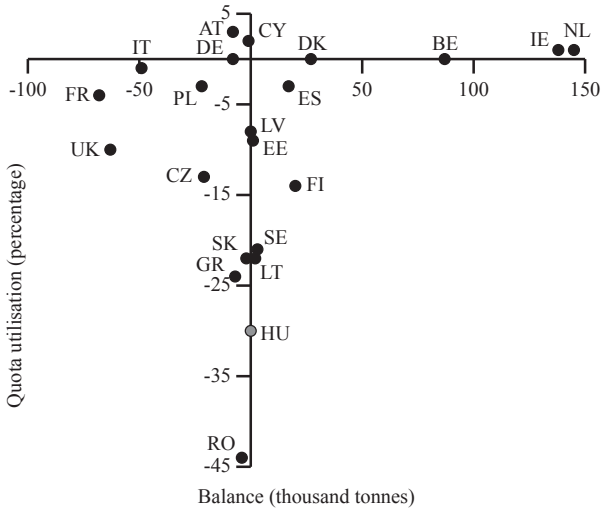

Figure 3: The trade balance of butter in 2011 and the quota utilisation in the 2012/13 quota year by EU Member State.

Source: own calculation based on data from IDF (2013) and the European Commission

production after the phasing out of the quota system, with the highest increases occurring in Spanish and Italian production;

- **Group 4** comprises the least competitive Member States that have negative trade balances, no self-sufficiency and low quota use. The quota use of many of these countries deteriorated between the 2010/11 and 2012/13 quota years, with the exception of Hungary and Slovakia. These countries are deemed to be the market of the Member States in Group 1. Although Hungary belongs to this group, its trade balance improved substantially between 2010 and 2012, and the country has become nearly self-sufficient in terms of milk and dairy products. Group 4 countries can be considered as the potential trade partners of Hungary.

For the EU Member States, in terms of the trade balance of specific dairy products with respect to the quota use, the result are different. In the period around 2012 the most competitive exporters of liquid milk were Germany and Poland (Figure 1), of cheese the Netherlands, Germany, Poland, Denmark and France (Figure 2), and of butter the Netherlands, Ireland, Belgium and Denmark (Figure 3).

Immediately before the abolition of the system, in the 2013/14 quota year, milk production showed an increasing trend in most EU Member States. In that year the quota was exceeded in eight countries, altogether by 1.47 million tonnes with the largest transgressions being in Germany, the Netherlands and Poland. The most competitive countries often had to pay significant fines for exceeding their quotas in the last years of the quota system and in 2013/14 the penalty levied amounted to EUR 409 million. The other 20 Member States produced 8.4 million tonnes less than their quota and in 14 of them the quantity of the milk supplied did not reach even 90 per cent of the quota. Regarding the major producers, France did not use 6.9 per cent of its quota, while for the UK the shortfall was 10.6 per cent.

In Hungary, in the 2013/14 quota year the supply quota increased by 0.5 per cent, the direct sales quota grew by 6.8 per cent in comparison with the previous year. The buying of raw milk in the EU decreased by 4.8 per cent, the direct sales rose by 1.1 per cent resulting in the quota use dropping from 76.3 to 69.1 per cent. High buying prices drove production on the one hand, but did not benefit the processors on the other.

Price relationships of raw milk

For the period 2000-2013 (including the milk crisis in 2008/09) there was a positive trend in terms of global milk prices: prices grew on average by EUR 0.0012 each month, i.e. EUR 0.014 each year (Thiele *et al*. 2013). This positive price trend is mainly attributed to the growing global integration. The relationship between the global and the internal EU prices of raw milk has strengthened since 2006, as a result of the reduction of the intervention prices and the rise in the global demand. At the same time the volatility of both the global and internal prices has increased. Thiele *et al*. (2013) calculated that the variances of the global prices accounted for 60 per cent of the variances of the internal prices between 2000 and 2013 (adjusted R^2), indicating a significant relation-

ship. An increase of EUR 1 in the global price raised the buying price in the EU by EUR 0.54 on average. Between 2006 and 2013 the relationship was even more significant: the variances of the global prices accounted for 77 per cent of the variances in the EU prices. The direct effect of the change in the price was stronger, a EUR 1 rise in the global price induced an increase of EUR 0.78 in the EU prices. These more intense effects of the events in the global market mean that the rising prices have benefited the milk producers in the EU.

