How Will Decreasing Subsistence Production Affect Future Dairy Markets in the Central European Countries?

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Abstract

This paper presents an approach to depict subsistence production of milk in a partial equilibrium sector model and applies this approach to Poland, Bulgaria and Romania in the European Simulation Model (ESIM). The restriction on milk production implied by the EU milk quota in a situation with increasing market demand along with decreasing subsistence production and consumption, potentially drives up prices for nontradable dairy products in the Central European Countries (CECs), and results in significantly lower net exports and lower production than if these countries do not accede to the EU. Results presented should be taken as tentative and in no way final as the empirical foundation of many of the relevant parameters is weak.

1 Introduction

The emergence of subsistence farming in Central European Countries (CECs) is due to a complex set of conditions during economic and social transition. The share of subsistence agriculture heavily depends on macroeconomic stability, especially with regard to income and nonagricultural employment opportunities (Janvry et al., 2002). Thus, in the course of economic development a decreasing share of subsistence agriculture can generally be observed. This process is also expected for the CECs in the years to come.

Currently subsistence shares are considerable for some products in some CECs. In the late 1990s about half of Romanian farm households sold none of their agricultural production (Sarris et al., 1999). According to Kostov and Lingard (2002a), in 1998 more than 77% of individual farms in Bulgaria sold no output. Pouliquen (2001: 41) summarizes "… the contribution of the semi-subsistence sector to the total agricultural production of the 10 candidate countries is at least in the order of half, although this proportion is more modest in the Czech, Slovak and Estonian farm sectors, i.e. in a minority part of the whole of central and eastern European agriculture." Economic development will probably be positively affected by EU accession and is expected to proceed quickly in the years to come. GDP is expected to grow by 5.2% in 2005 in Bulgaria, by 5.0% in Romania, and by an average of 4.5% in eight new Central European EU member states (IMF, 2004). Various factors such as the flexibility of labor markets and the degree of government transfers to the holders of agricultural production factors will affect the extent to which economic development will translate into a decreasing subsistence share.

A decreasing share of subsistence agriculture could affect market results (quantities and prices) in various ways. First, a lower share of subsistence agriculture would imply a higher responsiveness of domestic demand and supply to changing market prices, whatever the source of such changes may be. Second, a decreasing share of subsistence agriculture may translate to increasing market supply and market demand. This would affect the domestic price equilibrium, or, if the price level is determined by international prices, the net trade situation. The development of subsistence agriculture in the CECs may be of special interest with regard to dairy markets, because subsistence production of milk is not restricted by EU milk quotas while market production is. The stronger the decrease in subsistence production, the earlier some CEC are therefore expected to be restricted by their milk quotas.

Effects of decreasing subsistence agriculture are usually not accounted for in equilibrium models used for applied policy analysis for the CECs, e.g. the former ESIM version (Münch, 2002) or the

CEEC-ASIM modelling framework (Wahl et al., 2000). Kostov and Lingard (2002b), however, present a dynamic model for Bulgaria that incorporates market-oriented and subsistence activities where agricultural production is determined by opportunity costs of agricultural labor. Due to the inefficiency of subsistence farming compared to market-oriented agricultural production, a possible persistence of subsistence will reduce total agricultural output significantly. Here, dairy milk, poultry and potato production in particular would gain from a higher degree of commercialization. Under different EU accession scenarios Kostov and Lingard show that high annual income growth has a strong impact on the commercialization of agriculture. Subsistence agriculture in Russia is analyzed in Wehrheim and Wobst (2002) based on a CGE model where agriculture is disaggregated by different farm types representing market-oriented and subsistence farming. An ex post scenario illustrates the buffer role of subsistence farming in Russian transition. In two ex ante scenarios, Wehrheim and Wobst show that exogenously reduced marketing margins have a strong positive impact on the competitiveness of Russia's large-scale market oriented farms as well as the degree of commercialisation of subsistence farming. Kostov and Lingard as well as Wehrheim and Wobst show that subsistence farming helped reduce the decline in total agri-food production and therefore contributed to food security.

This paper aims at including the above mentioned effects in a behavioral agricultural sector model. In Section 2 of this paper, possible effects of decreasing subsistence agriculture are first discussed theoretically and then translated into a formal approach to include part of these effects in partial equilibrium models. In Section 3, this approach is then applied to one specific agricultural sector model, ESIM, designed for agricultural policy simulation in the EU and accession candidates (Banse et al., 2005). Considering the examples of Poland, Bulgaria and Romania, various scenarios for the development of subsistence agriculture are formulated. Section 4 describes the dairy markets of these countries. In Section 5, various scenarios are formulated and results are discussed. Finally, in Section 6, conclusions are drawn, limits of the quantitative approach chosen are discussed, and the need for empirical foundation of the parameters identified is highlighted.

2 Development of a Formal Approach to Cover the Effects of Decreasing Subsistence Agriculture in Behavioral Sector Models

One of the reasons why decreasing subsistence agriculture could affect market results significantly is that subsistence agriculture usually responds less to prices than does market production. Still the price responsiveness of subsistence agriculture is not necessarily zero, since market prices affect the gains from subsistence production compared to nonsubsistence activities. If subsistence agriculture reacts less than market production, this leads to a more sluggish adjustment of quantities and corresponding welfare effects under different policy scenarios. Therefore the use of models which do not account for this effect, hereafter the "price response effect", would tend to overestimate the size of effects under different simulations. A possible way to deal with the price response effect in market models would be to treat the subsistence quantity of production and consumption as fixed, or at least as less price responsive than the market quantity.

A second effect resulting from the different degree of price responsiveness of subsistence and market production is that a decreasing subsistence agriculture may result in very different product composition of production and consumption. This is because at the supply side, the composition of subsistence production is oriented to what is needed at household level whereas the composition of market production is decided according to relative market prices, which may lead to very different results. The same holds for the consumption side: subsistence consumption is oriented towards what is available on farm level whereas the composition of market consumption is determined based on relative market prices. Not including this effect of decreasing subsistence agriculture, the "product composition effect", in behavioral sector models could lead to strong biases in terms of projected product composition at the demand and the supply sides and in the resulting price and net trade effects. The bias would be higher the more the composition of subsistence production and consumption deviates from the composition of market production and consumption. This effect is difficult to handle in partial equilibrium models without explicitly depicted factor markets, which would steer the relocation of production factors freed from subsistence production such that marginal factor productivity equalizes in all sectors.

