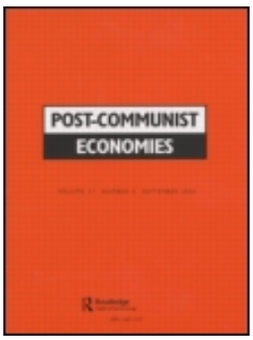


Routledge
Taylor & Francis Group

Post-Communist Economies

ISSN: 1463-1377 (Print) 1465-3958 (Online) Journal homepage: http://www.tandfonline.com/loi/cpce20

Bulgarian Agriculture and EU Accession

Nedka Ivanova , Mariya Peneva , Plamen Mishev , AntoaneTa golemanova & Emil Erjavec

To cite this article: Nedka Ivanova , Mariya Peneva , Plamen Mishev , AntoaneTa golemanova & Emil Erjavec (2007) Bulgarian Agriculture and EU Accession, Post-Communist Economies, 19:3, 263-280, DOI: 10.1080/14631370701503174

To link to this article: http://dx.doi.org/10.1080/14631370701503174

Post-Communist Economies, Vol. 19, No. 3, September 2007

Bulgarian Agriculture and EU Accession

NEDKA IVANOVA, MARIYA PENEVA, PLAMEN MISHEV,
ANTOANETA GOLEMANOVA & EMIL ERJAVEC

Abstract

This article analyses markets, income and agricultural policy changes in Bulgaria after its accession to the EU. A country AG-MEMOD model, consisting of 18 commodities organised in four sub-models (crops, livestock, milk & dairy and a link between crops and livestock) is applied. The model is an econometric, dynamic, partial-equilibrium and multi-product one. In order to examine the policy environment in Bulgaria, two scenarios are designed: baseline or non-accession (N-Ac) and accession (Ac). The accession scenario should have a very positive effect on the crop sector in Bulgaria, whereas the effect is the opposite on the livestock sector. The most remarkable results come from the milk sector. The effect on income is also positive, despite the pessimistic macroeconomic projections.

This article sets out an analysis of markets, income and agricultural policy changes for Bulgaria applying a country AG-MEMOD[1] model. The AG-MEMOD Partnership model is an econometric, dynamic, partial-equilibrium and multi-product model that allows market projections and simulations to be made in order to evaluate Common Agricultural Policy (CAP) instruments at national level and in aggregate for the EU member states and for countries about to accede (Chantreuil *et al.* 2005).

The agricultural sector has played a significant role in the Bulgarian economy and since it provides temporary or permanent employment for 1.1 million people is of crucial importance especially for rural areas (MAF 2005). The relative share of the agrarian sector in the total GVA in the economy decreased from 18.8% in 1998 to 10.9% in 2004, which is still a significant share compared with the EU average (Eurostat).

From a total area of 11.1 million ha, the utilised agricultural area (UAA) was 5.3 million ha in 2003, or 47.7% of the total territory. The share of cultivated land in

Nedka lvanova, Mariya Peneva and Plamen Mishev, University of National and World Economy, Sofia, Bulgaria.
Emil Erjavec, University of Ljubljana, Slovenia.
Antoaneta Golemanova, University of Ljubljana, Biotechnical Faculty, Chair for Agricultural Economics, Policy and Law, 3 Groblje Street, 1230 Domzale, Slovenia, and University of National and World Economy, Sofia, Bulgaria. Email: antoaneta.golemanova@brfo.uni-li.si.

[1] The AG-MEMOD project is financed by the 6th EU Framework and by contributions from the partner institutes throughout the EU; http://www.tnet.teagasc.ie/agmemod/.

ISSN 1463-1377 print/ISSN 1465-3958 online/07/030263-18 © 2007 Taylor & Francis
DOI: 10.1080/14631370701503174

Bulgaria amounts to 3.2 million ha (60.4%), which is slightly higher than the EU-25 average (58.6%). Bulgaria's main field crops are wheat, maize and barley. The main industrial crops are sugar beet, sunflower and tobacco. Tomatoes, cucumbers and peppers are the most important vegetable exports. Production of apples and grapes, Bulgaria's largest fruit products, has decreased since the communist era, but the export of wine has increased significantly. The most important types of livestock are cattle, sheep, poultry and pigs, and the main dairy products are yoghurt and white cheese.

With regard to trade, Bulgaria has a positive agricultural trade balance. Trade in agricultural products accounted for 10.7% of total exports and 5.6% of total imports in 2004 (MAF 2005). A large share of Bulgarian agricultural trade is with the EU-15 (accounting for 38.3% of exports and 41% of imports). Of exports, 23.3% went to Greece, followed by Germany (21.1%) and Italy (15.4%). The commodity list of Bulgarian exports to the EU member states was headed by Oriental-type tobacco, whole and half lamb carcasses, black oleaginous and motley sunflower seeds, fat goose liver, natural honey etc. In the case of imports of agricultural commodities, the two largest suppliers were again Greece and Germany, and amongst the new EU member states the list was headed by Hungary (7.1%) and Poland (6.4%).

During the transition process the total value of agricultural production has generally declined, reaching a low in 1996, when it dropped to about 62% of the 1990 level. Agricultural production then stabilised over the following three years and even recovered slightly to reach a level of around 67% of the 1990 level, before falling off again in 2000 and 2001 back to around the 1996 level. Crop production dominates over livestock production.

According to the latest census (MAF 2003) a total of 665,548 farms operate with an average size of 4.4 ha. Some 70% of the total area is cultivated by farms with the legal form of juridical entities, 58% of which are cooperatives. While they are large in terms of area (on average 593 ha), they account for only 0.3% of the total number of farms.

