MODELLING OF THE SLOVAK CEREALS PRODUCTION[1]

MODELOVANIE SLOVENSKÉHO SEKTORU OBILNÍN

Ján Pokrivčák – Ľubica Bartová – Pavol Ciaian

We build a Slovak sectoral dynamic partial equilibrium econometric model. The model is used to analyze the development of the Slovak cereal market and some key features of EU accession. We investigate how the Slovak cereals market reacts to different temporary and permanent shocks to the system.

cereals, econometric model, EU, Slovakia, CAP

Slovakia will join European Union (EU) in May 2004 and thus become a part of the single European agricultural market. Part of this process is the introduction of the Common Agricultural Policy (CAP). This will bring about a substantial change in the level of support as well as changes in the set of agricultural policies applied in Slovakia. Furthermore, the CAP is under process of deep reform directed toward de-coupling the policy instruments from production while stressing environmental compliance and rural development. Given these developments, it is desired to investigate the impact of these processes on the Slovak agriculture.

In order to analyze the impact of EU accession on the Slovak agricultural sector we build an econometric models of agriculture. The model is used for analysis and projection of the impacts of policy and other changes on farm production, prices, incomes, product consumption and government expenditure.

Methodology

The model is based on the EU Gold model, developed by FAPRI and extended by Teagasc. The EU grain, oilseed, livestock, and dairy (GOLD) model was developed by P. Westhoff of FAPRI at the University of Missouri-Columbia. The EU GOLD model is a synthetic, dynamic, partial equilibrium commodity model that disaggregates the EU into six "countries".

It is an econometric, partial equilibrium, dynamic, structural, and synthetic and model. The whole Slovak model covers cereals (wheat, barley, and maize), oilseeds (rapeseed, sunflower seed, and soybeans), sugar beet, potatoes, livestock (cattle, pigs, sheep, and poultry), and dairy (fluid milk, cheese, butter, skim milk powder, and whole milk powder) sectors.

[1] This research is conducted within AG-MEMOD, which is a collaborative partnership that aims to build sectoral economic models which will measure the impact on EU agriculture of changes in policies and markets that may occur over the next 10 years. The Partnership is financed by contributions from the EU Fifth Framework Programme for Research, Technological Development and Demonstration (RDT) Activities and from national resources of partner countries.

The model incorporates the major policy instruments associated with current national and alternatives of Common Agricultural Policy market organisations, as well as external trade commitments made by the EU in the context of the Uruguay Round Agreement (URA) of the GATT (WTO).

Prices are linked to French market prices, which in the GOLD model are generally the EU market clearing prices. Assuming a given French price, price linkage equations determine domestic prices as a function of the French price and the domestic and French self-sufficiency ratios. Self-sufficiency ratios are defined as production plus beginning stocks divided by domestic consumption.

The main assumptions made in order to generate the baseline projections concern the macroeconomic variables (real income, population, exchange rates, inflation, …) and the Common Agricultural Policy (CAP) variables (cereals intervention prices, direct payments, …). Slovak macroeconomic variables assumed

- 3 percent yearly inflation rate;
- 4 percent yearly GDP growth;
- 0.5 percent yearly population growth;
- slight appreciation of the Slovak currency against Euro and dollar (0.5 percent per year);
- international agreements remain in place over the projection period.

Moreover, considering the CAP, this scenario corresponds to the implementation of Agenda 2000. The policy assumption correspond to FAPRI forecasts. The projection period starts in 2002 for the most variables and are made until 2010.

Scenarios and Assumptions

The following three scenarios are considered:

Scenario 1: Baseline scenario

§Current policies (pre-accession policies) remain in place. The policies observed in the last year (2000 or 2001) are used as future projections.

Scenario 2: Accession scenario with current CAP policies

§Agenda 2000 policies are introduced in 2004 and after, but with:

- a decrease of the intervention price for cereals by 5 percent from 2004;
- an increase of the arable area aid payment to 66 €/tonne;
- a decrease of the key cereal prices by 2.27 percent as compared to the projected ones.