Analyzing the product composition effect is complex, especially if product shares of market production and consumption are very different from subsistence shares. However, in a partial approach looking at one product, a more simple question can be formulated: How much of subsistence production/consumption of a certain product converts into market production/consumption if the subsistence quantity decreases? This effect is referred to as the "conversion effect" throughout this paper and is worked out in the following. Total demand and supply consist of market quantities and subsistence quantities:

$$(1)\ Q_{S,M} + Q_{SUBS} = Q_{S,T}$$

$$(2)\ Q_{D,M} + Q_{SUBS} = Q_{D,T}, \text{ with}$$

Q = quantity of product i; First index: **S**upply/**D**emand, Second index: **M**arket/**Subs**istence/**T**otal

If, in the course of economic development Q_{SUBS} decreases:

$$(3)\ Q_{SUBS,2} = Q_{SUBS,1} \bullet (1+w_S),$$

with w_S being the growth rate of subsistence agriculture and the second index indicating time. Two relevant questions arise:

1. To what extent will production factors previously used in subsistence production of this product now be used in market production of this product?
2. To what extent will previous subsistence consumption of this product translate into market demand for this product?

For each of these links a parameter can be defined:

$$(4)\ Q_{S,M,2} = Q_{S,M,2,NS} + Q_{SUBS,1} * (-w_S) * C_S, \text{ and}$$

$$(5)\ Q_{D,M,2} = Q_{D,M,2,NS} + Q_{SUBS,1} * (-w_S) * C_D,$$

with $0 < C_S, C_D < 1$.

Where $Q_{S,M,2,NS}$ is the marketed quantity which would be supplied without the shift from subsistence agriculture and C_S and C_D are conversion factors which indicate the extent to which former subsistence quantities translate into market quantities at the supply and the demand side. If decreasing subsistence shares in other agricultural markets are also taken into account, C_S, C_D may also be > 1, if part of subsistence production or consumption of other products translates into market production or consumption of the product concerned. What factors could determine the size of C_S and C_D?

For C_S:

- The higher the comparative advantage in the production of the product concerned, the higher C_S.
- The more specific and fixed production factors are, the higher C_S. For example for pasture land-based production systems one would expect an almost complete transfer from former subsistence farms to larger farms. For less land-based production systems like pigs and poultry production, C_S could be much lower.
- For milk in the CECs, C_S could be limited by production quotas which limit market supply.

For C_D:

- A default assumption would be $C_S = 1$. But especially in cases, where per capita consumption on subsistence farms is much higher than in other households (e.g. due to low valuation of family owned production factors), C_S could be significantly below one.

The relative size of C_S and C_D could affect market outcomes in three ways:

- if $C_S = C_D$, the market price/net trade does not change,
- if $C_S > C_D$, the market price decreases/net trade increases,
- if $C_S < C_D$, the market price increases/net trade decreases.

So, the conversion effect can be derived at an individual product level. The main weakness, which results from not fully covering the product composition effect defined above, is that nothing is said about what happens to those production factors which were previously employed in subsistence agriculture and are not used in market production of the product concerned, nor about which products people consume instead, if their former subsistence consumption does not fully translate into market consumption. Symmetrically, effects resulting from decreasing subsistence production for other products, such as production factors shifted from any other product into the product at hand, can only be covered by including these effects in the exogenous C_S and C_D parameters of the product concerned.

3 Modelling a Decreasing Share of Subsistence Milk Production in ESIM

3.1 Short General Model Description

ESIM is a comparative static partial equilibrium multicountry model of agricultural production, consumption of agricultural products, and some first-stage processing activities. ESIM has recently been updated and extended in terms of base period, product and country coverage, policy formulation and software platform (GAMS) (Banse et al., 2005). ESIM is a partial model, as only a part of the economy, the agricultural sector, is modeled, i.e. macroeconomic variables (like income or exchange rates) are exogenous. As a world model it includes all countries, though in greatly varying degrees of disaggregation. Some countries are explicitly modelled and others are combined in an aggregate the rest of the world (ROW). In its current version, ESIM includes 10 CECs (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia), Malta, Cyprus, Turkey, the EU-15 and the US. All other countries are aggregated as the ROW. As ESIM is mainly designed to simulate the development of agricultural markets in the EU and accession candidate countries, policies are only modelled for these countries. Thus for the US and the ROW, production and consumption take place at world market prices. Trade is modelled as net trade for all countries. ESIM is a static model, as adjustments in time are not explicitly covered. There are, for example, no lagged price responses or price expectations modelled at the supply side. Therefore, all simulation results have to be interpreted as long term equilibrium states. Nonetheless, ESIM is a projection model as shifters at the supply as well as the demand side (e.g. productivity or income growth) are accounted for. Projections are made for a period of 11 years (2003-2013) after the base period, but all projections are independent comparative static equilibria.

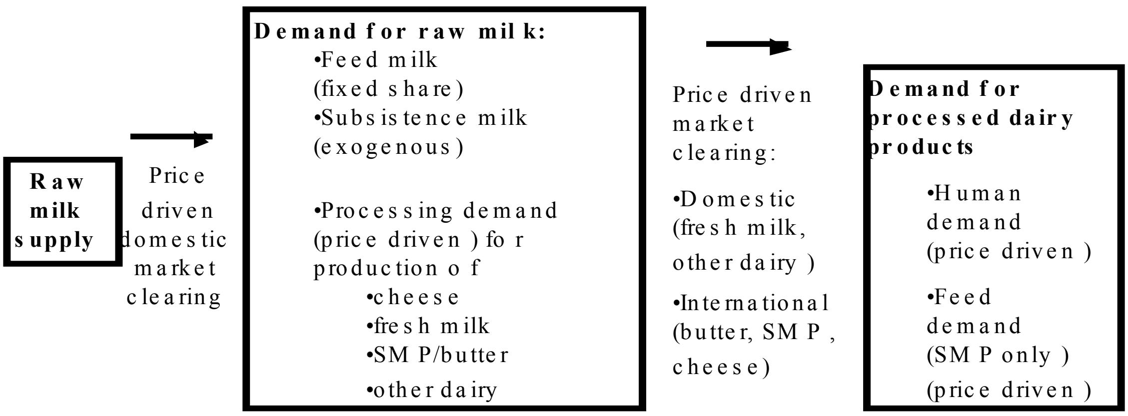
ESIM depicts a high variety of policy instruments including specific and ad valorem tariffs, tariff rate quotas, intervention and threshold prices, export subsidies, product subsidies, direct payments for keeping land in agricultural use, production quotas and voluntary as well as obligatory set aside. All behavioral functions in ESIM are isoelastic. Supply at farm level is defined for 15 crops, 6 animal products, pasture and voluntary set aside. Human demand is defined for processed products and each of the farm products except rapeseed, fodder, pasture, set aside and raw milk. Some of these products only enter the processing industry, e.g. rapeseed, and others are only used in feed consumption, e.g. fodder or grass from permanent pasture.

