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# **Assessing the Future Development of the Macedonian Agriculture: Partial equilibrium model of livestock-feed sector**

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## Abstract

The country is facing one of the biggest challenges since its independence – the process of the EU accession. Taking into consideration that „forecasting important economic events is source of power“ (Howitt, 2005), the aim of this paper is to develop a model in order to assess the impact of the EU membership on the Macedonian agriculture.

The model is recursive, dynamic, multi-product partial equilibrium model for the meat, dairy and cereals sector in the Republic of Macedonia. It follows the AGMEMOD principles, hence comprising the local features of the Macedonian agriculture.

The baseline scenario shows a positive growth of the pig meat, lamb meat and cow milk sectors. On the other hand, in the EU scenarios the most positive effect is expected in the extensive sectors, e.g the sheep and beef productions. The grains show modest growth on the supply side, but the projections on the net-trade demonstrate further deficit increase. The biggest gain in the EU scenarios comes from the higher level of prices, but also from the higher budgetary support. Compared with the experiences of the previous enlargements, the model confirms the expectations about the development of the selected sectors after the EU accession.

**Key words:** partial equilibrium model, agricultural policy, Macedonian agriculture

## Introduction

Macedonia<sup>1</sup> is facing one of the greatest challenges since its independence - the process of accession to the EU. Preparations for this process include numerous reforms to the existing system and capacity building for the understanding of future obligations and adjustments to the EU. Past experiences show that agriculture is one of the most important sectors in the accession negotiations, due to the complexity of the common agricultural policy (CAP) of the EU. By signing the Stabilization and Association Agreement with EU, Macedonia started the process of adjusting its policies through reforms in policy, regulations and institutions (Ерјавец, Димитриевски, 2008). However, Macedonian agricultural policy is still significantly different in support share and measures as compared to the EU countries. Hence, the question arises, *what to expect for Macedonian agriculture when Macedonia will become part of EU?*

Agriculture has always been sensitive to changes, natural disasters or economic crisis, which affect the relationships at the agricultural commodity market. The need for projecting the future has always been a goal for a timely adjustment to the expected changes. The dynamic environment further leads to the need for building models. With this idea in the background, or as Howitt (2005) has written "the prediction of significant events is a source of power" numerous models are built.

A model is a simplified representation of real situations through identifying and presenting the relationships among the most important factors (Greene, 2008). The simplest market model is the Marshall model of supply and demand, where producers and consumers seek to maximize profits and product utility, and ultimately find their compromise in the equilibrium price. The simplification of this single market model goes to that extent, that beside price it does not include other factors affecting the supply and

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<sup>1</sup> Macedonia's constitutional name is the Republic of Macedonia and this country is being provisionally referred to within the United Nations system as 'the former Yugoslav Republic of Macedonia' (UNSC Resolution 817/1993)

demand. Furthermore, this simplified model does not take into account any relationships that exist between different products as their production inputs or substitutes, or market size and structure, governmental policy, population and living standard etc. Simultaneous analysis of multiproduct markets by taking into account other factors brings up the need for more advanced market models such as the partial equilibrium models.

Partial equilibrium models describe specific or groups of agricultural sub-sectors, analyzing in details both sides of the equation between supply and demand, the price formation, interdependency of agricultural inputs and outputs between different product lines, the policy impact on supply and producers income etc. Partial equilibrium models have proven to be a useful tool for assessing the impact of market-price measures on agricultural markets, as well as the changes in the internal and international market (Erjavec & Kavcic, 2004, Bienfield, Donnellan, & McQuinn, 2001; Jensen, Bjerre, Andersen, & Nielsen, 2002). There are several partial equilibrium models with wider or global coverage, such as FAPRI, OECD-USDA, AGLINK, etc. (European Commission, 2009). In recent years, the AGMEMOD model was built under the initiative of the European Commission in order to predict changes that would occur in the common European market and on the market in each Member State from the largest enlargement in 2004. The successful application of the model to extends to its use to provide an answer to other questions, such as of the CAP reform, as well as the assessing the strength of the new candidate countries such as Turkey, Croatia and Macedonia.