For the same time period, we compared Hungarian raw milk prices with global prices and those of the EU and the EU's largest producer, Germany (Figure 4). Our regression analyses also indicate a strengthening relationship between the Hungarian and global as well as between the Hungarian and the EU buying prices. The variance of the global prices accounted for 49 per cent of the variance of the Hungarian prices between 2007 and 2013, while no significant relationship could be observed in the preceding period when prices were artificially regulated (Table 2). Between 2007 and 2013 a EUR 1 rise in the global price induced a price increase of EUR 0.48 in the Hungarian price. There was a statistically significant relationship between the Hungarian and the EU prices during both EU programming periods. However, while the variance of the EU prices accounted for only 16 per cent of the variance of the Hungarian prices between 2000 and 2006, the value of the same indicator was as high as 84 per cent between 2007 and 2013, suggesting a very strong integration. During the latter period a EUR 1 rise in the EU price caused the Hungarian price to increase by EUR 0.99. A strong correlation was also observed in the case of Germany, Hungary's main supplier. In the period 2007-2013 the variance of the German prices accounted for 75 per cent of the variance of the Hungarian prices and a EUR 1 increase in the former induced a change of EUR 0.74 in the latter.

Medium-term forecasts

The medium term outlooks are favourable both globally and EU wide. The increase in the real demand for milk and milk products and the trade exceed that of production, suggesting that global reserves will dwindle or could run out completely in some regions. The OECD therefore forecasts that although the production of the EU-28 will grow by 3.1 per cent (Figure 5), the export of milk and milk products from the EU will increase by 14.3 per cent between 2013 and 2022. The milk producer price is expected to rise from 2016 onwards. A new phenomenon is the growth in the Asian, mainly the Chinese, demand. Despite being the largest milk producer globally, the EU exports only a small part of its milk production, with that going to adjacent markets. Its share in the dynamically growing Chinese and in other Asian markets, compared to the main exporter New Zealand and the fast-expanding USA, is of no weight, though it is growing.

According to the medium-term outlook of the EC covering the period to 2023 (EC, 2013), purchases of milk in the EU are forecast to continue to grow after 2015, though more slowly than in the previous two years. They are expected to reach 150 million tonnes in 2023, i.e. 9.6 million tonnes more

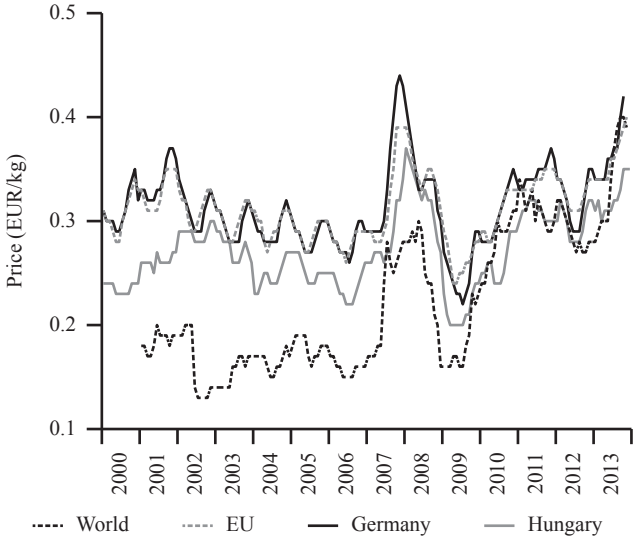

Figure 4: Monthly global, European Union, German and Hungarian raw milk prices, 2000-2013.