3.2 Depiction of Dairy Products in ESIM

ESIM includes, besides fresh milk, four dairy products for human consumption and livestock feed. These are butter, SMP, cheese and other dairy products. The latter is an aggregate of various processed milk products which is considered nontradable beyond country borders, such as yoghurt, cream, curd, etc. Butter and SMP are linked by a fixed technical factor. Therefore, the dairy industry in ESIM has the possibility to shift between 4 different products, with each of them making full use of the fat and the protein components of raw milk attributed to the respective output: 1) fresh milk, 2) cheese, 3) other dairy, and 4) a butter/SMP combination. As a result, there is a market clearing condition for milk, but not for the fat and the protein components, as they go together in all products. This is, of course, a highly simplified approach; it is impossible within this model to depict changes in the relative prices of the protein and the fat components on product composition, for example, the production of a lower fat content cheese as a response to higher international butter prices.

The supply of any dairy product is considered to be dependent on the price of raw milk, its own price, the prices of other dairy products as they are regarded close substitutes in production and on the price of other, nonagricultural inputs. Figure 1 provides a schematic overview of the dairy processing sector in ESIM.

Figure 1: Dairy Markets in ESIM



At the raw milk level domestic market clearing happens via the raw milk price. Under a binding milk quota, only the demand side adjusts to the market price. Two out of three demand components are not modelled as responding to price: feed milk, which is a fixed coefficient of total milk production, and subsistence milk, which is exogenously determined for some of the CECs and produced and consumed on farm and does thus not enter the dairy processing industry. Processing demand for raw milk is modelled for each of the four dairy industry outputs and is homogeneous of degree zero in all input (raw milk, other inputs) and output prices. All processing outputs are substitutes, i.e. the signs of the respective cross price elasticities are positive. Processing supply of processed dairy products is equal to the processing demand for the respective product multiplied by the technical extraction coefficient. Price-driven market clearing for processing outputs takes place at the domestic market for nontradables (fresh milk, other dairy products) and on international markets for cheese, SMP and butter.

Based on this model, a higher cheese price, perhaps due to a shift of the demand curve, would result in higher cheese production for two reasons. First, the processing industry would shift from other processing outputs to cheese: the substitution effect. Second, a higher cheese price would result in an overall higher demand for raw milk. Via the domestic market clearing condition, this would result in a higher farm gate price for milk and thus higher production (at least, in the absence of quotas): the output effect.

The elasticity matrix for dairy processing set up for each region consists of four rows for the processed products and seven columns: five for the product prices, one for the price of raw milk, and one for the price of other inputs. The latter aggregate does not to appear in the final model version, but merely works to achieve homogeneity. Own price elasticities for the four products are set at two for butter and three for all other dairy products. The elasticities with respect to the input costs are generally calculated by weighting the own price elasticity with the negative cost share of the respective input. As a next step, an Allen-elasticity of substitution among dairy products is searched for in a calibration algorithm that minimizes the sum of squared deviations from homogeneity of degree zero over all products in the dairy product supply matrix. In the second step, homogeneity and symmetry are strictly imposed while cross price elasticities and the elasticity with respect to other inputs are allowed to vary and the squared deviations from their start values are minimized (for details see Banse et. al, 2005).

3.3 The Coverage of Subsistence Production of Milk in ESIM

As ESIM does not cover factor markets, the product composition effect described above cannot be fully covered. Instead, the price response effect and the conversion effect are modelled only for milk. In order to cover the price response effect, the supply and the demand curves for milk in ESIM are, in deviation from the standard functional form, formulated additively. For the supply side:

$$(6)\ Q = Q_{SUBS} + Q_M\ (\mathbf{p}, \mathbf{r}),\ \text{with } \mathbf{p} \text{ and } \mathbf{r} \text{ being vectors of product and factor prices.}$$

In addition, an exogenous shifter reduces Q_{SUBS} each year of the projection horizon (see equation 3 above). Finally, in order to depict the conversion effect, part of the reduction in Q_{SUBS} is added as a shifter to market-oriented production Q_M ($\mathbf{p}$, $\mathbf{r}$):

$$(7)\ Q_2 = Q_{SUBS,1} + Q_{M,2}\ (\mathbf{p}, \mathbf{r}) \bullet (1+w_S \bullet -1 \bullet (Q_{SUBS,1}/Q_1)/(1 - Q_{SUBS,1}/Q_1) \bullet C_S$$

For the technical implementation of the shift from subsistence to market-oriented production, the intercept of the milk supply function $Q_M(\mathbf{p},\mathbf{r})$ is recalculated after each period to include the conversion effect as an exogenous shift of the milk supply function to right. In the next period, total milk supply consists of a reduced subsistence part and an increased market-oriented part of total milk supply. If the milk price remains constant, total milk supply is assumed to be unaffected by this conversion. However, due to an increase in the share of price-responsive supply, total milk supply can be higher or lower due to changes in the milk price.

A similar approach applies to the demand side, although the conversion effect on the demand side is modelled such that reduced subsistence consumption is not fully shifted to market demand for liquid milk. Instead, the market demand functions for liquid milk, butter, cheese, SMP and other dairy products are shifted according to their shares in total market consumption of dairy products. These shares are calculated in milk equivalent in each period.

4 Dairy Production in the CECs: Poland, Bulgaria and Romania

The effect of decreasing subsistence production on future dairy markets in Poland, Bulgaria and Romania is considered. These countries are chosen due to their relatively high shares of subsistence production and, in case of Romania and Poland, significant market size. Before simulations with ESIM are carried out in the next section, this section describes base quantity and price data used in the simulations and discusses their reliability. Table 1 displays production data as well as various demand categories for raw milk.