*Is there a need for a partial equilibrium model for Macedonian agriculture?* There are partial equilibrium models for Macedonian agriculture too. The first attempt was single-product model, for pork meat only (Hristovska, 2005). Multiproduct models were built for the livestock – feed sector, such as the comparative-static model from Pelling (2007), and the dynamic synthetic models from Regoršek and Kotevska (Regoršek 2010; Kotevska, 2010). All models differ in policy measures and budget size, as well as assumed scenarios.

The objective of this paper is to assess the future development of the Macedonian livestock-feed sector. The partial equilibrium model used for making future projections is described in the methodology part. The results along with the discussion are presented separately for the four analysed scenario, the baseline scenario and three EU accession scenarios. This chapter also discusses the implications of the model for the sector. The conclusions are given in the end.

### **Method**

The partial equilibrium model was used as a method to evaluate the future development of the Macedonian livestock-feed sector. The AGMEMOD model structure served as a basis of the Macedonian grain, meat and milk model. The partial equilibrium model is based on a regression analysis of food balance sheet for grains, meat and milk. Balances are based on official statistics from the State Statistical Office (SSO) for the period 1995-2008, supplemented by expert opinion on items where no information was available.

The food balance sheet, as a comprehensive picture of the country supply and demand for a certain commodity during a given reference period, gives the total quantity of products produced in the country, added to the total imported quantity, on one side, and the exported quantity and the quantity used for feeding livestock and human consumption on the other side.

For all modelled variables a multiproduct linear regression for the period from 1995 to 2008 is made, on which the projections up to 2020 are based. The regression coefficients were included in the model and then calibrated in accordance with the theoretical foundations as well as the principles of AGMEMOD, which makes the model rather synthetic than econometric.

The complexity of the model can be observed from the diagram of the sub-model for corn (Fig. 1). It shows the set of data included: modelled variables (single-lined ovals), calculated variables (single-lined boxes), external variables (double-lined ovals), as well as variables modelled in the others sub-models (double-lined boxes). For each individual product a sub-model is built, later integrated into a single model. The model includes seven products, grouped into three sub-models with similar structure. Thus, the grain market sub-model includes wheat, barley and maize sub-models, the meat markets sub-model includes beef, pork and lamb sub-models, and the milk market model covers only a sub-model for raw cow's milk without its products.

The policy modelling is in accordance with the policy harmonization model developed under the AGMEMOD partnership (Salputra, Miglavs, & van Leeuwen, 2008), where the national ceiling is determined by the budget size for direct coupled payments, historical payment and regional payments (decoupled payments), further distinguished between regional payments for arable land and pastures. All these payments are used to calculate the reactive price, or part of the support which complements the market price of the product and which together affect the production decisions of farmers. It is the mechanism for integrating the agricultural policy in the model.

The model is based on few basic assumptions about price formation, supply and demand factors, and some macroeconomic indicators:

- Small country, open to external markets, dependent on the level of world prices
- The link with the external markets is through the prices projections of the key agricultural markets from the combined AGMEMOD model (thus indirectly includes the impact of economic crisis)
- No significant changes in factors affecting the supply (climate, market size and structure, or technological progress) and demand (consumers taste and habits)
- Aggregation at sector level
- Homogeneous products
- Population growth (trend analysis + UN forecast: growth rate 0.22%)
- GDP deflator (up to 2013, projection of MF<sup>2</sup>; 2014-2020 - growth rate 2%)
- Real GDP (up to 2013, projection of MF; 2014-2020 - growth rate 4%)
- Currency: Euro (stable exchange rate: 61.27 den/€)

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<sup>2</sup> MF = Ministry of Finance