Data sources: LTO Nederland (global); BLE-BMELV (Germany); European Commission (EU) and AKI (Hungary)

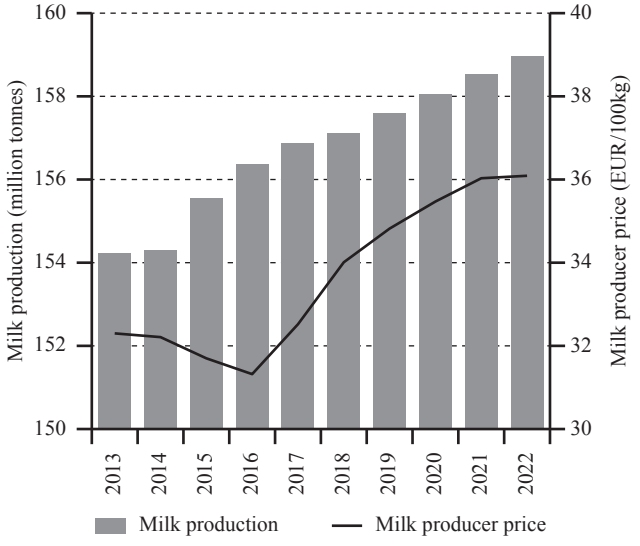

Figure 5: Projected milk production and average milk producer price of the EU-28 between 2013 and 2022.

Source: own composition using OECD data

Table 2: Interdependences between the buying prices of raw milk on the Hungarian market and those on the global (GL), European Union (EU) and German (GER) markets.

	2000-2013			2000-2006			2007-2013		
	GL	EU	DE	GL	EU	DE	GL	EU	DE
adjusted R^2	0.431	0.684	0.612	-0.012	0.157	0.109	0.491	0.838	0.752
No. observations	155	167	166	72	84	84	83	83	82
Regression coefficient	0.338	0.909	0.699	-0.044	0.388	0.287	0.477	0.992	0.740
t-value	10.85	19.00	16.16	-0.358	4.05	3.34	8.951	20.59	15.71

Source: own calculation

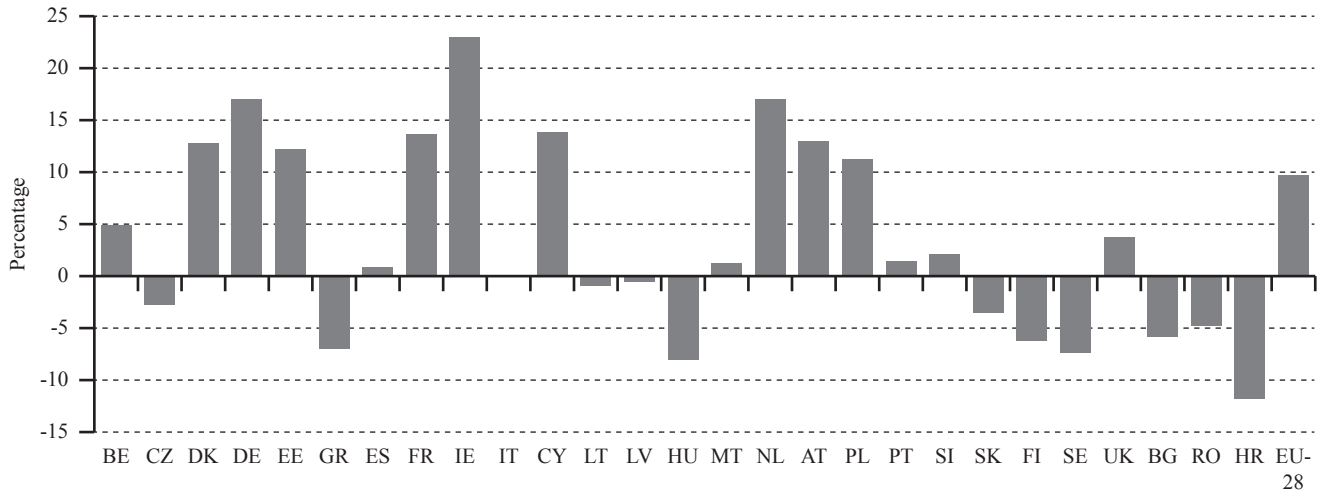

Figure 6: Projected changes in procurement of raw milk by processors from domestic producers in each EU Member State between 2012 and 2023.
Source: EC (2013)

than in 2012. The largest share of the increase is likely to be generated in the EU-15, with the combined purchases of the Eastern EU Member States (excluding Croatia), Malta and Cyprus growing by only 1.2 million tonnes. The quantity of the milk used in the economy might drop to a larger extent than in the preceding decade; direct sales and use for feeding calves are expected to moderate as well. As a result, the average share of raw milk production in the EU purchased by processors might reach 93 per cent. The growth in the yield will also be more dynamic, 2.7 per cent annually. The decrease in the numbers of dairy cows might even reach 1.9 per cent.