Table 1: Production Demand for Raw Milk in Poland, Bulgaria and Romania (averages 2000-2002)

		Poland	Bulgaria	Romania
(1)	**Milk production (1,000 t) /1**	11,902	1,468	5,147
(2)	**Feed milk (1,000 t) /2**	662	n.a.	708
(3)	**Deliveries (1,000 t) /3**	8,500	722	1,093
(4)	**Direct sales (1,000 t) /3**	464	257	1,964
(5)	**EU milk quotas (1,000 t)**			
(6)	initial /3	8,964	979	3,057
(7)	final /3	9,380	1,018	3,093
(8)	**Subsistence milk /4**			
(9)	(1,000 t)	2,276	287	1,382
(10)	in % of milk production	19.1%	19.6%	26.9%
(11)	**Share of cows in holdings of one cow per farm /2**	17.6%	37.5%	22.7%
(12)	**Subsistence milk applied in ESIM /1**			
(13)	in 1,000 t	2,276	415	1,382
(14)	in % of milk production	19.1%	28.3%	26.9%
(15)	in % of milk production minus feed milk	20%	33%	31%
(16)	**Marketed milk in ESIM (1,000 t)**	8,962	851	3,057

Sources: /1 ESIM database. /2 Poland: Central Statistical Office GUS (2005). Bulgaria: National Statistic Institute (2004). Romania: National Institute of Statistics (2005). /3 EU-Commission, /4 (1) minus (2) minus (3) minus (4). Feed milk for Bulgaria is calculated by applying the Romanian share of feed milk in that country's total milk production.

The ESIM database shows an average milk production in Poland of more than 11.9 Mio t for 2000-2002, while milk production was 1.5 Mio t in Bulgaria and 5.1 Mio t in Romania. The share of feed milk for calves was 5.5% in Poland and 13.8% in Romania in 2000-2002. Rows (3) and (4) display deliveries and direct sales which add up to the initial milk quotas (6) in these countries in the year of accession. The shares of deliveries in the total quota quantity differ significantly, from 36% for Romania to 94% for Poland. The final milk quotas (7), which will apply from the year 2006 on for Poland and from 2009 on for Bulgaria and Romania, include additional special restructuring quantities, which can be used, e.g. for young farmers' programs. Based on this data, subsistence milk can be calculated as the difference between milk produced on farm minus feed milk and minus deliveries and direct sales (8-10). Subsistence shares in total milk production thus calculated vary between 19% for Poland and 27% for Romania. The 19.6% subsistence share in Bulgaria seems very low compared to numbers published by Kostov and Lingard (2002a), who present an average share of subsistence consumption of Bulgarian households of almost 50% for milk for the years 1995-97. Based on the ESIM database, this share would result in 397,000 t of subsistence milk for Bulgaria. Also in view of the farm structure, data for Bulgaria suggest that the subsistence share should be higher than in Poland and Romania. More than 37% of Bulgarian cows are kept by producers with a single cow, whereas this share is only around 20% in Poland and Romania. Therefore, 50% of the direct sales in (4) is considered to be subsistence production instead of direct sales of milk and the calculation of the subsistence share in Bulgaria is adjusted accordingly. With this adjustment the subsistence shares in total milk production (excluding feed milk) in this analysis are 20% in Poland, 31% in Romania and 33% in Bulgaria, line (15) in table above.

Total marketed milk equals processing demand in ESIM, as raw milk is considered a nontradable. Table 2 shows how this processing demand splits into different outputs of the dairy industry in the ESIM base period. In addition, external trade of tradable dairy products in the ESIM base period is depicted.

Table 2: Utilization of Raw Milk and Net Trade of Processed Dairy Products (2000-2002)

	Production						Net trade		
	Poland		Bulgaria		Romania		Poland	Bulgaria	Romania
	1,000 t	% m.e.[a]	1,000 t	% m.e.	1,000 t	% m.e.	1,000 t	1,000 t	1,000 t
Production of milk	11,902.0	100	1,467.6	100	5,147.2	100			
Feed milk	661.9	6	201.9	14	708.0	14			
Subsistence milk	2,276.0	19	415.2	28	1,382.4	27			
Production of dairy products									
Fresh milk	1,395.8	12	347.0	24	19,11.6	37			
Butter	123.9	23	1.4	2	5.6	2	5.1	-1.1	-0.9
SMP /1	142.2		0.5		7.1		86.5	3.1	-1.2
Cheese	420.2	25	35.6	17	31.7	4	27.7	7.0	1.1
Other dairy	1,899.1	16	224.5	15	801.1	16			

[a] m.e.: milk equivalent. /1 the share of SMP in milk use is included in the share of butter.
Source: ESIM Database.

Table 2 illustrates the use of milk for liquid milk consumption (feed and human) and dairy products (butter, SMP, cheese and other dairy). While milk and other dairy products are considered nontradables, only butter, SMP and cheese are tradable products. In Poland 48% of total milk production is used for butter and cheese production. For Romania this share is only 6%, and Bulgaria uses 19% of total milk for butter and cheese production. The different shares of tradable and nontradable products in the total dairy product market have an impact on price formation for milk and processed milk products under various scenarios: the Polish milk price depends much more on international prices while the milk price in Bulgaria and Romania is mainly driven by domestic supply and demand.

In order to understand price changes for dairy products in the CECs in the case of accession, one has to compare EU and CEC dairy product prices in the ESIM base period. To this purpose Table 3 depicts prices for dairy products in the EU-15 as well as Poland, Bulgaria and Romania. Prices for tradables are expressed relative to the world market price level. Prices for nontradables are expressed relative to the EU-15 price level.

Table 3: Prices for Dairy Products in the EU-15 and Poland, Bulgaria and Romania in the ESIM Base Period (2000-2002)

	World Market	EU-15	Poland	Bulgaria	Romania
Tradables					
Butter	100.0	145.6	100.4	127.1	100.0
SMP	100.0	111.5	100.0	100.0	103.5
Cheese	100.0	129.2	100.0	100.0	100.8
Nontradables					
Producer price milk	-	100.0	67.4	64.0	103.3
Consumer price milk	-	100.0	70.0	69.0	111.3
Other dairy products	-	100.0	77.4	77.4	77.4

Sources: ESIM database, own calculations.