**Table 1: Scenarios overview**

<i>Scenario</i>	<i>Description</i>
<i>Baseline scenario (MK-BS)</i>	<i>Policy:</i> <ul style="list-style-type: none"> <li>• 2008-2012 as expected from MAFWE<sup>3</sup>, (2009);</li> <li>• 2013-2020, as policy in 2012</li> </ul>
<i>Price convergence scenario (EU-PC)</i>	<i>Policy:</i> as scenario MK-BS <i>Price convergence:</i> by using multipliers
<i>Optimistic EU scenario (EU-OPT)</i>	<i>Pre-accession policy:</i> as scenario MK-BS <i>Post-accession policy:</i> <ul style="list-style-type: none"> <li>• Introducing CAP in 2015.</li> <li>• National ceiling as expected from MAFWE (2009)</li> <li>• Due to the large pre-accession budget, it assumes a greater topping-ups rate from national budget, as the case with Slovenia in 2004.</li> </ul> <i>Measures:</i> <ul style="list-style-type: none"> <li>• Different amount of regional payments for pastures (80 € / ha), arable land (250 € / ha) and perennial crops (500 € / ha)</li> <li>• Coupled payments allowed only for beef and lamb, total 3.5% of the national ceiling</li> <li>• No historic payments</li> </ul> <i>Price convergence,</i> as scenario EU-PC.
<i>Pessimistic EU scenario (EU-PES)</i>	<i>Pre-accession policy:</i> as scenario MK-BS <i>Post-accession policy:</i> <ul style="list-style-type: none"> <li>• Introducing CAP in 2015.</li> <li>• National ceiling is 75% of EU-OPT</li> <li>• Topping-ups from national budget is fixed at 30% in the period 2015-2020</li> </ul> <i>Measures:</i> <ul style="list-style-type: none"> <li>• Regional payments - equal per unit capacity for arable land, pasture and perennial crops</li> <li>• No coupled payments</li> <li>• No historical payments</li> </ul> <i>Price convergence,</i> as scenario EU-PC.

The price adjustment is assumed in all scenarios with EU accession. This assumption is based on experiences from the previous enlargements in 2004 and 2007, indicating that the adjustment of domestic prices of agricultural products at lower or higher prices in the EU occurred in the first few years after EU accession. The direction, intensity and rate of change depend on the level of prices in the pre-accession period and the level of market support in the period before and after accession. Hence, price reduction is expected only for pork meat, while for the rest of the modelled products an increase to their prices is expected.

<sup>3</sup> MAFWE = Ministry of Agriculture, Forestry and Water Economy

## Results and Discussion

### Baseline Scenario

The baseline scenario shows a positive development for all subsectors, except for beef (Fig. 2). The supply of pork, lamb and cow's milk is rising more than 30%, while the increase in grains is about 15%. Reduction in the supply of beef is about 5%. Smaller increase in the supply of grains primarily is due to the lower yield, which is a major factor in increasing production in the projections for Macedonia, as well as worldwide. Hence, this is a critical point for the development of this sector. However, the projections for an increasing grain area, with stable or increased yields, lead to projections for increasing production. Despite global projection trends for increasing production of corn and stagnating production of barley (European Commission, 2009), the production structure in Macedonia changes at the expense of reducing the area of corn and barley, while increasing the share of wheat and other grains. Despite the increase in livestock numbers, this is explained by the low interest in using corn for ethanol production and not using barley for human consumption. The main driving force at the grain sub-sector is the governmental support, which in addition to the market price significantly increases the producers' income. The second factor that would affect the positive development of these markets are assumed to be potential growth of livestock, or more specifically projections for increased production of pork meat (+35%), lamb meat (+53%) and cow's milk (+47%). There are favourable conditions for livestock productions - large areas of pastures and grains, as well as relatively broad and stable market. However, in terms of yield of grains and pastures Macedonia is generally lagging behind in the region and the EU, thus limiting its development and making the sector uncompetitive.

The negative development of the beef sub-sector in Macedonia is due to present trend of reduction of the suckler cows number and the weak competitive position at the international market where the sector receives much greater support. The expected increase in the pork and lamb producers' income pulls positive development for these two sub-sectors. The relatively protected price of pork is an additional factor which maintains the good position of this product in the domestic market. In the sheep sub-sector, increased producers income is expected to come from the increasing governmental support as well as the growing trend of international market prices. The projections for milk show big potential for development of this sub-sector, although it is not expected increase in the farmers' income. The increase in the milk production is expected to be due to the increased productivity per cow, as well as the trend for increasing the number of cows. However, these projections are still uncertain due to some recent developments at this market in Macedonia, *i.e.* the impact of the "Swedmilk" crisis reflected on the herd size, as well as the financial readiness of farmers for further investments and loans.

In terms of trade position, except for lamb meat as the main export-oriented product from the livestock-sector, the baseline projects that Macedonia is to be a net exporter of also cow's milk and wheat, while for the other analyzed products the country continues to be a net importer.