§Up to 2004, the policies are the same as in Scenario 1

Scenario 3: Mid term reform scenario

§Direct payments (cereal and oilseed compensation) are removed in 2004 and in the following years.

§The rest of the policies are the same as in the CAP but not changed as in scenario 2. The same hold for the key prices.

§Up to 2004, the policies are the same as in the Scenario 1

Modelling Results

Domestic Prices

Nominal domestic prices of wheat, barley and maize are modelled as a function of key French prices, which are exogenous in the model. So the changes observed in domestic prices, after

2001 when the projection period starts, are mainly driven by the development of the key prices. This can be seen in figure 1 and figure 2 for scenario 1 and 2, respectively. Each figure shows the development of French key wheat price and the Slovak domestic price of wheat. Over time both prices follow a similar path with shocks transmitted to the domestic price one year later. This is because the domestic price for wheat is modelled as a function of the lagged French price. In the same time, the fluctuations of the domestic price are lower than the fluctuations observed in the French price because of the domestic price unproportional response to the key price.

Figure 1. Development of wheat prices

Scenario 1 (SK per tonne)

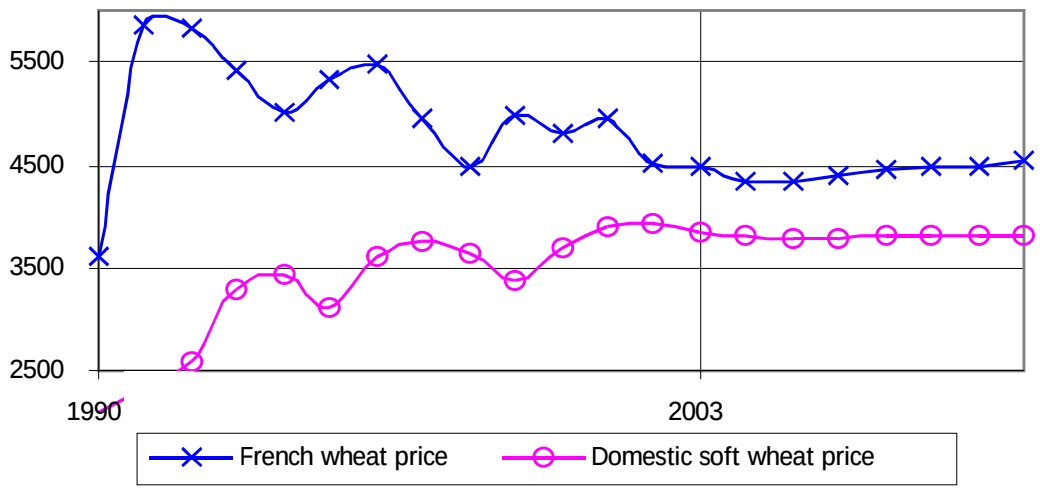
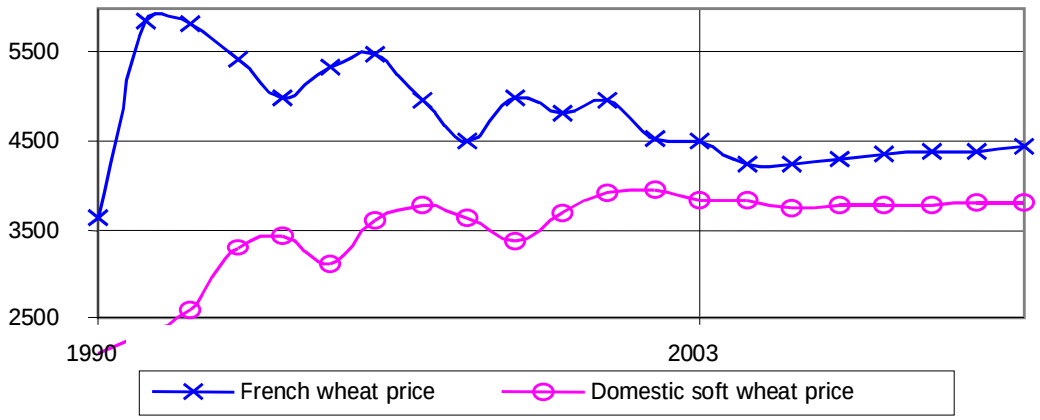


