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Modelling of cereal and oilseed crop production in Bulgaria in the context of policy changes

The article presents the results from a modelling exercise on five crops: wheat, barley, maize, sunflower and rapeseed. These crops cover 55 per cent of the utilised agricultural land in Bulgaria and over 90 per cent of the arable land. The main goal of the research was to project the development of the production and trade of these crops in Bulgaria between 2013 and 2017, as well as to implement an analysis of certain scenarios related chiefly to upcoming changes in the Common Agricultural Policy (CAP). The model is linked with the global crop market through European Union prices, as the Bulgarian commodity market is considered to be a price taker, and it assumes the development of other agricultural sectors (livestock) and the macro-economic situation in Bulgaria as exogenous variables. The research is an attempt to incorporate into Bulgarian analytical practice modelling methods that can provide useful figures and projections about the impacts of different political measures for decision makers, and market information on the prices and global supply and demand trends for farmers and agri-business organisations. The results show that the production of the modelled commodities will continue to increase in the coming years, mainly as a result of the growing global demand for cereals and the advantages of the production of these crops in Bulgaria compared to other field and permanent crops. It is also evident that the expected changes in the CAP will cause a small decrease in the planted and harvested area for most of these crops.

Keywords: baseline projection, cereals, oilseeds, model, trade, policy, prices

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Introduction

Agriculture in Bulgaria, as in the other eastern European Union (EU) Member States, is characterised by a notable dualistic structure: a large number of small farms on the one hand, and a small number of large farms with market orientation on the other. Although the share of the agricultural sector within the national GDP has been decreasing over the years, according to Eurostat data it still exceeds the equivalent share in other EU Member States. Furthermore, the significance of agriculture in exports has increased since 2007, from 10.7 to 16.8 per cent, while in absolute value agricultural exports have almost doubled.

In 2011 wheat, barley, maize, sunflower and rapeseed were grown on about 55 per cent of the utilised agricultural area and over 90 per cent of the arable land in Bulgaria. Besides, these crops accounted for about 75 per cent of the gross output in the crop sector and 43 per cent of the gross agricultural output in that year. They have benefited from Bulgaria's accession to the EU via the equal per hectare payments under the Common Agricultural Policy (CAP) (Popov, 2011). Since 2007 the cereal sector has managed to recover its level of production to become the leading crop production sector in Bulgaria in terms of value output (Ivanov *et al.*, 2012). Agricultural producers prefer to grow cereals rather than be involved in livestock and dairy, or fruit and horticulture production because the expected profitability is more calculable and reliable.

These five crops also play a major role in the agricultural trade balance of the country and are conducive to its positive net trade. The net export position of Bulgaria has strongly increased since 2008. This is a result of a higher production of cereal crops and improvement in the agro-technical conditions in respect of machinery, equipment and plant protection and seeding practices. Since 2000 the farm structure in the cereal subsector in Bulgaria has changed, as enlargement of the cereals producers via consolidation

of arable land holdings has been a notable feature. According the 2010 Agrarian Census, 5,300 farms cultivate about 2,830,300 ha, the average size per farm being about 530 ha (MZH, 2012). More than 80 per cent of these farms are specialised in crop production and by expanding their land area they have achieved various advantages such as economy of scale and better agro-technical conditions, resulting in higher competitiveness. However, beyond cereals, Bulgarian agriculture has not maintained a large-scale farm structure since the transition from a centrally planned to a market economy.

The improvement of the on-farm production environment allows advantages to be gained in the grain global market. Using the domestic resource costs (DRC) index, Gorton and Davidova (2004) found that, due to the price of the land, rent and labour, the Bulgarian cereal sector already had a relative competitive advantage prior to Bulgaria's accession to the EU. Their results also suggested that over time Bulgaria was even increasing its competitive position in cereals. This provides a consistent demand in the domestic market that is relatively autonomous from the economic situation and valorises on the propitious conditions for exports to the Turkish and European markets (Mitova, 2012).