Table 3 shows that, except for butter in Bulgaria, prices for tradables in Poland, Bulgaria and Romania are close to world market prices. In the EU however, the butter price is more than 45%, the domestic cheese price is 30% and the price of SMP is more than 11% higher than world market prices for these commodities, which is expected to affect the price level in the CECs in the case of accession. For nontradables (milk and other dairy products) prices in Poland and Bulgaria are far below the EU price level. Only in Romania are milk prices higher than in the EU.

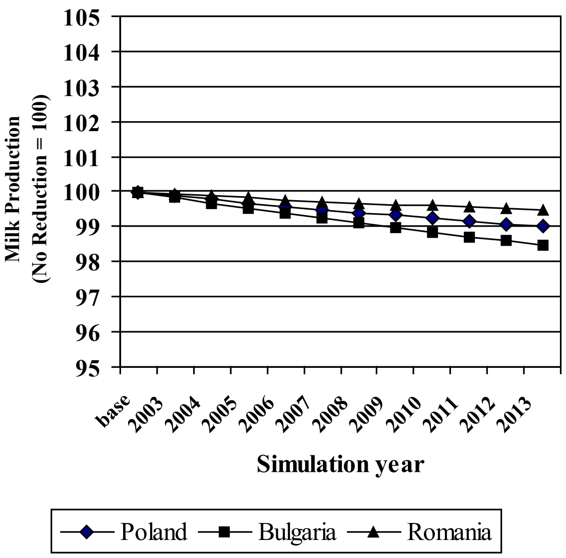
5 Scenario Formulation and Results

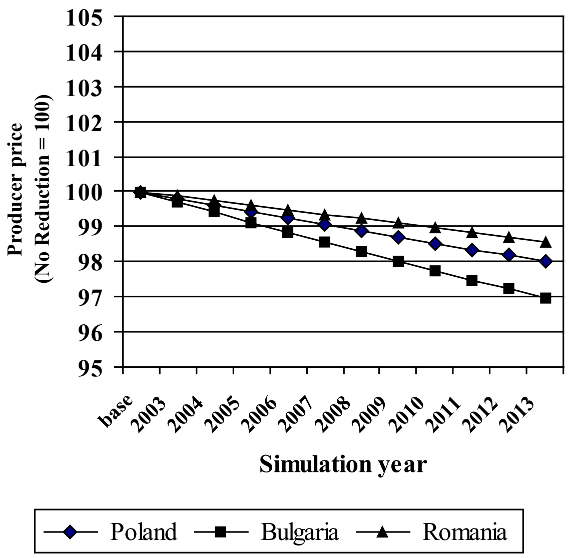
To assess the effects of decreasing subsistence dairy farming, various scenarios are formulated and run for each year between the base period and 2013. For a situation with accession of the 10 new member states in 2004 and the accession of Bulgaria and Romania in 2007, the ROW component is calibrated such that FAPRI world market price projections (FAPRI, 2004) for 2013 are met. For all other scenarios world market prices can deviate from FAPRI projections. All scenarios include full implementation of the Mid Term Review reforms (MTR), i.e. the decrease in institutional prices and partial decoupling of direct payments in the EU-15, as well as the implementation of the Simplified Area Payments Scheme (SAPS) for most of the new member states, assuming that national top-ups are fully granted to farmers. Technical progress shifters of milk supply in Poland, Bulgaria and Romania are at 1.3% annually. Annual demand shifters for Poland, Bulgaria and Romania are income (3.8% for Poland, 5.8% for Bulgaria and 4.6% for Romania) and population growth (-0.65% for Bulgaria to +.02% for Poland annually).

5.1 Reduction of Subsistence Production Compared to no Reduction

Initially two scenarios are compared. As a reference, a NO REDUCTION projection until the year 2013 with unchanged policies in the EU and the CECs, no accession and no reduction of subsistence production is chosen. A second scenario is compared to the reference, SUBS REDUCTION, in which subsistence production falls by 2% each year and the decrease in subsistence production and consumption is fully transferred into market demand and production, i.e. $C_S = C_D = 1$.

Graphs 1 and 2: Development of Milk Production and Milk Producer Prices, SUBS REDUCTION Compared to NO REDUCTION (NO REDUCTION = 100)





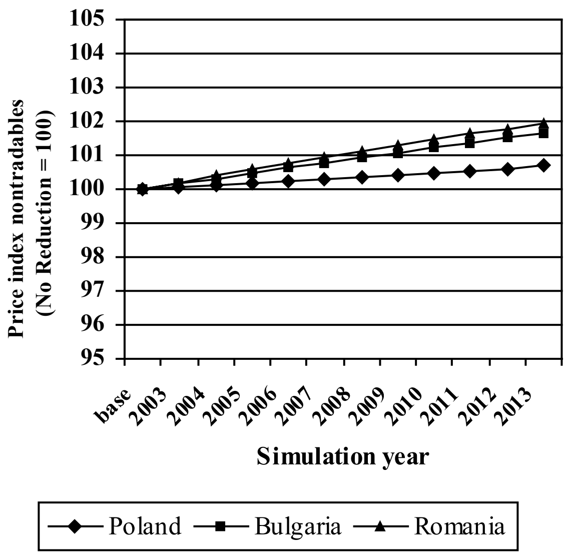
Source: Own calculations.

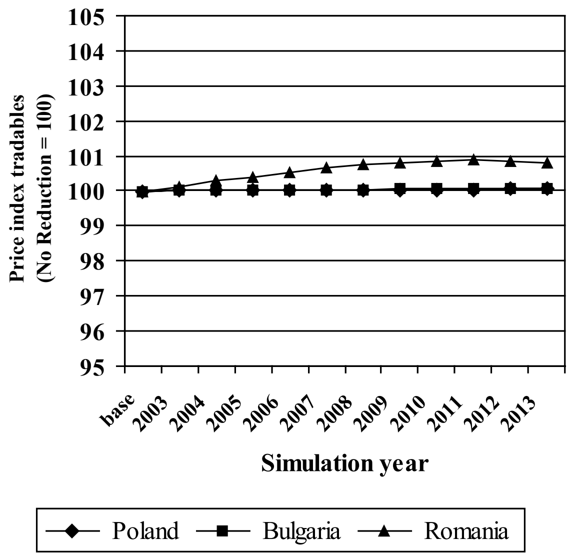
Graph 1 shows the development of milk production and the milk producer price under the scenario SUBS REDUCTION compared to the scenario NO REDUCTION. The effect of a decrease of subsistence production by 2% annually has a relatively small effect on total milk production: production falls between 0.5% in Romania and 1.5% for Bulgaria. This is within expectations: as the decrease in subsistence milk is fully shifted to market supply and demand, total production should be little affected. Nonetheless production is slightly lower than under a constant subsistence level, which results from the producer price for milk being lower, between 1.3% in Romania and 3.0% in Bulgaria (Graph 2). The decreasing producer price under the SUBS REDUCTION scenario reflects the shift in subsistence milk to market demand as being less price effective than the shift to market supply for two reasons:

1. The shift in market demand has to pass through the processing industry, which is not infinitely elastic in its response (see above). This can be seen in Graphs 3 and 4 below. Market price indices for tradable as well as nontradable outputs of the dairy industry increase in a situation where the input price of raw milk decreases, i.e. the processing margin increases. The total increase in processing demand varies between 3.7% for Poland and 8.4% for Romania. The elasticity of demand for raw milk by the dairy industry with respect to the processing margin, which is implied by the elasticity set described in Section 2 above, is not empirically founded and thus subject to discussion. Additionally, an opposite effect may result from higher efficiency of the milk processing industry with accession, which may result from higher FDI flows and the implementation of EU legislation. This would shift processing demand functions (and thus supply for processed milk products) to the right, and would result in higher raw milk prices.

2. The shift in market supply is fully price effective on the domestic market, because raw milk is a nontradable product. The shift in market demand, however, is less price effective because it occurs only partially for tradable products, which does not lead to as significant an increase in price as for nontradable products, because increasing demand can be met by increasing imports and/or decreasing exports. This is reflected in Graphs 3 and 4; the price index for tradables (Graph 4) increases much less than for nontradable outputs of the dairy processing industry (Graph 3).

Graphs 3 and 4: Development of Price Indices for Nontradable and Tradable Dairy Products under the Scenario SUBS REDUCTION Compared to the Scenario NO REDUCTION (= 100)





Source: Own calculations.

The price index for nontradable dairy products increases 0.8% for Poland to 1.9% for Romania under the SUBS REDUCTION scenario compared to a situation with constant subsistence farming. The price index for tradable dairy products is constant for Poland and Bulgaria and increases by about 0.8% for Romania compared to a situation with constant subsistence milk production and consumption.

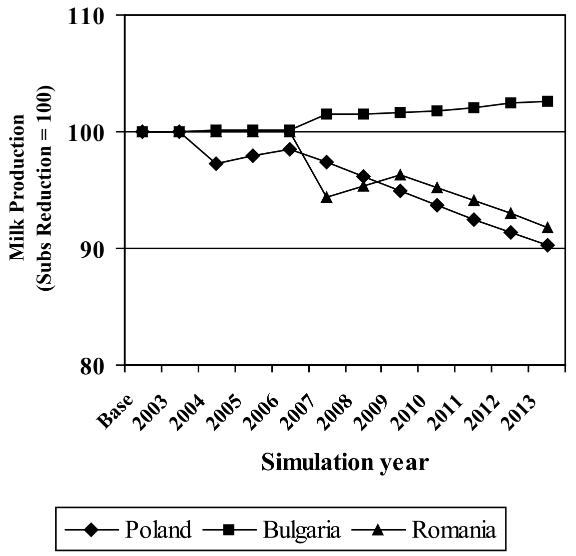
5.2 EU Accession Compared to Nonaccession with Subsistence Reduction

For the next set of scenarios, the scenario SUBS REDUCTION is taken as the reference. Two accession scenarios are compared to the SUBS REDUCTION scenario. Under both accession scenarios the 10 new member states accede in 2004, and Bulgaria and Romania accede in 2007. Accession scenarios are:

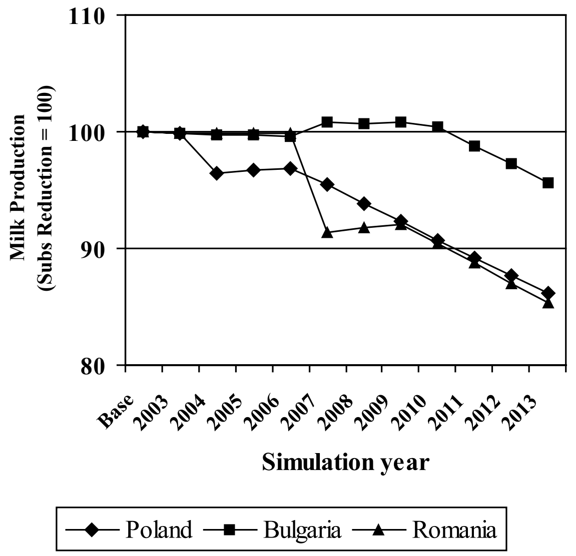
- A scenario under which the annual rate of subsistence reduction remains at 2%, ACC LOW.
- A scenario under which subsistence production is reduced by 4% per year, ACC HIGH. The rationale behind this scenario is the potential for accession to enhance economic growth and therefore induce a faster reduction in subsistence agriculture.

Graphs 5 and 6 show the development of milk production under the scenarios ACC LOW and ACC HIGH compared to the SUBS REDUCTION scenario.

Graph 5: Milk Production under Scenario ACC LOW Compared to SUBS REDUCTION Scenario



Graph 6: Milk Production under Scenario ACC HIGH Compared to SUBS REDUCTION Scenario