Figure 2. Development of wheat prices

Scenario 2 (SK per tonne)



Development of real domestic prices is dependent on the inflation rate. An annual 3 percent inflation rate is assumed in the model after 2001. Since the nominal prices, as shown for instance for wheat in figures 1 and 2, are almost stagnant after 2001, the real prices are expected to decline over time. Figures 3, 4 and 5 show the development of real prices for wheat, barley and maize, respectively, for all three scenarios (see annex I for more detailed

results). They decline over time and this trend is a continuation of the trend observed in the period before 2002, for which the data are available. However, the forecasted period does capture fluctuations observed before 2002. This is mostly because of a very simplistic way of modelling the domestic price, thus of depending only on the key price. In reality, this may not always be the case. Even though it is not clearly seen from the figures, the price for scenario 2 is always smaller than the prices for the other two scenarios in the period after 2003.

Figure 3.

Real soft wheat price (2003 = 100%)

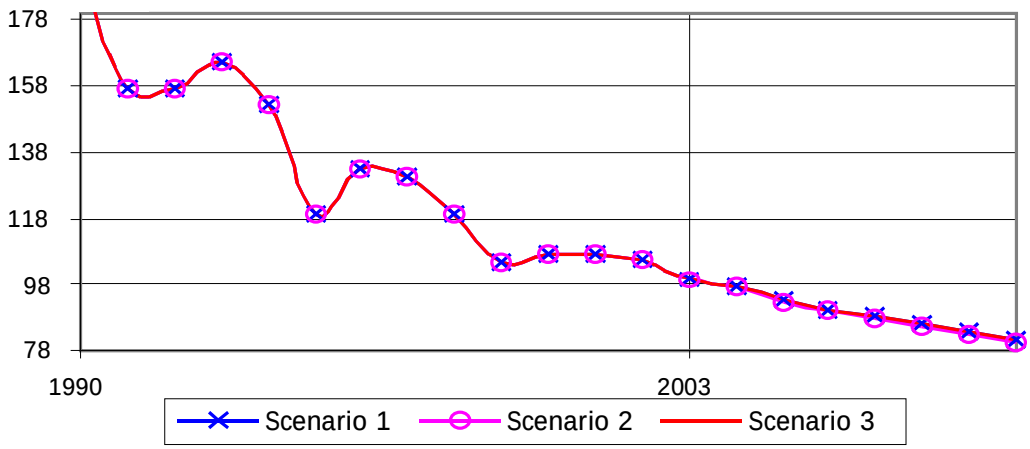


Figure 4.

Real barley price (2003 = 100%)