Bulgaria's average level of self-sufficiency during the period 2000-2010 was 112 per cent. With production systematically exceeding domestic demand, Bulgaria is a structural exporter of cereals. The wheat market in Bulgaria is strongly integrated with both the EU and the Balkan markets. The EU is the main destination for Bulgarian cereals exports, with wheat, maize and barley being the dominant crops according to Bulgarian Ministry of Agriculture and Food (MZH) data for the period 2002-2012. Bulgarian National Statistics Institute (NSI) and FAO data show that in 2011 the share of Bulgarian wheat exports in world wheat trade was 1.2 per cent, whereas concerning maize it was 0.78 per cent, positioning the country in the top 15 exporters worldwide. Even so, the country can be seen as a 'price taker' in a market with robust

competition, i.e. it does not influence the world market with its export surplus. Globally, Bulgaria was the second largest exporter of sunflower seeds in 2010, according to FAO data. After 2006, owing to the high international prices, rapeseed became the second most important oilseed crop in Bulgaria in terms of production area.

This paper presents the results of a modelling exercise designed to make five-year (2013-2017) supply side projections for the five major crops in Bulgaria in the context of a given agricultural policy framework and linked to the development of the global cereal market. Following on from this, our paper has two objectives: (a) to demonstrate the methodological approach and to present the main results concerning supply side of the five crops over a mid-term period; and (b) to make a comparative analysis of the changes and possible effects on the development of the production of these crops under the new (2014-2020) CAP framework versus the continuation of the former (2007-2013) CAP framework.

The model was set up on the principles and state-of-the-art knowledge achieved by similar research (FAPRI-GOLD, AGMEMOD). The result of our work is an econometric modelling system adapted to Bulgarian reality that can be used to make baseline projections of the major indicators concerning the development of the most important cereal and oilseed crops, and that can be used for further scenario development, and market and policy impact analyses.

Overview of the CAPA research project and model

The study is a part of a research project entitled 'Establishment of the Centre for Agri-policy Analysis – CAPA' financed by the America for Bulgaria Foundation (www.americaforbulgaria.org). The main goal of the project is to develop a system for the analysis of agricultural production, trade and policy using econometric methods. The sectors included in the analysis (cereals, oilseeds, dairy, meat and horticulture) represent the main production activities in Bulgarian agriculture. The research is being implemented by a team from the Institute of Agricultural Economics in Sofia in association with the Food and Agriculture Policy Research Institute (FAPRI) of Missouri University in the USA. The concept of the project is to develop specific agricultural econometric models that comply with the local circumstances and conditions; relying on the FAPRI experience and approach in implementing such activities and methods (Meyers *et al.*, 2010).

The model was used to generate baseline projections of the cereal and oilseed crops for a five year period to 2017. The historical data used for the projections cover the period from 1998 to 2011 (2012 in some cases). The data sources used were mainly national, from the NSI and the MZH. External sources were: Eurostat (<http://www.epp.eurostat.ec.europa.eu>) and FAO (<http://faostat.fao.org/site/342/default.aspx>). Where there was a lack of official data, the judgment of experts was applied and datasets were compiled from a network of representative farms. The model was calibrated by comparing the projected figures with historical data.

The development of the model required the creation of a database not only of data for the crop sectors, but also macroeconomic data, figures relating to agricultural policy in terms of support to the sector via different schemes and programmes, and the implementation of particular requirements, and technological data (regarding chemical and fertiliser use in agricultural production). The macroeconomic outlook included data about GDP, population, national incomes, exchange rates and inflation in Bulgaria. These were exogenous variables taken from external sources. Most of the data were from the Bulgarian national statistics, whereas the projections for GDP, inflation rates and exchange rates were compiled from IHS Global Insight (www.ihs.com) and national institutional forecasting. The policy outlook included data about the 2007-2013 CAP measures (Single Area Payment Scheme (SAPS) payments, top-ups, others) and the anticipated CAP expenditure in the period 2014-2020 (basic payment, 'greening' payment etc.). The data for the amounts of direct payments, and eligible and authorised hectares in 2007-2013 are based on the annual Agrarian Reports published by the MZH and the Bulgarian Payment Agency. The data regarding CAP 2014-2020 were taken from the Regulations accepted by the European Commission. The distribution of the payments under the new CAP was based on the provisions of EU Regulation 1307/2013 (EC, 2013).