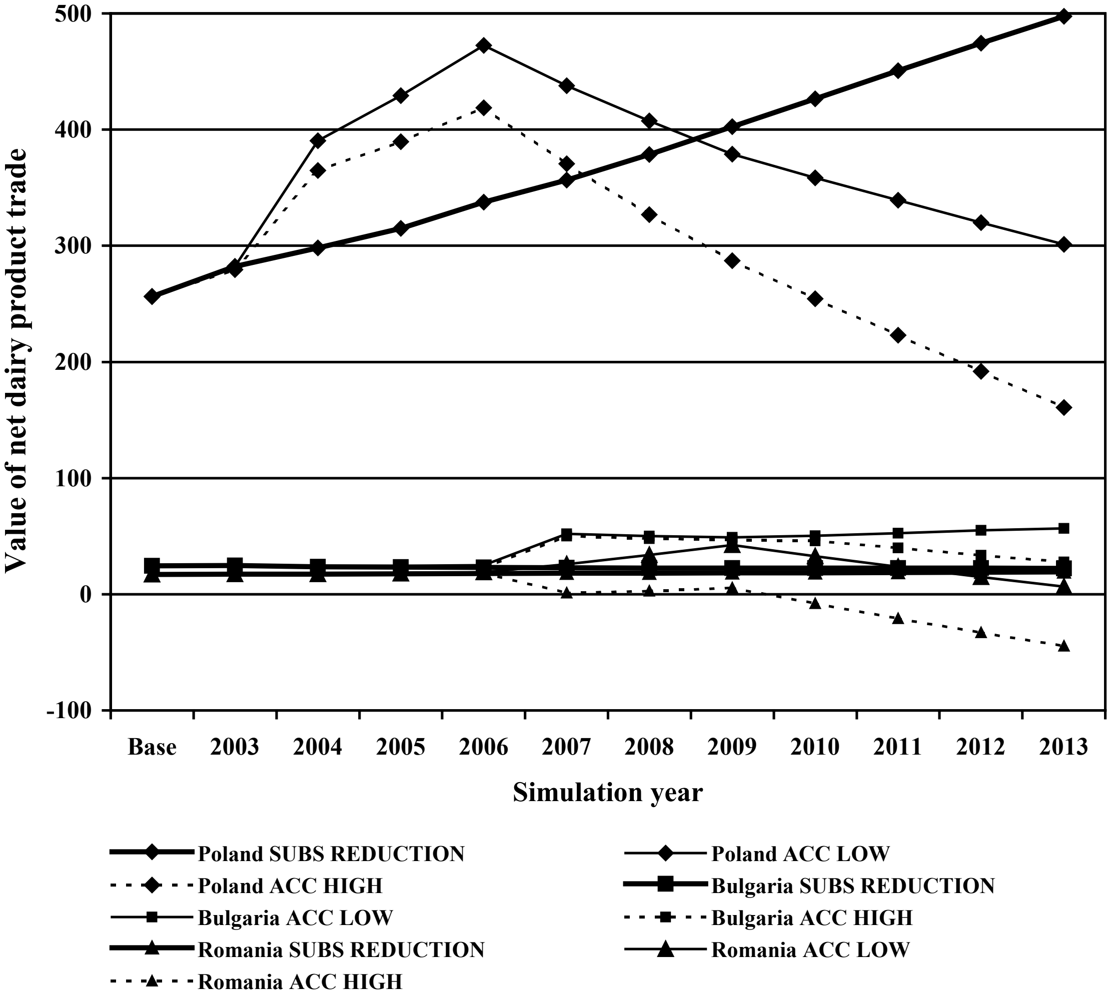


Source: Own calculations.

Under both accession scenarios milk production in Poland and Romania is considerably lower from the year of accession on than under the SUBS REDUCTION scenario, in which the CECs do not accede to the EU and are therefore not subject to the production quota, as the quota for market production is binding from the year of accession on. The quota limits Romanian milk production and milk output declines by almost 9% compared to scenario SUBS REDUCTION. The temporary "recovery" between 2007-09 is due the stepwise introduction of the additional special restructuring quota quantities. For Bulgaria, the quota is not binding under the ACC LOW scenario. This is because of the "water" in the quota for Bulgaria at the time of accession (see section 4 above). Under the ACC HIGH scenario, the quota also becomes binding in 2010 for Bulgaria, when subsistence production is reduced by more than 30% and is shifted to market production, which hits the quota in that year.

The higher reduction of subsistence dairy production and consumption under the ACC HIGH scenario leads to stronger market demand and thus, due to the quota restriction on domestic supply, on higher imports and/or lower exports. Graph 7 depicts the development of total net trade of dairy products (base price weighted quantities) under the SUBS REDUCTION scenario as well as under the two accession scenarios.

Graph 7: Net Trade in Dairy Products under the Subs Reduction Scenario and the Two Accession Scenarios, in Mio €

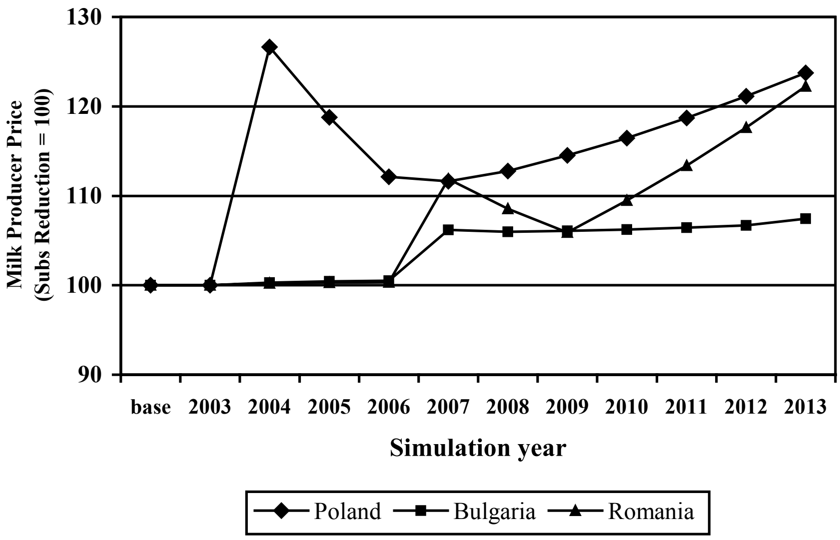


Source: Own calculations.

Graph 7 shows that net exports are typically lower under the accession scenarios than under the SUBS REDUCTION scenario if the quota is binding for the respective country. For Poland, net exports exceed the level under the SUBS REDUCTION scenario in the first years after accession, which results from the relatively high dairy prices in the years before full implementation of the MTR (see Graphs 10 and 11 below). The same holds for Romania under the ACC LOW scenario. But under the ACC HIGH scenario net exports by Romania are below the level under scenario SUBS REDUCTION from the year of accession on and Romania becomes a net importer of dairy products after 2010. Under the ACC LOW scenario, in which the quota is not binding in Bulgaria, net exports are higher from the year of accession on than under the nonaccession scenario. This is due to the 10 to 13% higher price level for tradable dairy products in the case of accession. Under the ACC HIGH scenario, on the other hand, net exports start decreasing from 2010 on due to the binding quota and are at about the base level in 2013.