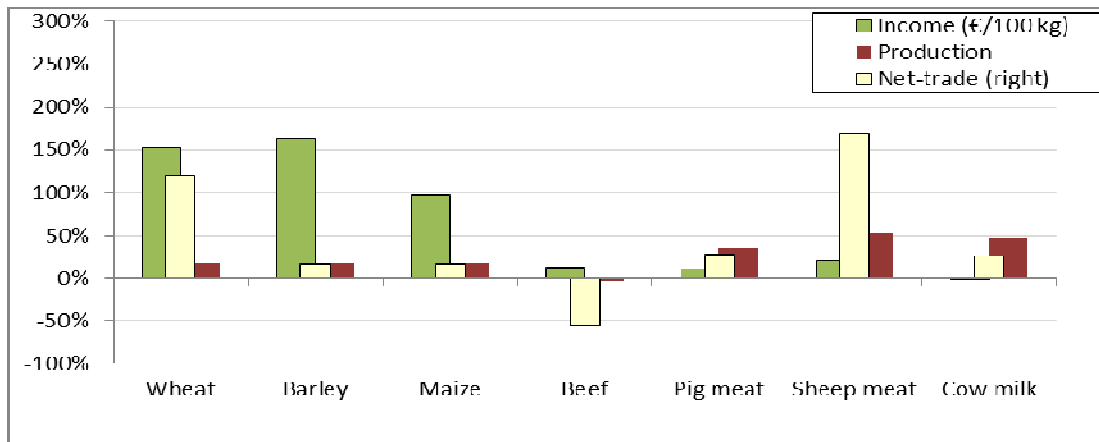


Figure 2: Cross-sectoral comparison of the baseline scenario

### Price Convergence

Integrating at the common European market brings a negative development for the pork and grain market (Fig. 2). This is due to the higher pork price in relation to the European market, and the assumption of reducing the price after integration in the common market. The development of the pork market reflects on the grain market too, particularly for corn and barley, which are major inputs in the pig production. The increase of the price of grains for about 4% fails to compensate the negative development of pig production. Other products noted a slight improvement (Fig. 3). The increase in the price of beef and lamb by 11% and milk by 8% is causing an improvement for about 5% compared to the baseline.

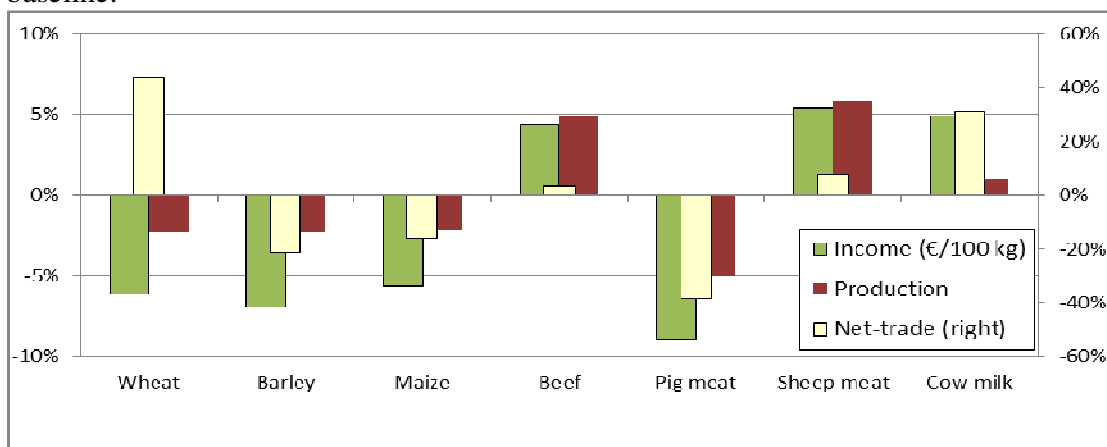


Figure 3: Cross-sectoral comparison in the EU-PC scenario

### EU Scenarios

In scenarios with EU accession, the biggest benefit comes from the higher level of prices and greater budgetary support. The scenarios include decoupled support, thus the larger benefit goes to the extensive productions, such as beef and sheep production (Fig. 5). However, the beef sector in Macedonia is uncompetitive compared to other EU countries, which limits its positive development, as reported for other countries from the EU-10 in their pre-accession projections (Erjavec & Donnellan, 2005). EU scenarios forecast