There are two groups of assumptions, firstly regarding the data and the variables used in the model and secondly regarding the model parameters. The Bulgarian crop model was connected with both the FAPRI global modelling system (Meyers *et al.*, 2010) and their GOLD (grains, oilseed, livestock and dairy) model (Hanrahan, 2001; Binfield *et al.*, 2005) for the EU through the commodity prices at EU level. In line with the historical data it was assumed that the Bulgarian prices follow the major developments in the EU prices (Hanrahan, 2001). Moreover, most of the production is exported, meaning that the prices in Bulgaria are transmitted to the foreign, world prices (Keats *et al.*, 2010). For the grain crops the French price was used as a proxy for the EU price, while for the oilseeds Rotterdam or Hamburg prices were assumed to be determined on the world markets. The Bulgarian prices were linked to them with an elasticity coefficient of 1 following the GOLD model methodology (Hanrahan, 2001; Binfield *et al.*, 2005). In most cases the equations are linear and the model coefficients were then calculated based on the average historical data and the assumed elasticities (Hanrahan, 2001).

The policy variables are based on the country specific CAP measures – the SAPS and agri-environmental payments (AEP) under Pillar 2 of the CAP. Market measures such as coupled support are not included in the model because no such measures are implemented in the grain and oilseed sectors in Bulgaria. The 2014-2020 CAP direct payments include the so called 'greening' measures. It is assumed that, due to these changes, farmers will seek to bring additional land (idle land) into production in order not to lose production opportunities due to the specific greening requirements. According to the 2010 Agrarian Census (MZH, 2012) Bulgaria still has about 8 per cent land that is left idle and could be brought into production.

Application of the model

The model is dynamic, partial equilibrium, multi-product, non-spatial and econometric-based, and is designed to derive the basic supply and use tables, as well as estimates of prices (Meyers *et al.*, 2010) for five crops, wheat, barley, maize, sunflower and rapeseed. The model is predominantly deterministic, while stochastic analysis could be used in future for defining different scenarios and outcomes. The Bulgarian crop model follows the major steps in the GOLD model. However, the Bulgarian model for cereal baseline projections is not simply an adapted version of a cereal model used by FAPRI; it is rather a new model based on the FAPRI approach and the Bulgarian needs and conditions in terms of data availability and goals. The model consists of a system of single equations simulated in Microsoft® Excel®. The equations and the parameters have not been estimated; instead the selection has been guided by theory and expert feedback (Hanrahan, 2001).

The general work of the model can be described by:

$$y=f(X_1; X_2; X_3) \quad (1)$$

where y is a dependent indicator, which in separate equations can stand for area, yield, gross margins, costs etc., whereas different variables (X_i) represent independent factors influencing the development of the dependent ones.

That could also be presented as:

$$y=\alpha + \varepsilon\beta_1 X_1 + \varepsilon\beta_2 X_2 + \varepsilon\beta_3 X_3 \dots + \xi$$

where α is the intercept, ε the elasticity, β the regression coefficients, X_{123} are variables and ξ is an error term.

The five crops have a similar specification for the supply side of the model, so the following equations were applied to all crops. The regression coefficients were calculated when possible, using the regression function, while the elasticity coefficients were assumed in accordance with economic theory and the equation specifications. The supply side includes equations about the price of the commodities, the area harvested, the yield of the crops and the total production. The prices of the crops were modelled as a function of the EU prices as described above and were calculated on a marketing year basis. The price equation can be presented as:

$$BGPx_i=\alpha + \beta * EUPx_i + \xi \quad (2)$$

where $BGPx_i$ is the Bulgarian price of the modelled commodity i , $EUPx_i$ is the EU price of the commodity i , α is the intercept and β is the regression coefficient and ξ is an error term.

$$BGPx_i=f(EUPx_i) \quad (3)$$

The harvested area for the five crops was modelled as a total area, and then the shares of each crop in this total area were modelled:

$$5CHA=f(\text{adjusted } 5CERR) \quad (4)$$

where $5CHA$ is the total harvested area for the five crops and adjusted $5CERR$ is the expected real returns for the five crops composed of the market return and all subsidies (SAPS, top-ups, state support, etc.).

$$X_i \text{ share in } 5CHA=f(EMRx_i/5CEMR) \quad (5)$$

where X_i share in $5CHA$ is the share of the modelled crops in the total harvested area and is a function of the share of the crop's expected market return $EMRx_i$ out of the total five crops expected market return $5CEMR$.