Bulgaria has a diversified agriculture, with fertile soils and favourable climatic conditions. After 1990 priority was given to dismantling large production complexes and distributing land and non-land assets, including livestock, to former owners. Most input prices were decontrolled. However, new owners were often ill-equipped to manage their new assets, and price controls (together with export controls and taxes) were maintained on produce in order to keep food prices low for the urban population. This led to large illegal exports and shortages, especially of grains. By the mid-1990s both macroeconomic imbalances and lack of structural reforms caused a financial crisis.

In general the agricultural policy pursued in Bulgaria since 1998 has been less interventionist: no administrative price control (except for tobacco) and a free foreign trade regime with a low level of market and price support. In an attempt to introduce CAP-conforming market organisation measures, in 2002 legislation related to the export subsidy system was introduced. At the end of 2004, in order to stimulate exports of canned fruit and vegetables and dairy products in particular, export subsidies were introduced.

Before accession to the EU the main instruments used for supporting farmers were subsidies for short and long-term credits, direct subsidy schemes, input subsidies, milk price subsidies, export subsidies and support under the SAPARD programme in respect of the National Plan for Agriculture and Rural Development (NARDP). In addition to the traditional instruments, in 2005 less favoured area payments were introduced in six mountain regions to test this instrument, which has to be applied after EU accession.

According to the experience from previous enlargements, accession to the EU will change the economic environment for Bulgarian agriculture to a significant extent

(Banse 2000; Münch 2000; EC 2002b). Commodity price convergence towards EU-25 levels, driven by the introduction of price support mechanisms and followed by the introduction of Single Area Payments (SAPS), will be experienced across Bulgarian agricultural sectors. Although these payments are de-coupled, they could still stimulate production to some degree, and this possibility should be analysed. The introduction of CAP reform (probably in 2013 for Bulgaria) and an increase of direct payments in line with the Accession Negotiation Agreement (European Commission 2004) will be a further step towards integration into the CAP.

This article provides general outlooks for the different Bulgarian agricultural sectors in the period until 2015, concentrating on the impact of accession after 2007. The policy environment to be examined includes:

1. a baseline preceding EU accession,
2. EU accession under SAPS.

The article is structured in four sections. Following this introduction, we first provide some background to the development of the Partnership and the challenges faced in developing models for the accession countries. We also discuss the methodological approach applied together with our scenario assumptions. The main results are presented in the next section. Finally, the conclusions that are drawn from the research are presented.

Modelling Approach and Background

General Methodology: the AG-MEMOD Modelling Approach

As noted above, the AG-MEMOD country models are econometric, dynamic, multi-product, partial-equilibrium commodity models. As a multi-product modelling system, the model is well suited to reflect the supply and demand inter-relationships among agricultural products (as exemplified by the beef and grains/feed relationship). Indicative relationships reflecting supply and demand responses can be built in. Another advantage of this type of model is the flexibility it offers to incorporate exogenous variables such as technical change, population growth, income and consumer preferences trends.

One of the key challenges in building the AG-MEMOD model was the primary task of trying to assemble a coherent and consistent set of data for each commodity. The political and economic changes that many of the participating countries have undergone in the last 10–15 years (Swinnen 2000) mean that it is often practical, reasonable and meaningful to restrict the data coverage period to relatively recent years. Additionally, collection of statistics in Bulgaria has only recently come under the aegis of EUROSTAT. So the lack of common definitions and reporting standards in the compilation of historical data is a particular difficulty in some AG-MEMOD countries. The annual data were obtained from national statistical offices and national academic databases in addition to New-Cronos and OECD databases, as well as FAPRI[2] forecasts.

[2] The Food and Agricultural Policy Research Institute (FAPRI) is a unique, dual-university research programme. With research centres at the Center for Agricultural and Rural Development (CARD) at Iowa State University and the Center for National Food and Agricultural Policy (CNFAP) at the University of Missouri-Columbia, FAPRI uses comprehensive data and computer modeling systems to analyse the complex economic interrelationships of the food and agriculture industry for national and international organisations.

The estimation of the model parameters follows the general rules provided in the AG-MEMOD modelling approach (Hanrahan 2001). However, owing to data inconsistency and structural breaks in policy, calibration techniques were used. The econometric approach is generally used to give the initial values for the regression coefficients used in the models. Most of the equations are estimated using annual data for 1992–2000 or shorter periods when data are not available. The model produces projections for production (of crops, livestock and animal products), consumption, exports, imports, stocks and prices.

The Bulgarian country model consists of 18 commodity sub-models: grains (soft wheat, barley, maize), oilseeds (sunflower), livestock (cattle and beef, pigs, poultry and sheep), milk and dairy products (cheese, butter, skimmed milk powder) and a module providing the link between the crop and livestock sectors. The share of products included in the model varies over the years but in general forms over 70% of gross agricultural output. In the last reported year included in the model (2004) the crop products analysed amounted to 61.3% of crop output and the animal products analysed formed 86.1% of livestock output, making a total of 72.1% of GAO.

The crop sub-model is constructed in a two-step procedure on the basis of land allocation between grains and oilseeds and then based on the shares of the crops included in the two groups. In contrast to the FAPRI GOLD model[3], the first step of the crop model (land allocation between grains and oilseeds) is replaced from the separate block for total land allocation.

The livestock sub-model is constructed on the basis of five product-specific modules providing the balance of animals in each group and estimating the output on the basis of the number of animals slaughtered and slaughter weight. Production of dairy products is based on the allocation of protein and fat content of milk among different products.

Macroeconomic indicators, policy variables and reference prices for the products analysed are exogenous for the model. The following macroeconomic factors are taken into consideration: real GDP, GDP deflator, population and exchange rate. The key prices (French, Dutch, Italian and world market prices) are used as reference prices in the product sub-models.

The CAP policy variables, as in the FAPRI GOLD model, are used for estimating the policy impact. The policy instruments explicitly considered in the model are payments per hectare. For Bulgaria it has been decided that payments for the crop sector will be made only per hectare. For the livestock sector payments will be based on density recalculation per animal.