The results of the ESIM suggest that the higher buying price of milk has contributed considerably to the maintaining of the production level, and the elimination of the quota system would not in itself have led to an increase in the volume of production. Eleven member states (including nine of the EU-15) had so-called 'competitiveness reserves', with three of them (Ireland, the Netherlands and Germany) being the most competitive. The study took into account other factors as well, such as the investments and the technological developments made (significant especially in Denmark, Ireland and the United Kingdom) or the meeting of environmental requirements (mainly the Netherlands and Ireland). Besides, trends independent of the price and the net profit were observed, which are ascribed to the structural changes occurring in the sector. With respect to the purchase of milk, negative trends have occurred in Bulgaria, Romania, Croatia, Hungary, Greece, Slovakia, Sweden, Finland, the Czech Republic, Lithuania and Malta, while positive trends were seen in Poland and Estonia. Based on the results, in the medium term, purchases of milk are expected to grow especially in Ireland, Germany and the Netherlands (Figure 6), while the most significant drops are foreseen for Hungary (8 per cent) and Croatia (12 per cent).

The main findings of the ESIM modelling are that the purchase of milk after the abolition of the quota system will be highly dependent on factors such as the competitiveness of the milk production, the trends depicting the production and the demand of the processors, the volume of the investments, the environmental restrictions and the buying prices. The growing output of the more competitive EU Member States puts pressure on the buying prices that might make the less competitive countries moderate their domestic purchases of dairy products in favour of imports. In Member States where the independent structural trends and the other production restrictions are less significant, the price will be decisive. The decrease in the buying prices in the EU will spill over, through trade, to many of the Member States. This, however, might be mitigated by global trends, through the expanding international trade.

The AKI model is generally based on the profitability of milk production. According to the model results, with annual increases of around 1.5 per cent, the number of dairy cows in Hungary could increase by 8 per cent in the period 2016-2020 (Figure 7). Owing to the increasing productivity per cow, milk production will increase by about 2.5 per cent annually and by 13 per cent over the five year period.

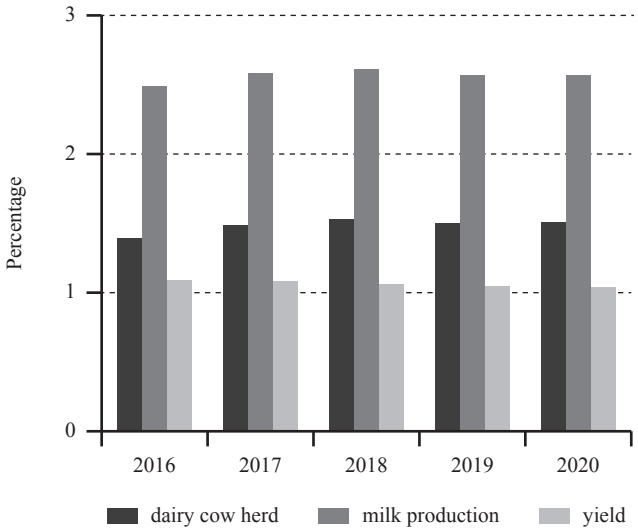

Figure 7: Projected annual percentage changes in dairy cow number, total milk production (tonnes) and milk yield per cow in Hungary in the period 2016-2020.
Source: own composition