The total five crop area ($5CHA$) is multiplied by the X_i share in $5CHA$ in order to get the harvested area (HA) for each crop:

$$HAx_i=X_i \text{ share in } 5CHA * 5CHA \quad (6)$$

The sunflower area was calculated as a residual, i.e. as the difference between the total projected area and the areas of the other four crops.

The expected market returns are the main factor in projecting the harvested area. In order to avoid price spikes and to represent balanced farmers' expectations of the return on each crop, the market return for each crop was calculated using the expected yield multiplied by a weighted three-year average farm gate price, altogether subtracted by the three-year weighted average production costs (Hanrahan, 2001) (the weights are as follows: 0.5 for t-1, 0.3 for t-2 and 0.2 for t-3). The main assumption is that the returns for the last three years have different weights in the decision-making process; with the returns and the costs of the year t-1 having greater importance than the ones from year t-2 and t-3.

$$y=\sum_{n=1}^{x_i} \overline{\alpha_{xi}} \{(\eta_{xi} * \rho_{xi}) + (\int \theta_{xi}) - (\chi_{xi})\} \quad (7)$$

where y is expected real market returns, $\overline{\alpha_{xi}}$ is the average share of each crop in the total area, $\eta_{xi} * \rho_{xi}$ is the equation of yield by weighted price of the commodity x_i , added with $\int \theta$, the sum of all CAP payments for the commodity x_i from Pillar 1 and 2, less the production costs (seeds, chemicals, fertilisers, fuel) denoted as χ_{xi} .

The adjustment for the total area was made by including the subsidies (SAPS payments and AEPs). The subsidies were included by multiplying the average payment per ha by a decoupling rate (Binfield *et al.*, 2005) which is different for the different policy measures. We assume a rate of 0.3 for the SAPS payments, because although they are decoupled from the production they still affect the producer decisions. The decoupling rate for the AEP is assumed to be 0.6, because they require implementation of specific production activities.

The CAP framework after 2013 will directly impact the projected figures for expected real return, participating in the total area function. The average yield of the different crops YLD_i is modelled as a function of the trend yields $TYLD_i$ and the precipitation $PREC_{kj}$, where k and j represent the months from which the rainfall data used in the model are taken. For wheat, barley and rapeseed the rainfall in March was used as a proxy and for maize and sunflower the data for July were sourced. The specific months were chosen after a

correlation analysis was made between each month's rainfall and the harvested yields.

$$YLDx_i = f(TYLDx_j, PREC_{kj}) \quad (8)$$

The total production was calculated as an identity for each crop.

$$PRx_i = HAx_i * YLDx_i \quad (9)$$

A scenario analysis was implemented regarding the effects of the changes in the CAP after 2013 in order to provide an insight into the effect of the future changes of the CAP on the five crops. The basic scenario assumes that the CAP measures in place in 2007-2013 will continue without change. The new scenario uses the CAP measures set out in EC (2013), but without the final decisions about the redistribution and degressing of the biggest subsidies.

Results

The five year projections of the chosen indicators, i.e. commodity prices, areas harvested and yields, for the five crops are the main baseline indicators resulting from this research. There is a positive growth trend in the projected yields for all five modelled crops compared to the actual data for 2012 (Figure 1). It was assumed that the average rainfall in certain months for the period 2013-2017 will be the same as it was during the period 1970-2012.