Price Convergence and Definition of Policy Variables

To meet future compatibility requirements with the EU framework, the Bulgarian modelling team had to address the following challenges in the modelling approach:

- Identification of the relevant key commodity price linkages;
- how to handle the convergence of Bulgarian prices to the EU price level;
- how to model the switch from pre-accession to post-accession policy.

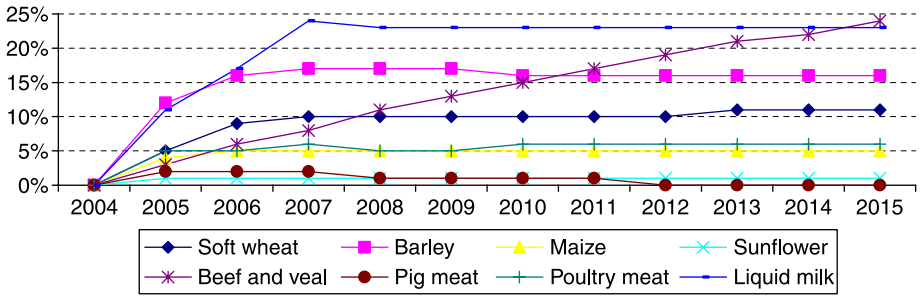
[3] The GOLD (grains, oilseeds, livestock and dairy) model is a dynamic, partial-equilibrium model of the EU agricultural sector that is maintained by FAPRI at the University of Missouri and has been used for the analysis of recent changes in EU policy (Binfield & Westhoff 2003; Binfield *et al,* 2003a).

In performing the accession analysis, the modellers looked at the process of linking farm and commodity prices in Bulgaria to those in EU markets. EU key prices were used which allowed the price equations to remain unchanged. Dummies were used to take account of tariff barriers between Bulgaria and the EU.

To some degree the rate at which producer prices might converge towards the EU level is an unknown. In the modelling approach for this study, the experience of previous EU accessions (especially of the CEE countries) was taken into account. Where producer prices are above the EU level in the pre-accession period, then, on accession, one might expect convergence to occur quite quickly. However, where prices are initially below the EU level, upward convergence of prices towards EU price levels might be expected to take place more slowly. There are a number of exogenous factors that would affect the rate of price convergence: these include, among other things, the GDP growth rate, the level of self-sufficiency for the product concerned, and the quality of the product produced in Bulgaria relative to that of the EU15.

The producer price assumptions are the other main elements of the enlargement scenario. The price situation in comparison with the EU differs from sector to sector. The producer price level in Bulgaria is significantly lower than the EU key price levels for meat (beef and poultry), milk and sunflower. However, this is not the case with grains, where Bulgaria is a net exporter. Figure 1 presents the percentage changes from the baseline projections for the prices of four key commodities in the Bulgarian AG-MEMOD model. The country experts predicted different price convergence patterns to the reference EU level. For the majority of products (except beef), there should be an immediate price increase effect after accession. The most substantial one could be expected for milk prices (somewhat less than 25%), followed by barley prices (17%) and wheat (10%). For all other products analysed (except beef), the initial increase in prices would be at most 5%. The beef price in the base year is substantially lower than the EU key price and it could be expected that price transmission would increase and by the end of the period of projection the existing price gap would be eliminated.

The support policy mechanisms used in Bulgaria in the period up to 2004 included mainly credit subsidies (lower interest rates for long and short-term credits provided via the State Agriculture Fund) and direct payments per hectare/animal at a very low rate. The latter were introduced in 2002 and the amount per hectare increased up to 2004 at the expense of the credit subsidies but remained at a much lower rate than the EU payments.



Source: Bulgarian AG-MEMOD model (2006).

Figure 1. Reference prices for key products in Bulgaria (% changes from 2004).

Bulgaria, like Romania, will gradually phase in the CAP direct payments scheme between 2007 and 2016. Direct payments will start at 25% in 2006, 30% in 2007 and 35% in 2008 of the present system and increase by 10 percentage point steps to reach 100% of the then applicable EU level in 2016. According to the current governmental decisions, the SAPS will be the only direct payments instrument used in Bulgaria after accession. Additionally, in the form of top-up funds to SAPS, national complementary direct payments (NCDP) amounting to 20% are intended to be made. However, there is still no final decision on this issue. SAPS and NCDP would be introduced on a per hectare basis for utilised agricultural area according to the EU regulation in the form of one single area payment which is valid, therefore, for crop products as well as for the livestock sector. No commodity-specific payments are going to be used.

The coupled rate for all products analysed is assumed to be 0.5 for SAPS payments, as well as for NCDP. A relatively high level of multiplier could be explained by the low yields and capital investment needs in the country, where small investments in inputs and capital could have a significant production effect. In respect to milk, the quota is fixed at the level of 979,000 tons. For the purposes of modelling, the direct payments for the livestock sector are recalculated from payments per hectare to payments per head on the basis of the livestock density per area (for cattle 1.4 head per hectare; for sheep 0.15 units or 9.3 head per hectare).

In the model, the different policies in operation before and after accession were handled using the same policy variable construct for the pre-accession and post-accession periods. A subsidy per unit value of production was calculated and added to the producer price to create a synthetic price construct—described as a 'basic price'. Such basic prices should reflect the changes in the nature and the value of the support that is given to agriculture. For the pre-accession period the direct payments part of the PSE calculations is used (OECD 2002).

Description of Functional Forms

In the two crop sub-models (grains and oilseeds) we assume that land allocation is made in a two-step process. In the first stage of the process producers are modelled as determining the total land area allocated to grains, oilseeds and root crops (i). Then, in a second stage, the shares of the land areas allocated to grains, oilseeds and root crops are allocated to each crop k belonging to the corresponding crop group i.