reduction in the grain supply. The increased consumption in these scenarios, based on the growth of livestock, has deepened the import dependence of RM for these products. If the opportunities for reducing the net-trade deficit are considered, the baseline scenario is optimal. The most affected sector in the EU scenarios is the pig meat sector, as a result of the price decrease but also due to the removal of the governmental support after accession. Common expectations for the livestock commodities are the increase in the competitive pressure and problems that might occur in the quality standards implementation. Grains models and pig meat models do not project that Macedonia will be a net-importer, as the baseline scenario does, but project further deepening of the import dependency. In the other hand, the improving of the trade position of beef, lamb and cow's milk is so small, almost negligible.

When comparing the two scenarios with EU accession and application of CAP, but with different measures and budget, it is evident that the development of sub-sectors goes in the same direction but with different intensity (Fig. 4 and 5). EU-OPT scenario includes higher direct support and thus has stronger development. On the other hand, EU-PES scenario which is only 75% of EU-OPT and includes only regional payments, intensifies the negative market development of grains, and at the same time reduces the positive development of other markets (up to +10%), especially of the beef market.

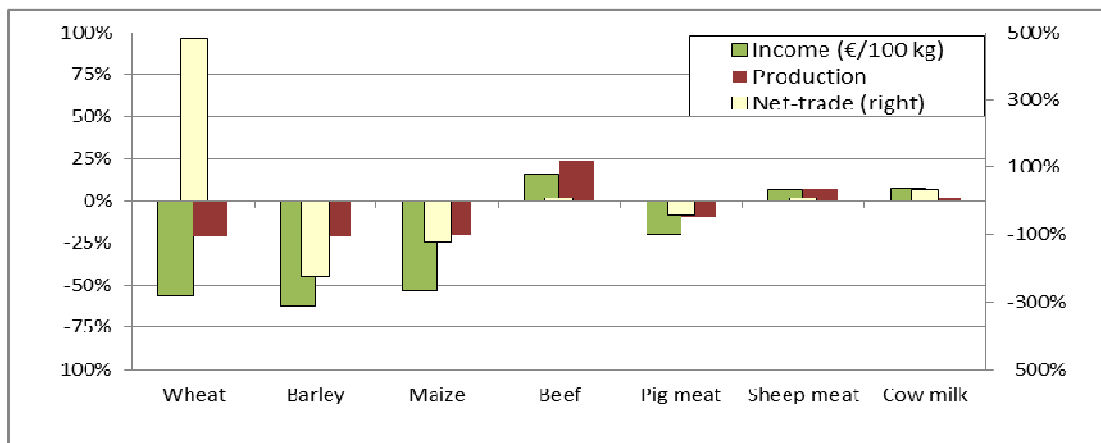


Figure 4: Cross-sector comparison in the EU-OPT scenario

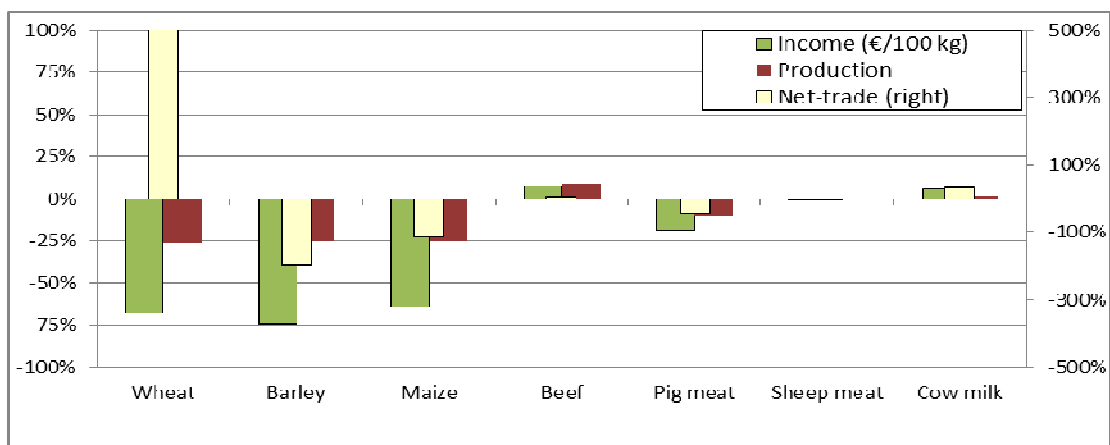


Figure 5: Cross-sector comparison in the EU-PES scenario

### **The Implication of the Model and its Results**

The projections for unfavourable development of certain subsectors after EU accession should not be interpreted as a signal to divert production. On the contrary, these findings should be an initiating signal for government and farmers to use the remaining time in order to prepare for the more competitive market and higher sanitary and quality requirements. Since the country lags behind the other countries in the region and the EU with the level of yield and some other technical indicators which are driving factors for progress in each sector, it is necessary to take measures for improvement of seed and breed structure, to increase the educational level of farmers as well as the level of utilization of IPARD funds.

Support without a vision, plan and continuity does not encourage the development of agriculture, but rather confuses farmers, disturbs markets and weakens the already fragile economy in rural areas. That is why steadiness in implementation, monitoring and analysis of the effects is essential in order to fulfil the national development vision for agriculture. The projections of the sectors development and the effects of different levels of support can be used in planning the agricultural policy, in the choice of measures and their share in the total budget. In addition, it is important to note that the models can easily be used for analysis of other scenarios, describing different environment.