The production also depends on the harvested area (Figure 2), the projected values for which explain why the overall production of some crops are expected to decline, while others will maintain a positive trend. For example the total production of wheat in 2017 is projected to be about 4474 thousand tonnes, i.e. still higher than the total production in 2012, but

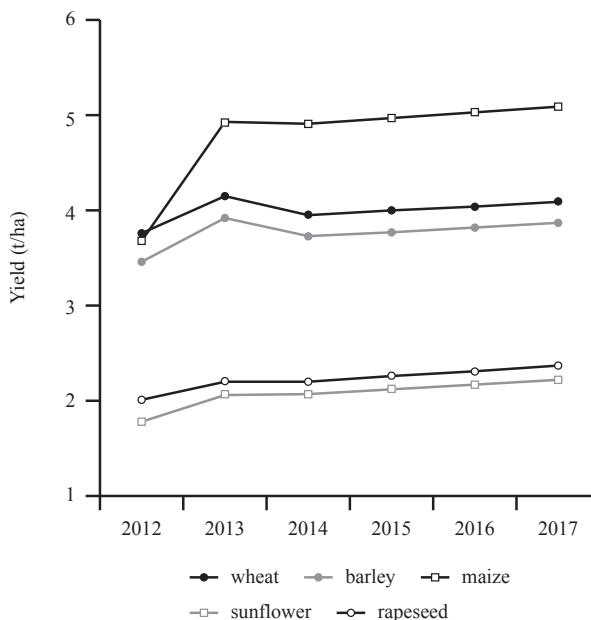


Figure 1: Yields of the five major crops grown in Bulgaria in 2012 and projections for the period 2013-2017.
Sources: 2012: MZH; 2013-2017: CAPA calculation, part of the Bulgarian Crop Model

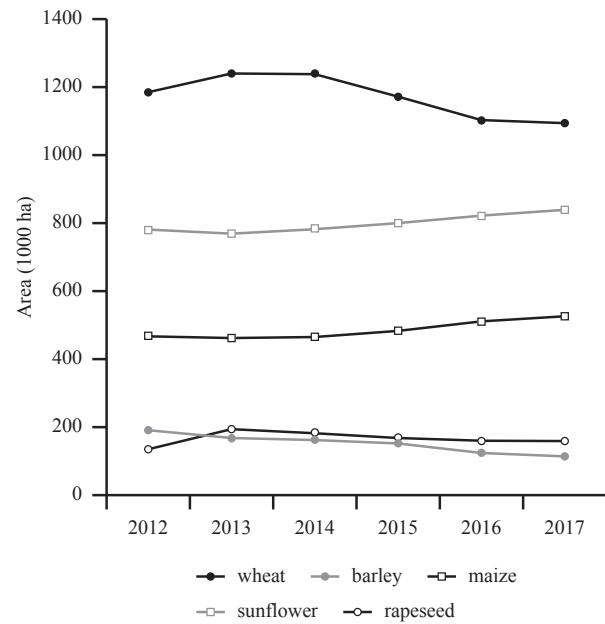


Figure 2: Areas of the five major crops grown in Bulgaria in 2012 and projections for the period 2013-2017.

Sources: 2012: MZH; 2013-2017: CAPA calculation, part of the Bulgarian Crop Model

less than the production in 2013 due to the smaller production area. Currently, farmers cultivating arable land in Bulgaria do not have many options for diversification of production and in the coming years they will look for a minimal internal restructuring, as the slight reduction in the areas with wheat, barley and rapeseed compared to the 2012 harvest year will be counterbalanced by increases in maize and sunflower (Figure 2).

We believe the main reasons for the different directions of the development concerning the five crops are the market return and the elasticity to it along with the specificities in the production. The prices are the underlying signal driving the internal restructuring and prompting upward and downward fluctuations in the area and production data. The projected

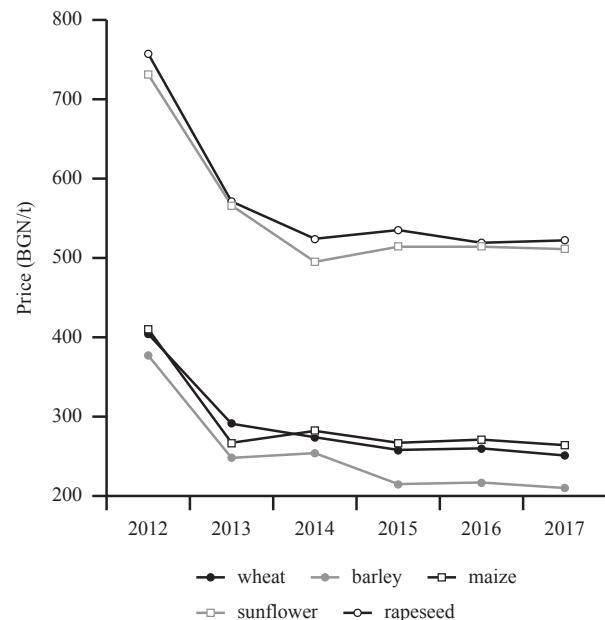


Figure 3: Prices of the five major crops grown in Bulgaria in 2012 and projections for the period 2013-2017.
Sources: 2012: NSI; 2013-2017: CAPA calculation, part of the Bulgarian Crop Model