The total harvested area equations for grains, oilseeds and root crops can be written as

$$ah_{i,t} = f\left(p^k_{i,t-1}, ah_{i,t-1}, V\right) \quad k = 1, \ldots, n; \quad i = 1, \ldots, 3 \tag{1}$$

where $ah_{i,t}$ is the area harvested in year t for crop group i, $p^k_{i,t-1}$ the real price in year $t-1$ of crop k belonging to crop group i, and V is a vector of exogenous variables which could have an impact on the area of crop group i harvested (such variables include, *inter alia*, the set-aside rate and the rate of arable aid compensation).

The equations used to determine the share of crop k belonging to crop group $i(sh^k_{i,t})$ can be written as

$$sh^k_{i,t} = f\left(p^k_{i,t-1}, sh^k_{i,t-1}\right) \quad k = 1, \ldots, n \tag{2}$$

The yield equations of crop k in crop group i can be written as

$$r_{i,t}^{k} = f\left(p_{i,t-1}^{k}, r_{i,t-1}^{k}, V\right) \quad k = 1, \ldots, n \tag{3}$$

where $r_{i,t}^{k}$ is the yield per hectare of crop k belonging to crop group i, and V a vector of variables which could have an impact on the yield per hectare of the crop being modelled.

In the specification of the AG-MEMOD crops sub-models' supply side we do not consider income per hectare in the functional forms. This choice was made in order to distinguish the price and compensation variables' separate effects on producers' supply decisions.

On the demand side, crush and feed demand and non-feed use per capita are modelled using the following general functional forms

$$Fu_{i,t}^{k} = f\left(p_{i,t}^{k}, Z\right) \quad k = 1, \ldots, n \tag{4}$$

where $Fu_{i,t}^{k}$ is the feed demand for crop k belonging to crop group i and Z a vector of endogenous variables which could have an impact on the demand considered (number of animals, for example).

$$NFu_{i,t}^{k} = f\left(p_{i,t}^{k}, NFu_{i,t-1}^{k}\right) \quad k = 1, \ldots, n \tag{5}$$

where $NFu_{i,t}^{k}$ is the non-feed demand for crop k belonging to crop group i, considering also the prices of substitute products. Crush demand for oilseed crop k ($CR_{i,t}^{k}$) is modelled as

$$CR_{i,t}^{k} = f\left(p_{i,t-1}^{h}, p_{i,t-1}^{l}, CR_{i,t-1}^{k}\right) \quad h, l = 1, \ldots, n \tag{6}$$

where $p_{i,t-1}^{h}$ is the real price of the seed oil considered and $p_{i,t-1}^{l}$ the real price of the seed meal produced as a product of the crushing process.

The stock level, exports and imports equations for the grains and oilseed models in general have the following functional forms

$$St_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, St_{i,t-1}^{k}\right) \tag{7}$$

$$Ex_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, Ex_{i,t-1}^{k}\right) \tag{8}$$

$$Im_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, Im_{i,t-1}^{k}\right) \tag{9}$$

where $Im_{i,t}^{k}$, $Ex_{i,t}^{k}$ and $St_{i,t}^{k}$ are respectively the end-of-year stocks, exports and imports for crop k belonging to crop group i in year t, $PR_{i,t}^{k}$ and $DU_{i,t}^{k}$ are the production and the total domestic use of crop k belonging to crop group i.

The other commodity markets considered in the crops sub-models are the oils and meals markets. The supply sides of these markets are determined by oilseeds crushed and technical coefficients. For all these markets the specification of equations for exports, imports, stocks, oil per capita consumption, industrial demand for oil and meal domestic use are similar to equations (7), (8) and (9). The estimation of these functional forms allows us to determine harvested areas, yields, feed and non-feed uses, end-of-year stocks, exports and imports for the corresponding commodity markets.

While the structure of individual livestock and meat sub-models varies, their general structure is similar and is presented below. End-of-year numbers of breeding animals can be written as

$$cct_{i,t} = f(cct_{i,t-1} p_{i,t}, V) \quad i = 1, \ldots, n \tag{10}$$

where $cct_{i,t}$ is the end-of-year number in year t for breeding animal type i, $p_{i,t}$ is the real price in year t of animal i, and V is a vector of exogenous variables which could have an impact on the end-of-year inventory concerned (such variables are the direct payments linked to the animals concerned or specific national policy instruments).

Numbers of animals produced by the breeding herd inventory can be written as

$$spr_{i,t} = f(cct_{i,t-1}, ypa_{i,t}) \quad i = 1, \ldots, n \tag{11}$$

where $spr_{i,t}$ is the number of animals produced from breeding herd $cct_{i,t}$ in year t and $ypa_{i,t}$ is the exogenous yield per breeding animal concerned.

Within each animal type i there may be m categories of slaughter j. The number of animals in animal type i that are slaughtered in slaughter category j can be written as

$$ktt_{i,t}^{j} = f\left(cct_{i,t}^{j}, p_{i,t}, z_{i,t}^{j}, V\right) \quad i = 1, \ldots, n \quad j = 1, \ldots, m \tag{12}$$

where $ktt_{i,t}^{j}$ is the number of animals slaughtered in category j of animal type i in year t, $z_{i,t}^{j}$ is an endogenous variable that represents the share of different categories of animals slaughtered in the total number of animals slaughtered for the animal type concerned, and V is a vector of exogenous variables. Average slaughter weight for animal type i can be written as

$$slw_{i,t} = f\left(slw_{i,t-1}, z_{i,t}^{j}, p_{i,t}, V\right) \quad i = 1, \ldots, n. \quad j = 1, \ldots, m. \tag{13}$$

Total meat production from animal type i is then derived as the product of average slaughter weight and total slaughter for that type, which is defined as

$$ktt_{i,t} = \sum_{j} ktt_{i,t}^{j} \quad i = 1, \ldots, n. \; j = 1, \ldots, m. \tag{14}$$

End-of-year stocks of animals (breeding and non-breeding), and meat production are derived using identities. Total domestic use of meats is derived as the product of per capita demand for the meat concerned times an exogenous population variable. Per capita consumption of meat can be written as

$$upc_{i,t} = f\left(upc_{i,t-1}, p_{i,t}, p_{k,t}, gdpc_t, V\right) \quad k, i = 1, \ldots, n; \; k \neq i. \tag{15}$$

where $upc_{i,t}$ is the per capita consumption of meat i in year t, $gdpc_t$ is the exogenously determined per capita real income and V is a vector of other exogenous variables that have an impact on per capita meat consumption.