Graph 8 depicts the development of milk producer prices under the scenario ACC LOW compared to the nonaccession scenario SUBS REDUCTION.

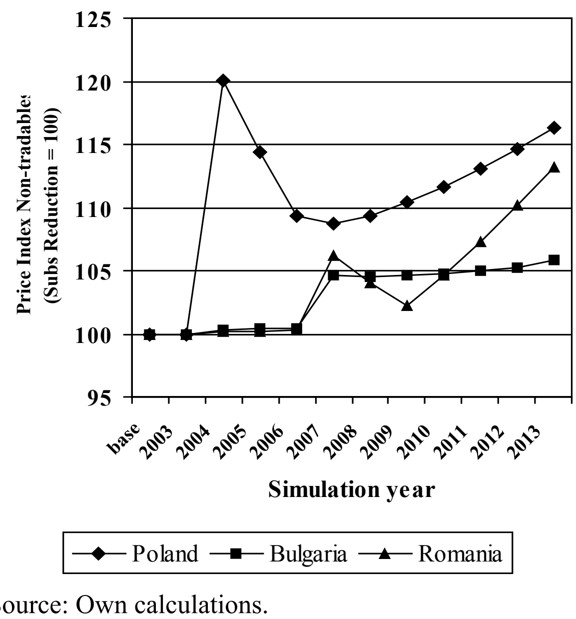
Graph 8: Development of the Milk Producer Price under Scenario ACC LOW Compared to Scenario SUBS REDUCTION (= 100)

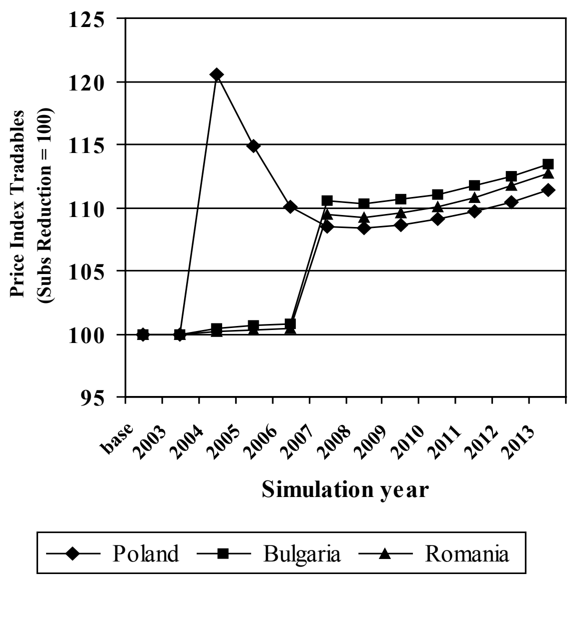


Source: Own calculations.

Milk prices increase considerably under the ACC LOW scenario; from 8% for Bulgaria to 23% in Poland. This is due to increasing prices for tradable dairy products following accession (see Graph 10 below) as well as increasing prices for nontradables (see Graph 9 below). Graph 10 shows that all prices for tradables develop in a parallel manner from 2007 on, which stems from the fact that they all reflect the EU price level in a fully integrated market. Differences exist in the development for nontradable milk products. For Bulgaria the price index is only 5% above the nonaccession level, which mainly results from cross effects with tradable dairy products. For Poland and Romania, the increase is stronger due to the binding quota, which restricts the supply of nontradable dairy products. Similar effects occur under scenario ACC HIGH, with an even higher increase in domestic milk prices for all three new member states.

Graphs 9 and 10: Development of Price Indices for Nontradable and Tradable Milk Products under Scenario ACC LOW Compared to Scenario SUBS REDUCTION (= 100)





Source: Own calculations.

6 Conclusions

Shifting equal quantities of subsistence milk to market production and consumption in ESIM leads to slightly declining producer prices and total production for milk. There are two reasons for this change. First, part of the shift in market demand is less price effective than the shift in market supply, because it partially occurs for tradable products, which does not lead to as significant an increase in price as for nontradable products. This is because increasing demand is partially met by increasing imports/decreasing exports. Second, elasticities of processing demand currently used in ESIM are in the order of two to three with respect to the output price and smaller with respect to the input price. This implies decreasing returns to scale in the dairy industry, which is at least questionable. For the future, sensitivity analyses with i) higher price elasticities of processing demand with respect to in- and output prices, and ii) technical progress in the dairy processing industry are foreseen.

Poland, Bulgaria and Romania are net exporters for dairy products in the base period and are projected to remain net exporters in case of nonaccession to the EU. With accession, net exports are projected to be lower although higher prices for tradable dairy products provide an incentive for higher market milk production. But market milk production is restricted by quotas. Quotas are increasingly binding the stronger the shift from subsistence milk to market milk. This is because only market production is restricted by quotas. The restriction on milk production in a situation of increasing market demand and decreasing subsistence production and consumption, potentially drives up prices for nontradable dairy products. Depending on the scenario, this increase is considerable for some countries which raises a question as to whether the formulation of raw milk, liquid milk for consumption, and the aggregate of other dairy products as fully nontradable is adequate. From a certain price difference on these products may in reality become tradable between EU member states. The speed with which the quotas become binding in the future depends on how much "water" they contain in the base period, i.e. on the assumption of whether the "direct sales" part of the quota is fully used for direct sales, or if in fact part of this is subsistence production which is not subject to quotas.

The approach presented here is based on exogenously determined shifters. An empirical foundation of i) the expected speed of a decline in subsistence production, and ii) the degree to which declining subsistence production translates into market production and consumption much needed, but cannot be generated by a partial equilibrium simulation approach. Instead, econometric analysis or simulation models which explicitly depict factor allocation economy wide, such as CGEs or at least factor allocation within the relevant households such as partial equilibrium household models, may be more appropriate.

The price responsiveness of milk processing as modeled in the current ESIM version is not based on econometric estimates nor has it yet been validated based on observations. Also, the reliability of base data on product composition of the output of the dairy processing industry as well as domestic prices, especially in Bulgaria and Romania, is quite weak. Therefore, results presented here should be taken as tentative. Nonetheless, including subsistence production of milk, particularly its future development in a partial equilibrium approach, yields valuable insights into the future situation of CEC dairy markets. Not accounting for subsistence production does not allow total milk production in the new member states of Central Europe to be adequately depicted, especially in light of the EU quota regime.

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