prices in the Bulgarian market move in synchrony with the EU prices, as the perspective is downward compared to the period 2011-2012 and dropping to the levels of 2006-2008 (Figure 3). However we must keep in mind that these are projections of average market prices on the basis of marketing years, so certain changes and shocks may be expected in the period.

The projected prices for the oilseed crops are expected to be higher than those of the cereal crops with the price for sunflower seed a little over BGN 500/tonne for each year to 2017. Only for the marketing year 2014/2015 is the price expected not to go above 500 BGN/tonne. Altogether, the results distinctly show that the prices will go down in next five years, with the highest percentage fall (44 per cent) being estimated for barley, followed by wheat (37 per cent), comparing 2017 with 2012.

The projected maize prices are in the BGN 260-280/tonne range. The highest price is projected for 2014 – BGN 282/tonne. The decline in the price of maize by 2017 compared to 2012 is about 35 per cent, which is very close to the expected fall in the wheat and barley prices. However, one of the highest expected increases in the yields of these crops is recorded in maize, as in 2017 the yield per ha is estimated to be 35 per cent higher than in 2012.

The expected effects on the harvested area resulting from the planned changes in the CAP after 2013 were modelled. Two scenarios were run to see the possible effect of the new structure of the CAP, especially the direct payments and the agri-environmental payments (AEP). The current policy framework (CAP 2007-2013) is envisaged as a baseline scenario and the already approved changes for the 2014-2020 periods as a new scenario. The effects the subsidies have in the model are reflected in the total harvested area of the five crops and on that basis on the harvested area each crop will have. The new policy measures are predicted to cause a reduction in the total area sown to the five crops but this decline is expected to be minor. The wheat area will be about 20 thousand ha less in 2014, in 2015 about 18 thousand ha less, and in 2016 and 2017 about 17 thousand ha less (Table 1). Bearing in mind that the total harvested area of wheat for these years is about 1100 thousand ha, the change is really subtle and the effects on linked indicators such as production, self-sufficiency and trade are not expected to be substantial. The situation with the other crops is similar: the change is even smaller and only in rapeseed is it more than 10 thousand ha. If the yields per hectare could be improved the production itself will not be much affected.

We believe that the effect of the CAP 2014-2020 (i.e. an end to the increase in the production areas of the five major

Table 1: Expected effect of the post-2013 changes in the Common Agricultural Policy on the harvested area of the five major crops grown in Bulgaria, 2012-2017, thousand ha.

	2012	2013	2014	2015	2016	2017
Wheat	0.00	0.00	-20.5	-18.6	-16.9	-16.8
Barley	0.00	0.00	-2.7	-2.4	-1.9	-1.8
Maize	0.00	0.00	-7.7	-7.7	-7.8	-8.1
Sunflower	0.00	0.00	-3.0	-2.7	-2.5	-2.4
Rapeseed	0.00	0.00	-12.9	-12.7	-12.6	-12.9

Source: CAPA calculation, part of the Bulgarian Crop Model

crops) will mainly occur through the implementation of the 'greening' elements. Thus, even though the area of these five crops will decline slightly, the total agricultural area in farms and countrywide will slightly increase. The reason for this is that as farmers are required by the new CAP to assign 5-7 per cent of their land as ecological focus areas that a bigger area will be sown to legumes. It is anticipated that the