The functional form used to estimate the end-of-year stocks of meats has the same general form as that used in the estimation of the animal breeding inventories, equation (10). Similarly the specifications of the trade equations for animals and meats follow the same general functional form used in the grains and oilseeds models, equations (7)–(9).

Of the AG-MEMOD sub-models, the dairy model is arguably the most complicated. A particular feature of the dairy model is its emphasis on the allocation of milk fat and milk protein (rather than just simply milk) to the production of the various dairy commodities modelled. These products are butter, cheese, skimmed milk

powder, whole milk powder and 'other dairy products'. For each dairy commodity modelled, supply and utilisation are projected, as are wholesale prices at the country level as well as at the aggregate EU level (the latter being exogenous variables in national models).

The AG-MEMOD dairy sub-model comprises several components. The first component determines milk production, milk imports and exports. The second component allocates milk to feed use and fluid milk consumption. Total milk factory use (manufacturing milk) for further processing into dairy products is then determined as a balancing item.

Milk yield per cow can be written as

$$ypc_t = f\left(ypc_{t-1}, p_t, qua_t, V\right) \tag{16}$$

where ypc_t is the yield per cow in year t, p_t is the real price of milk, qua_t is the exogenous milk quota for the country concerned, and V is a vector of other exogenous variables that could have an impact on yields of milk per cow. Dairy cow end-of-year numbers can be written as

$$dct_t = f\left(ypc_t, p_t, qua_t, V\right) \tag{17}$$

where dct_t is the end-of-year number of dairy cows and other variables are as defined above. Total milk production is then derived as the product of milk yield per cow and total end-of-year cow numbers.

As noted earlier, total milk production is allocated to three uses, feed use (ufe_t), fluid use (ufl_t) and factory use (ufa_t). Feed use of milk can be written as

$$ufe_t = f\left(ufe_{t-1}, p_t, V\right) \tag{18}$$

with fluid use derived as the product of population and per capita fluid milk consumption. The per capita fluid milk consumption equation specification has the same form as that for per capita meat consumption (see equation (15)). Factory use of milk is derived to balance total milk supply and use.

As noted earlier, the AG-MEMOD model allocates the fat and protein components of raw milk. The amount of fat and protein in the raw milk produced that is used in the manufacturing sector is first calculated. This calculation involves a number of assumptions concerning the fat and protein content of the raw milk and the fat and protein content of the dairy commodities produced with manufacturing milk.

Once the available supplies of milk protein and fat are calculated, the next step is to allocate the protein and fat components. The milk protein allocated to dairy commodity i can be written as

$$ppc_{i,t} = f\left(ppc_{i,t-1}, p_{i,t}, p_{k,t}, V\right) \quad i,k = 1, \ldots, n; \quad i \neq k. \tag{19}$$

where $ppc_{i,t}$ is the allocation of protein to dairy commodity i in year t, $p_{i,t}$ is the price of dairy commodity i, and V are exogenous variables that affect the protein allocation to commodity i. Total protein available is allocated to n dairy commodities. Milk protein allocation equations are estimated for $n - 1$ products, with the milk protein allocation to the *nth* product derived as a balancing residual allocation.

Production of dairy commodities using milk protein is derived as the total milk protein allocation divided by an exogenous technical protein content conversion factor. Given these production levels the allocation of milk fat to these products is derived from fixed technical factors.

The allocation of milk fat to butter or other dairy products is written as

$$fpc_{i,t} = f(fpc_{i,t-1}, p_{i,t}, p_{k,t}, V) \quad i,k = 1, \ldots, n; \quad i \neq k. \tag{20}$$

where $fpc_{i,t}$ is the fat allocation to dairy commodity i, $p_{i,t}$ is the price of dairy commodity i, and V are exogenous variables that affect the protein allocation to commodity i. Given the allocation of milk fat to other dairy products or butter the allocation of the remaining milk fat is derived from the milk fat supply and use identity.

To complete the building of the Bulgarian AG-MEMOD country model for each of the commodities modelled it is necessary to add an equation describing the equilibrium for each commodity market. This condition implies that production plus beginning-of-year stocks plus imports equal domestic use plus end-of-year stocks plus exports. In a closed economy, this supply and use equilibrium condition is sufficient to determine endogenously the equilibrium country market prices, matching supplies and demands.

When the national market is not considered the key market in the Europe Union, the price linkage equations used in the model can be written as

$$p_{j,t} = f(Kp_{j,t}, p_{j,t-1}, ssr_{j,t}, Kssr_{j,t}, V) \tag{21}$$

where $p_{j,t}$ is the national price of crop j in year t, $Kp_{j,t}$ is the key price of crop j in year t, $ssr_{j,t}$ is the self-sufficiency ratio (domestic use divided by production) for commodity j in the country concerned, $Kssr_{j,t}$ is the self-sufficiency rate for the same commodity in the key price market, and V a vector of exogenous variables which could have an impact on the national price.

Description of the Scenarios

In this article, the baseline scenario represents agricultural policy in Bulgaria as it might have existed had accession not occurred. As such, it shows market outcomes in the absence of a shift in agricultural policy or enhanced economic progress in the country—the situation that would exist if accession did not take place. This baseline, or non-accession (N-Ac) scenario, is an indication of the evolution of agricultural markets in the next decade and can be interpreted as a measure of how the production potential might evolve without initiatives provided by the CAP.