Discussion

After the abolition of the quota system the European Union is expected to produce more milk, though this increase will not be substantial at international level. Most experts agree that the majority of the growth will occur in the 1-2 years following the abolition of the system. Production is likely to be higher in those Member States where it already approximates to or exceeds the limit. According to many forecasts, production will increase the most in Ireland, Germany, the Netherlands, Denmark, Austria and Poland. Total growth in the production of the EU-28 will reach 5-7 per cent between 2015 and 2020. However, there are some regions where a drop in production is foreseen. The international competitiveness of pasture based milk production in the European regions strengthens in line with the increase in cereal and oilseed prices, consequently the elimination of the production limits favours the north-western Member States. Milk production, in the long term, is expected to shift to countries with high precipitation and high grass yield (where fodder production is inexpensive), boosting the flow of milk and dairy products from North to South and from West to East. In the medium term – five to ten years – the more intense competition and the territorial realignment might redraw the structure of the EU milk market with raw material production taking place in cost efficient regions, and processing being carried out in regions with well-structured markets.

EU milk and dairy product exports became profitable as early as the 1990s and the export to production ratio is constantly growing. Owing to the measures liberalising the milk market and the dynamic growth in global demand, the effects of events in the global market were magnified in the EU. This is indicated by the fact that the impact of global milk prices on EU prices has grown notably in recent years. As a side effect, price volatility and the risk of the emergence of crisis situations have also increased. The consequences of the abolition of the milk quota are likely to be less severe than those of global events, therefore how the EU will be able to react to the changes occurring in the global market is crucial. Medium-term outlooks are favourable both globally and EU-wide. Global demand is expected to grow dynamically, especially in the developing countries. Thiele *et al*. (2013) estimates that the increases in the milk and dairy product exports of the EU will surpass that of the production between 2011 and 2022, rising from 19.1 to 22.6 million tonnes. This means that the share of exports will grow from 13.7 per cent in 2011 to 15.4 per cent in 2022, with global trends prevailing in the internal market.

In contrast to the ESIM projection which foresees a drop in Hungarian milk purchases, our profitability based model projects that the Hungarian dairy herd and milk production will increase slightly during the period 2016-2020. Possible reasons for this include:

- The ESIM model is a global, multi-country model which operates in an open economy and determines the expected evolution of the production on the basis of efficiency at macro level, while the AKI model simulates basically a semi-closed economy (it is adapted to the expected future price movements by international and Central European projections but it is actually a single-country model) and the projections are made on the basis of profitability;
- The AKI model does not explicitly calculate the projection from the total available national data, it is based on a statistically representative FADN sample and the results are scaled to the national level;
- The local nature of the AKI model means that it is not possible to make a meaningful projection for more than five years without knowing the detailed behaviour of the neighbouring countries. However this is also an advantage of our model because the short-term local behaviour can be modelled much better than by ESIM, since our model takes into account much more local data, such as actual land area, animal stock, profitability, support structure in the future and price changes in Central Europe. By contrast, the ESIM model does not consider the changes to the Hungarian support system which influence basically the future development of the animal stock and the milk production in Hungary;
- The AKI model does not take into account the relative impact of exports and imports.

Hungarian milk production and dairy cow numbers have both increased in the past two years due to the favourable events in the market and the high subsidies. At the same time the concentration of domestic milk production has accelerated: the number of private milk producers dropped by a quarter in 2013, while the average number of cows per farm grew by 35 per cent. Despite the rising fodder prices the profitability of the Hungarian milk producers has improved significantly, which is mainly ascribed to the increase in the buying prices and the direct supports that in 2013 made up approximately 15-20 per cent of the buying price. Direct supports of milk production in Hungary have grown continuously since 2004, and now are among the highest in the EU. However, the production cost of raw milk in Hungary is 25-30 per cent higher than in the more competitive Member States, due mainly to the high fodder costs but also to the macroeconomic conditions such as interest rates, rents, taxes and fees. Domestic milk production in Hungary has, over past decades, become highly maize-based, increasing its vulnerability to periodic prices rises, volatile markets and plant health problems (Szajner and Vőneki, 2013). However, it is an advantage of Hungary that, compared to Europe as a whole, the environmental state of the farms is favourable.