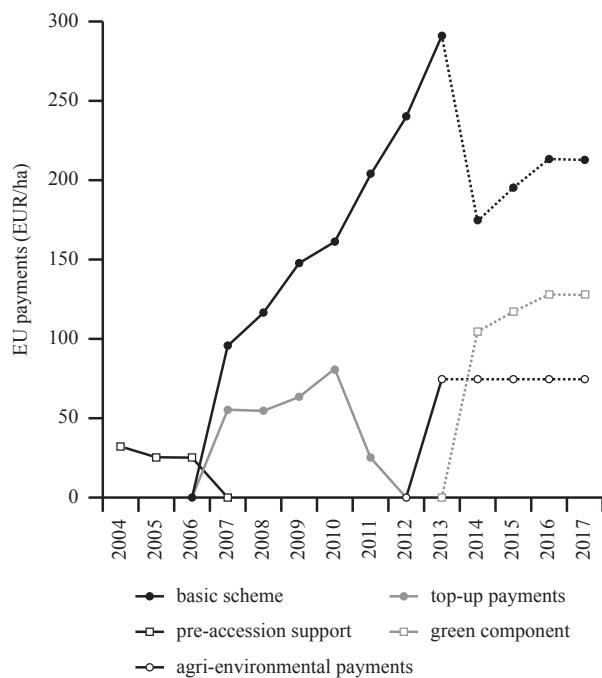


Figure 4: Allocation of European Union payments to agriculture in Bulgaria, historical and projected under the provisions of the Common Agricultural Policy 2014-2020.

Sources: 1998-2012: annual Agrarian Reports of the MZH; 2013-2017: CAPA calculation, part of the Bulgarian Crop Model

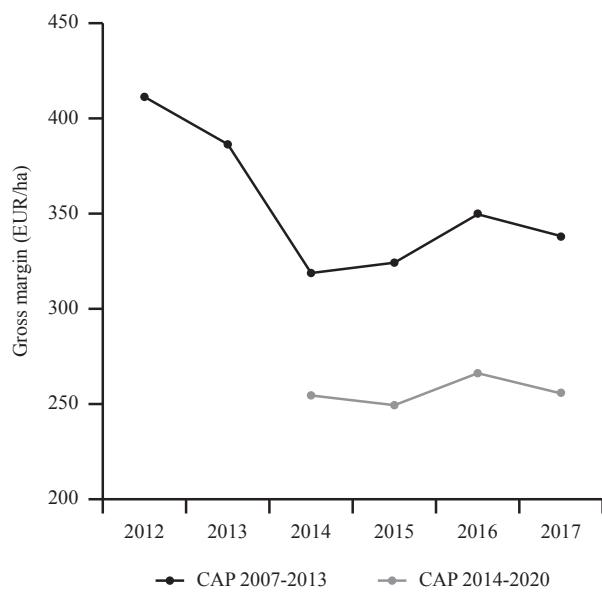


Figure 5: Projected average gross margins in the period 2014-2017 for the five main crops in Bulgaria under the provisions of the 2014-2020 Common Agricultural Policy framework, compared to those that would be obtained if the provisions for the 2007-2013 period were in force.

Source: CAPA calculation, part of the Bulgarian Crop Model

accumulated EU support per ha to agriculture in Bulgaria will fall after 2014 compared with the previous policy period (Figure 4). This can be seen as a favourable opportunity for the expansion of other crops which may beneficially impact the environment. The direct payment will be split into basic scheme and green payment and, in order to get the green component of support, farmers will need to diversify their cropping and reduce the area of cereals in favour of other crops such as legumes, industrial crops and grassland.

The gross margin of the production of five main crops under the two policy scenarios was projected for the period 2014-2017 (Figure 5). Owing to the decrease in the area harvested it is expected that the gross margin per hectare under the alternative (i.e. CAP 2014-2020) scenario will also be lower. However, the decrease (about EUR 20 per hectare for each projected year) will not be substantial. We should also bear in mind that there are possibilities for development, provided the producers manage to reduce their costs or diversify the commodity mix.