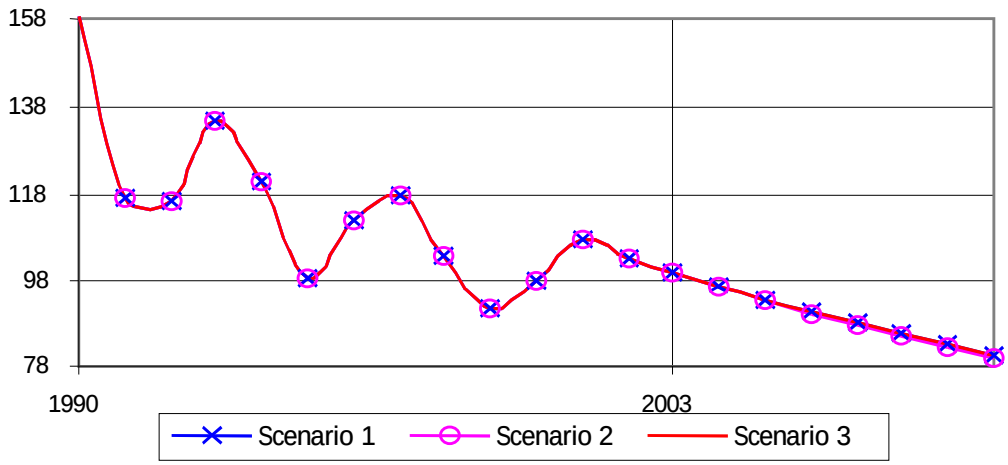
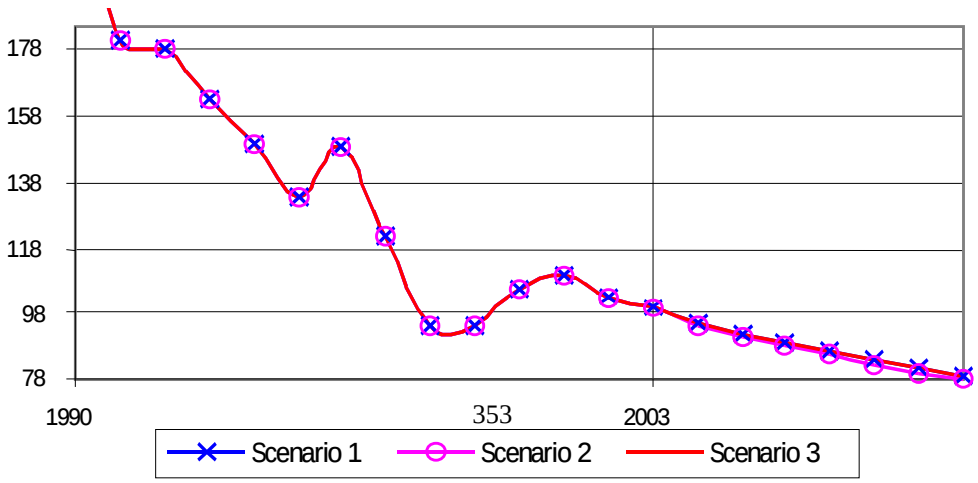


Figure 5.

Real maize price (2003 = 100%)



Harvested Area

Figures 6, 7 and 8 show the development of wheat barley and maize harvested area respectively for all three scenarios (see annex II for more detailed results). When comparing the results between scenarios, the smallest area cultivated by all three crops is in the scenario with de-coupled policies (scenario 3). Since intervention prices are assumed not to enter the harvested area equation, they do not affect the land allocation among the three crops. Expected gross market returns relative to the average 3-grain gross market return increases for barley, while for wheat and maize declines in the period 2003-2010. This explains the sharp decline of wheat and maize area harvested and relatively unchanged total barley area.

Similar results are obtained when summing areas over all three grains. Since de-coupling of the policy instruments (scenario 3) removes the linkage of the subsidy payment from the cereal crops, smaller returns are obtained for each hectare cultivated with cereals. As a result, the total area cultivated by cereal declines. This is reported in figure 9 (see annex II for more detailed results). The scenario 3 leads to the smallest area cultivated with cereals, while the opposite is obtained for the scenario 2. Note that scenario 2 contains the highest area payments.

Even though the cereal real prices declines over time, this is not the explanation for the negative trend obtained for area cultivated with cereals (figure 9). This decline is mostly driven by increase in area cultivated with other crops and by other variables included in the grain area equation (trend).