Direct supports for milk production in Hungary are expected to be provided until 2020. As a result of the reform of the CAP, the level of the subsidies granted to ruminants will remain constant or might even rise. A significant change in the new system is that milk producers are no longer entitled to a subsidy based on the milk produced, but rather on the number of animals in their possession. The total support for milk producers amounts to HUF 49.4 billion in 2015, which is 58 per cent more than in 2014. In the future, the total amount of subsidy is likely to decrease. The new system, in which the subsidy is granted per head, might have a negative effect on the volume of milk production, but a positive one on the fat and protein content of the milk. The per-litre subsidy of the farms with higher yields is expected

to be HUF 4-5 lower than that of those with lower yields. However it is important to note that the drastic change that is foreseen in the direct payments after 2020 might have an adverse impact on the funding and the competitiveness of the whole sector.

The position of the Hungarian milk sector can be assessed in comparison with that of neighbouring EU Member States. With respect to the genetic base of the livestock and the parameters of production, Hungary is considered to be a leader in the region. The country has a developed production structure as well: milk production is highly intensive, taking place in concentrated farms employing highly qualified staff, which provides a solid base for high quality production. The technology applied, the buildings and the machinery used have all been improved over the past 5-6 years (Borbély *et al*., 2013). Consequently, the sector is expected to experience no difficulties following the elimination of the system, which is crucial, as market positions are expected to be determined in the first 2-3 years of the new system.

Based on the natural capital, the number of dairy cows, the standard and the efficiency of the production technology, the level of the processing industry and the trade indicators of the milk and dairy products, Poland and the Czech Republic are Hungary's main competitors, followed by Slovakia. The country's main export markets regarding raw milk include Romania, Slovenia and Croatia. Although due to hectic market developments following Hungary's accession to the EU, a great wave of selection has taken place in the Hungarian milk production sector, concentration is expected to continue. The withdrawal of the large multinational companies from the domestic market increases the risk that the traditional Hungarian dairy brands will be produced even more from foreign raw milk, will be manufactured abroad, or even completely disappear in the domestic market.

Owing to the close ties with the rest of the EU, both the raw material and the finished product prices in Hungary adjust to those of the EU, thus the changes in global prices are expected to continue to influence domestic prices in the future. Taking into account the favourable conditions for milk production in Hungary, maintaining current export levels in the medium term is feasible. Despite the rise in raw milk prices in recent years, Hungarian prices are still competitive compared to the EU as a whole. However, it cannot be a long term strategy for Hungary only to supply raw milk to those EU Member States which are struggling with temporary shortages and quality issues (such as Romania). Hungarian milk and dairy product exports have been increasing since 2011. The competition in the EU is very intense in the cheese and cottage cheese market and especially in the market of acidified dairy products, with Germany being the toughest competitor. However, the outlook for the cheese market seems promising and the expected increase in EU exports might make way for Hungarian products, mainly in the domestic market. For the Hungarian cheese products the Middle East is foreseen to be a significant market.

Of significance in this respect is that the possible extent of the increase in production in the Member States after the abolition of the quota system is believed to vary according to the structure of the producers and the activities of the processors and retailers. Nearly 60 per cent of the Western European milk sector operates as part of co-operatives that have significant influence on prices and are the most adaptable to changes in both consumer demand and market conditions. The weakest point in the Hungarian supply chain, with no doubt, is the processing industry. While there have been remarkable investments made in the past five years in production, the processing industry – except for a few examples – has lagged behind. The most serious disadvantage though, in comparison with the more developed Western EU Member States, is the weak solvency of the consumers and the drawback stemming from the economy of scale. In order to increase the share of the high gross value added products at the processing stage, investment is essential. The competitiveness of the processors could also be boosted through cost reductions that could be achieved by the use of environmentally sound technologies which use less energy, improve the energy balance and utilise alternative energy sources as well.

In conclusion, after the abolition of the EU milk quota system intensification of market competition can be expected. However, the growth in EU exports as a result of the medium-term increase in the global demand is expected to ease the pressure on the internal market. Hence, market opportunities will expand of which the Member States with cost-effective production structures, competitive dairy sectors and effective, organised product chains will be able to take advantage. This could be an opportunity for Hungary to seize. The changes that have occurred over the past 2-3 years point to the fact that the concentration, modernisation and selection processes that are taking place in Hungary might allow it to maintain or even slightly increase its raw milk production in the future.

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