Integration of the national policy with the CAP of the EU is quite a complex process which requires strong political, institutional and analytical capability (Erjavec, Rednak, & Bajramovic, 2009). Therefore, the accession negotiations with the EU should be approached seriously with early assessment of the effects from the application of CAP. This or a similar model would be a useful tool for that. In experienced hands with an understanding of its limitations and shortcomings, such a model could help in understanding the effects of application of the CAP. Although partial equilibrium models have been proven good tool for analysis of price support measures, the contribution of the model goes more in showing the direction and relative intensity of the changes. The results of the model in absolute values should be taken with caution because of the unpredictability that goes with agriculture coming from its biological nature, dependence on climatic conditions, as well as the uncertainty of the broader environment, whether economic or political in nature. Also, the model does not include more details about the impact of surrounding conditions on the development of agriculture, for example, the availability of loans, the pace of knowledge transfer and technology progress, etc. It is based on economic behaviour, following the price as market signals, while the emotional behaviour of farmers is not explicitly included. All these questions give space for discussion and future development of the Macedonian model.

### **Conclusion**

The model confirms the expected potential for the development of the sub-sectors. Projections of the baseline scenario predict a positive development for almost all selected products, with the exception of beef sector. In the price convergence scenario positive development is expected only on the beef, lamb and cow's milk markets. EU accession scenarios foresee development in the same direction but with varying intensity among sectors. Positive developments are expected in beef, lamb and cow's milk markets while

negative development is expected in the pig meat and grains markets. In other words, the lamb and cow's milk sub-sectors have the greatest development potential.

The model allows understanding of the consequences of various policy measures, which is especially useful and important because of the existence of cross-relationships between products. Hence, the results of the model can be used to guide governmental actions to improve competitiveness, understand the effects of application of different agricultural policy measures in process of planning it, along with the accession negotiations with the EU.

The fact that this research is the latest one about the Macedonian livestock and feed sector, taking into account the period up to 2008 and partly including the effect of the global economic, complements the previous analysis and models. Still, the dynamic character of the model requires regular update with new data and results check. It is an opportunity for further testing and improvement of the model. Additionally, the value of the model will significantly increase if upgraded with other strategically important agricultural products, with larger share in the production structure of the Macedonian agriculture or for which the country has a comparative advantage, such as tobacco, wine, some types of fruits and vegetables, along with the inclusion of other policy measures.

Most AGMEMOD models are already built into the GSE application (Gams Simulation Environment) developed within the partnership. Besides facilitating the the inclusion of new countries and products, it is a good tool for quality control, enabling the integration of model in a regional model, such as the EU AGMEMOD. Hence, the future development of the model should involve the transfer of the model in GAMS and its closer connection with other models for the EU and Western Balkan region.

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