A model for Bulgaria is used to produce results of the impact of accession from 1 January 2007 based on the adoption of the decoupled flat rate area payment, known as the Simplified Area Payments System (SAPS). During the accession negotiations it was agreed that the level of direct payments would rise gradually from 25% of the EU15 in 2007 to 100% in 2016. The accession countries can, to some extent, provide additional payments through national financing (EC 2003a, 2003b, 2003c). From this accession and reform process we can derive the main accession scenario: Ac—Accession (with convergence of prices following accession in 2007) and SAPS in place until 2015.

Macroeconomic Assumptions

Table 1 shows projections for some key macroeconomic variables for the Bulgarian economy up to 2015, made for the purposes of the Bulgarian country model. Population is projected to decrease by around 15%, which is expected to be one of

Table 1. Projections for macroeconomic variables for Bulgaria

	Unit	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Population	million	7.9	7.6	7.5	7.4	7.3	7.3	7.2	7.1	7.0	7.0	6.9	6.8
GDP	billion 1995 euros	9.6	11.8	12.1	12.5	12.8	13.2	13.5	13.8	14.2	14.6	14.9	15.3
GDP per capita	1995 euros	1,208	1,556	1,617	1,680	1,745	1,812	1,878	1,943	2,021	2,094	2,169	2.245
Inflation	1995 = 1	31,117	38,603	39,844	41,076	42,302	43,523	44,740	45,956	47,215	48,447	49,679	50,911

Source: BG NSI, own calculations.

the main influences on the consumption of the products included in the model. According to the estimations, GDP of EUR 11.8 billon (1995 prices) in 2005 will reach the level of EUR 15.3 billion in 2015, which represents growth of 29.7% over the period of ten years. This, together with the decline in population, results in a rise in the absolute level of GDP per capita over the same period of 44.3%. The vector inflation shown is calculated taking as the base year 1995, which is the first 'economically balanced' year after the change from the old planned economy system towards a market economy, a process interrupted by the economic and political crisis in Bulgaria in 1997.

Results and Discussion

Crops

The conclusion that could be drawn is that EU accession in general should have a very positive effect in the Bulgarian crop sector. The price increases and significantly higher budgetary support compared with the baseline projections are expected to lead to an increase in the total grain production in Bulgaria by 10.9%, and for soft wheat by 16.0% and barley by 25.4% (Table 2). This reflects positive changes in both harvested area and yields. Apart from this, the production of maize is expected to decline by 2% compared with the baseline scenario. Nevertheless, it will remain 172% higher than in the base year. This is mainly due to the negative relative change in prices. However, the situation could be significantly improved if technological development in grain production were integrated into the modelling approach.

On the other hand, the growth of grain production is not followed by a similar trend in the use of these products. The model shows another very interesting result, namely the expectation of declining total domestic grain consumption by 8.7% compared with the base year. This can be attributed to decreased use for both animal feed and human consumption because of the reduction in livestock numbers on one hand and the significant decline in the population on the other.

Compared with the baseline projections domestic consumption is expected to increase slightly (by 0.4%), as consumption of maize will increase by 4.6%, compensating for the reduction in use of soft wheat (1.6%) and barley (2.8%). The reduction of domestic use should increase the export potential of Bulgarian grain producers after EU accession. However, the potential of this export position in relation to the EU is still limited. Owing to market deficiencies, fixed transport costs and price movements (as in Hungary after accession) this production could be used for intervention purposes.

Sunflower seeds are the most important Bulgarian oilseed, which shows an even stronger production increase than grains. Production of sunflower will increase by 42.3% compared with the baseline projections. The main reason for this is the much higher support (even though only half is considered coupled) than under the baseline scenario, as well as the substantial price increase compared with the base year. This growth in production is a result of both an increase in harvested area (20%) and yields (2%), compared with the baseline scenario. With the help of the model it can be predicted that, as a result of the price increase, per capita consumption should decline, leading to a reduction in total domestic use estimated at 10.0% compared with the baseline scenario. In nominal terms the total domestic consumption of sunflower seeds will also increase in relation to 2001. That is why Bulgarian producers should be competitive in the sunflower sector and such a production increase could emerge.

Table 2. Aggregate model results for grains and oil seeds

	Total grain (000 t)			Soft wheat (000 t)			Maize (000 t)			Barley (000 t)			Sunflower (000 t)		
	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac
Production	7,077.0	7,666.0	8,498.5	4,077.5	4,188.8	4,857.6	872.6	2,415.9	2,370.0	930.9	1,061.1	1,270.9	405.09	673.02	958.00
Use	5,240.0	4,731.0	4,751.6	3,565.5	2,451.2	2,411.0	892.8	1,682.7	1,760.7	770.0	596.5	579.9	384.72	770.80	693.51
Producer price	99.5	95.7	104.8	101.2	91.9	101.8	103.6	106.5	111.9	88.5	86.0	99.8	196.86	217.81	220.32

Source: Bulgarian AG-MEMOD Model (2006).

However, the increase in production depends mainly on the development and competitiveness of the processing industry. This is confirmed by the fact that investment and development in this sector have been taking place in recent years. Further, after EU accession Bulgaria will strengthen its position as a net exporter of sunflower and in this sense become a regional player.

Livestock and Dairy Produce

According to the model Bulgarian accession to the EU single market will lead to relatively unfavourable results in the livestock and dairy sector. The only positive result is for sheep raising. According to our expectations, the milk sector and as a result beef production will be negatively affected (Table 3).