Discussion

The modelling work described here is a first attempt to project the mid-term development of the five main crops in Bulgaria, taking into account the new CAP financing arrangements to be introduced after 2013 and assuming certain market and production trends. Its main purpose is two-fold: baseline modelling of important indicators concerning these crops and the creation of a relevant basis for analysis of the markets and policy and in simulation of different scenarios. Along with the possibility to run different scenarios, the obtained results indicate the overall development of cereal and oilseed production in Bulgaria and these predictions can be considered reliable due to the link created to the global markets and the control of errors through simulating and approaching the model results to the historical data. A comparison of the modelled results with the actual data for 2013 shows a slight enhancement of the projected results concerning cropping area of 5-6 per cent for wheat and less than 4 per cent for other four crops. In terms of yield, the deviation from the actual data for all five crops in 2013 is about 5 per cent while regarding prices the modelled results are underestimated by about 4 per cent compared with the actual numbers.

The model is based exclusively on the Bulgarian needs and specifications linked with the models run by FAPRI, particularly the GOLD model. In the model a huge system of collected data is interconnected by equations which run simultaneously and this gives an opportunity to quantify the results from the impact and activity of various economic, market, policy, climate and other factors. The study and the implemented model incorporate and recognise the state-of-the art in the model work done so far, referring to the AGMEMOD (Chantreuil and Barbenchon, 2009) and GOLD models, and introduce new components to some extent. For example, the CAPA model offers a different cost calculation component which is based on the explicit costs computation instead of using exogenous data, namely cost deflator. Resorting to this method of computation of the production

costs ensures higher accuracy of the calculations and better reliability of the results. The data for the explicit production costs are taken from representative farms and controlled by experts' judgement.

In terms of crop yields, the approach used in this study is also modified compared with the majority of the established models. The yield equation includes yield trend and the precipitation rate (rainfall in specific months), which is a proxy for the weather factor. The complementary analysis shows that there is a robust correlation between the precipitation rate in particular months and the crop yield, which predisposes using such a variable instead of others. Incorporation of the precipitation in the yield equations provides a higher relevance of the model, avoiding occasional relationships using other dummies and creates a higher understanding of the model.

In addition, this study is one of the first attempts to project in the mid-term the development of these crops in the context of the CAP framework for the period 2014-2020. Most of the analysed model works speculate with different scenarios of the policy, whereas the key changes in the policy in terms of the basic payment scheme, greening, broadened coupled support scheme and other elements are embedded in the CAPA model. In this study, all of the policy schemes are carefully analysed and involved, as they participate in the formulation of the expected return from agricultural activities. As with other models, the impact of the policy instruments is calibrated by a so-called decoupling rate, which reflects the separation of the subsidy from production in the implementation of the CAP.

In the CAPA model, the decoupling rate is not a constant coefficient but it is differentiated depending on the policy measure. Taking into account that the ecological payment (greening) is postulated to achieve different results compared to the basic payment, they are presumed with different decoupling rates. The ecological payments impose more restrictions on the production and farmers' decisions and entail higher costs for farmers to meet them. Such an assumption is used regarding other schemes too, as the primary goal was to create a system of equations that better corresponds with farmers' perceptions and performance.

The main limitations of the model pertain to the quality and the availability of the historical data at the national level. Historical data used in the modelling go back to 1998, but prior to this the data sets are very unreliable and other economic and political drivers strongly influenced the development of the cereal and oilseed sectors. Even the implemented econometric modelling is limited not only by the availability, but also the reliability of the data. During the process of data collection different sources provided conflicting figures for some variables, especially indicators related to the commodity prices and production costs. Regarding the costs, due to the data limitations, it was necessary to use representative farm data and the judgement of experts for the estimation of production costs. The limitations attributed to data availability and reliability resulted in the elaboration of functions and equations which deal with these by using proxy variables rather than unreliable or unavailable data sets. Such an example is the equation representing the yield per hectare, where the climate factors, normally composed of rainfall total and

distribution, soil moisture, temperature values, snow coverage and duration, climate extremes etc. are combined into a weather proxy based on precipitation for a certain month.

Altogether, this study uses and describes the set up CAPA cereal and oilseed model, which is thought to be linked further with other sectors' models, namely dairy, meat and horticulture, thus to become part of a general equilibrium model system transmitted to the global market by the FAPRI-GOLD model. The results of our analysis of the main crops grown in Bulgaria should be of interest to a great number of stakeholders, policy makers, farm associations, consumers' organisations and agri-business companies.

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