The impact of CAP integration on sheep is positive because of the number of herds and lamb and mutton production. This is a result of the positive price change (13.0% compared with the baseline scenario) and a substantial increase in support for the sector. The rise in the number of sheep under the Ac scenario is estimated at 29.5% compared with the baseline projections. The same pattern applies to lamb production. Generally, domestic consumption of lamb is low (mainly seasonal) and the price elasticity of lamb consumption is low. For this reason the price increase on lamb does not have much impact on domestic consumption: under the accession scenario it is estimated at 2.1%. However, the increase in sheep meat production is still limited and we do not expect a stronger impact on regional or single market trade. Nevertheless, the export potential of sheep meat will to some extent be increased after accession.

The most remarkable modelling results came from the milk sector. It is more or less clear that the milk quota determined in the accession negotiations is quite unfavourable for the sector. The production potential of this relatively less developed sector is depressed. Owing to milk quota limitations milk production under the accession scenario is 23.2% lower than under the baseline scenario. Lower milk production reflects mainly the production of cheese, estimated at 27.9% lower than under the baseline. The negative changes occur in the first year after accession. Further, the increase of relatively low milk yields worsens the situation. For butter production the model results show greater reductions: it is estimated at 55%. Practically, there is no change in milk and dairy consumption. The curtailment of production can be expected to change the trade patterns too. From a net exporter of cheese in the baseline scenario Bulgaria will become a net importer of cheese after accession.

Owing to the dual-purpose character of production, the negative trends in the milk sector are likely to have a significant impact on the beef sector. As a result of production restrictions the number of dairy cows will decline after 2007 and by 2015 the decrease is estimated at 10% compared with the base year and by 24% compared with the baseline scenario. This reduction in the number of dairy cows is reflected in the total number of cattle, for which the decline is estimated at 13% compared with the baseline scenario. The milk quota has a stronger effect than the increase in prices and support, which is quite strong in the beef sector. However, these opposite effects, together with the expected increase of slaughter weight and introduction of specialised cattle fattening breeds, should moderate the milk quota burden. Therefore beef and veal production decrease only by 14.1%, which is considerably less than the 23.2% fall for milk. The impact of the increase in beef prices on per capita consumption compared with the baseline scenario will be practically offset by the increase in

Table 3. Aggregate model results for livestock

	Beef and veal (000 t)			Fluid milk** (000 t)			Pork (000 t)			Poultry (000 t)		
	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac
Production	57.0	68.0	58.4	1,253.0	1,660.0	1,275.0	183.0	102.0	97.8	105.0	109.0	108.0
Use	73.0	98.0	94.2	1,681.0	1,691.0	1,690.5	205.0	126.0	131.6	117.0	120.0	118.9
Producer price	159.0	192.0	238.5	19.0	19	23.7	150.0	157.0	156.5	117.0	109.0	115.5
	Sheep meet (000 t)			Butter (000 t)			SMP (000 t)			Cheese (000 t)		
	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac	2001 N-Ac	2015 N-Ac	2015 Ac
Production	20.0	22.0	28.5	1.0	2.0	0.9	0.0	0.0	0.0	45.6	97.5	70.3
Use	13.0	14.0	14.3	2.0	2.0	2.0	0.0	0.0	0.0	38.7	83.0	83.0
Producer price	172.0	193.0	218.1	249.0	212.0	223.1	133.0	138.0	137.6	162.2	254.7	254.3

Source: Bulgarian AG-MEMOD Model (2006).

income but will lead to a lower per capita consumption increase than in the baseline scenario and, following this, the total domestic consumption of beef is estimated at less than 4% lower than under the baseline scenario. According to the model results the trade position of the Bulgarian beef sector worsens after accession and Bulgaria remains a net importer of beef.

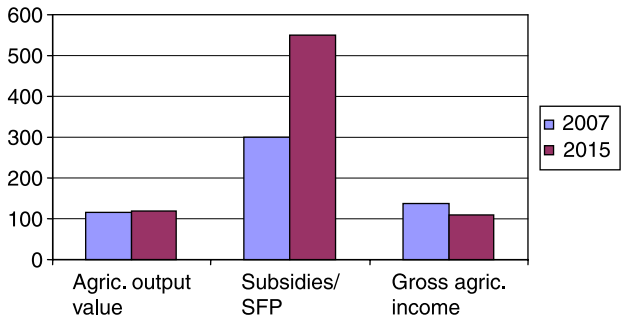
Pork and poultry production are less competitive and are still an important part of rural subsistence economies. Therefore the changes are limited, though with a negative sign. The higher increase in feed prices compared with the prices of output in the accession scenario leads to some reduction in pork and poultry production and could not be offset by increased productivity. It is estimated at 4.1% and 0.9% respectively. The impact of the negative relative price changes on these two sub-sectors could not be offset since practically there is no support for them and also because producer prices were close to the EU level even before accession. After the initial slight decline in domestic pork consumption per capita as a result of the price increase under the accession scenario, domestic consumption per capita will increase by 4.4% compared with the baseline scenario. In contrast to pork, and because the poultry price increase under accession is higher than under the baseline scenario, the domestic use of poultry is lower than in the baseline—by 1%. Bulgaria remains a net importer of pork and poultry.

Agricultural Income

The Bulgarian model also provides some pointers to the agricultural income situation after accession. The accession impact is quite positive, compared with the baseline scenario. Bulgarian gross agricultural income should increase by 56%. This result is mainly due to the substantial increase in subsidy receipts (increased nearly 4.5 times) and to a lesser extent to the increase in output (by 13%) (see Figure 2).

Conclusions

This article has outlined the progress made in developing a country level model for the agriculture sectors of Bulgaria following accession to the EU in 2007. The work represents a positive development in the analysis of the impact of agricultural policy changes for the countries that are modelled. Estimates of policy impact that are based



Source: Bulgarian AG-MEMOD Model (2006).

Figure 2. Agricultural income enlargement scenario change from baseline (baseline = 100).

on a rigorous factual basis already existed from models developed to analyse agriculture in the 'old' EU member states. The model developed here provides an alternative to projections which already exist, many of which are based on expert opinion or the extrapolation of past trends.

The outlook indicates that farmers in Bulgaria will gain from higher prices and budgetary support. Projections for most sectors show real improvements when measured against recent production levels, but less so when compared with historical production levels already achieved in the late 1980s and early 1990s. Accession supports the orientation towards crop production where Bulgaria, at least for sunflower, becomes an important net exporter. Among the products modelled, only sunflower will gain some significant share on the EU market. Bulgarian sunflower seed should increase total production in the EU by around 15%. However, if the policy remains the same in the grain sector, some additional costs for intervention purchases could be incurred. It has to be pointed out that some agricultural activities in Bulgaria for which the impact on the single market is expected to be stronger were not modelled. These sectors are vegetables, tobacco, wine and some other Mediterranean products.

Production growth in the dairy sector is much more limited under the accession scenario than under the baseline due to the introduction of milk quotas. The accession scenario results indicate that, in aggregate, Bulgarian agriculture would have less favourable growth potential if it were to remain outside the EU and retain the policy instruments in place before accession.

It is quite uncertain how technological development, quality differences and sanitary requirements will affect the development of various sectors. Quality and sanitary divergences may persist into the future or there may be convergence in a relatively short period of time. The rate of progress in this area may affect the outcome for several sectors in Bulgarian agriculture in the medium term. The rate at which technological progress is transmitted through the agricultural sectors is likely to change with accession, but it is difficult to be completely confident about the pace of its adoption. This uncertainty may additionally affect the projected path for some sectors of Bulgarian agriculture.

The macroeconomic assumptions based on National Statistical Institute publications are quite pessimistic. Bearing in mind the low level of development of the Bulgarian economy and the recent trends in GDP, an annual increase in GDP of 4.0–4.5% is realistic. As far as the population at the end of the period is concerned, a change in the tendency for depopulation could be expected. It is likely that ethnic Bulgarians from Moldova, Ukraine and Macedonia would migrate to Bulgaria, together with the return of Bulgarian citizens working in Greece, Spain etc.

These first results remain tentative and further investigation to improve the model design and engage country experts in more detailed review of the output is warranted. In addition, the methodology that has been developed to incorporate decoupled payments should be extended. However, the potential for analysis of relevant policy issues (commodity outlook, WTO, further reform of the CAP) is clear. Future steps will focus on the completion of the models and their preparation for CAP reform analysis, further updating of the models' datasets and further development of the methodology used. Additional goals would see the continuation of the network that has already been established so that the model can be migrated to a suitable platform to allow combination with models for the EU25. This would facilitate EU27 policy analysis at country-specific level. The development of similar models for countries identified for future accession, as well as models for trade-relevant countries neighbouring the EU, would also be a priority.

References

Banse, M. (2000) 'Macroeconomic Implications of EU Accession', in S. Tangerman & M. Banse (eds), *Central and East European Agriculture in an Expanding European Union* (Wallingford, CAB International), pp. 133–156.

Binfield, J. & Westhoff, P. (2003) 'FAPRI Analysis of the European Commission's Mid-Term Review Proposals', *Mid-Term Review of the Common Agricultural Policy July 2002 Proposals: Impact Analysis* (Brussels, European Commission Directorate-General for Agriculture, January).

Binfield, J., Donnellan, T., Hanrahan, K. & Westhoff, P. (2003) 'The Luxembourg CAP Reform Agreement: Implications for EU and Irish Agriculture', *The Luxembourg CAP Reform Agreement: Analysis of the Impact on EU and Irish Agriculture* (Dublin, Teagasc, October).

Chantreuil, F., Levert, F. & Hanrahan, K.F. (2005) 'The Luxembourg Reform of the CAP: An Analysis using the AGMEMOD Composite Model', 89th EAAE Seminar, Parma, Italy.

European Commission (2002b) *Mid-Term Review of the Common Agricultural Policy July 2002 Proposals: Impact Analyses* (Brussels, European Commission Directorate-general for Agriculture).

European Commission (2003a) *Prospects for Agricultural Markets in the European Union 2003–2010*, CAP reports, DG-Agriculture.

European Commission (2003b) *CAP Reform*, various documents available at http://europa.eu.int/comm/agriculture/mtr/index_en.htm

European Commission (2003c) 'Treaty Concerning the Accession of the Czech Republic, the Republic of Estonia, the Republic of Cyprus, the Republic of Latvia, the Republic of Lithuania, the Republic of Hungary, the Republic of Malta, the Republic of Poland, the Republic of Slovenia and the Slovak Republic to the European Union', *Official Journal of the European Union*, OJ L236, 46, September, http://europa.eu.int/comm/enlargement/negotiations/treaty_of_accession_2003/index.htm

European Commission (2004) 'Council Regulation', No 1782/2003.

Hanrahan, K. F. (2001) 'The EU GOLD Model 2.1: An Introductory Manual' (Dublin, Teagasc, Rural Economy Research Centre).

Ministry of Agriculture and Forestry of Bulgaria Agrostatistics Directorate (2005) *Structure of Agricultural Holdings in Bulgaria*.

Ministry of Agriculture and Forestry of Bulgaria Agrostatistics Directorate (2003) *Census*.

Ministry of Agriculture and Forestry of Bulgaria (2005) *Annual Report*.

Münch, W. (2000) 'Effects of CEEC-EU Accession on Agricultural Markets in the CEEC and on Government Expenditure', in S. Tangerman & M. Banse (eds), *Central and Eastern European Agriculture in an Expanding European Union* (Wallingford, CAB International), pp. 113–132.

OECD (2002) *Agricultural Policies in Transition Economies — Trends in Policies and Support* (Paris, OECD).

Swinnen, J. (2000) 'Agricultural Structures and Institutions within Central and Eastern European Countries', in A. Burell & A. Oskam (eds), *Agricultural Policy and Enlargement of the European Union* (Wageningen, Wageningen Press).