Figure 6. Wheat area harvested (2003 = 100%)

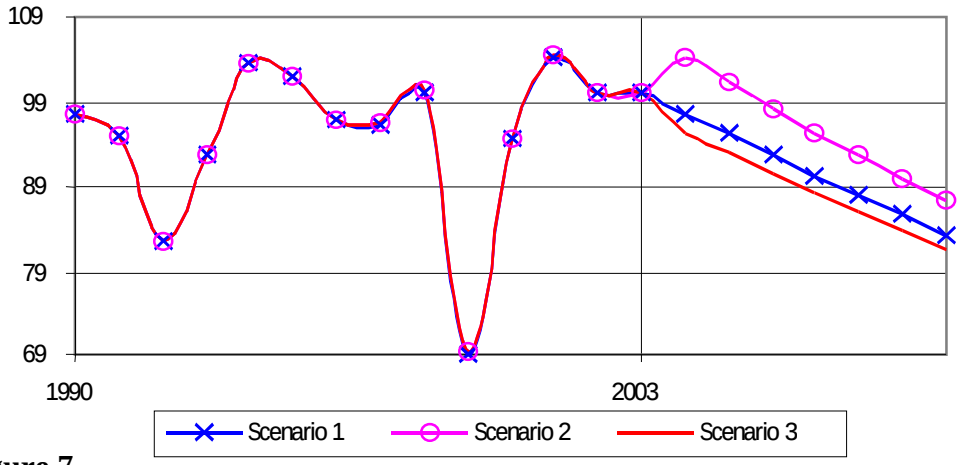


Figure 7.

Barley area harvested (2003 = 100%)

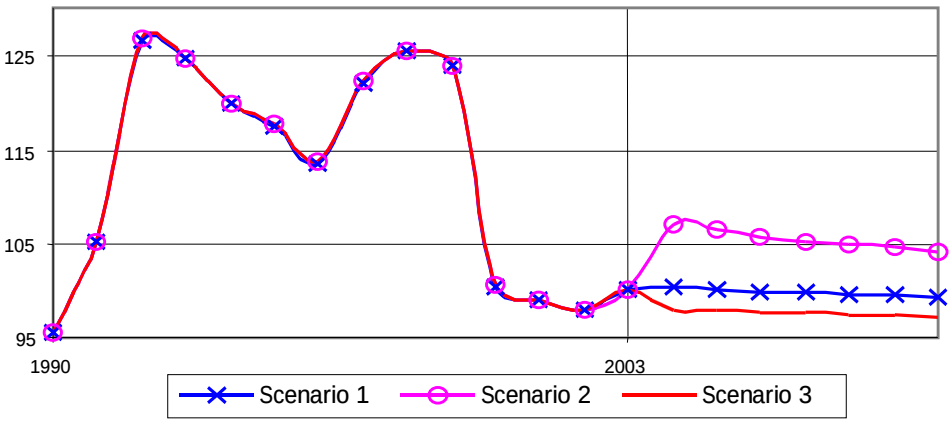


Figure 8.

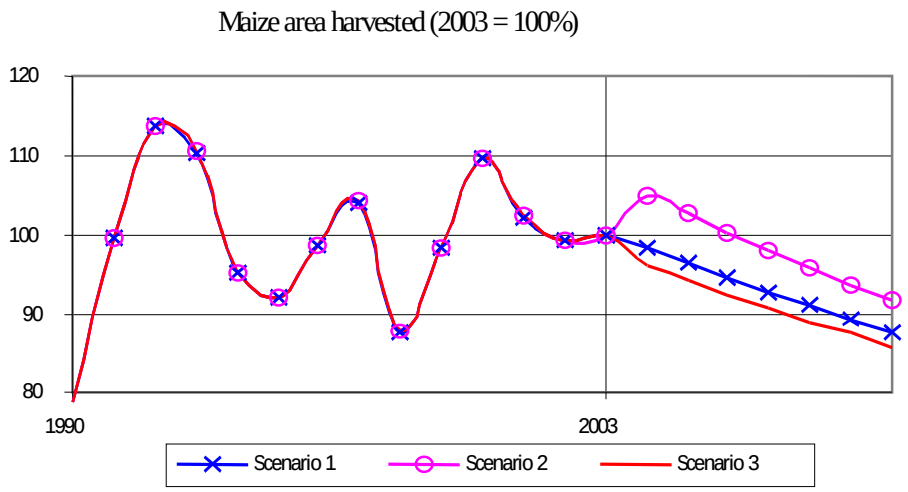
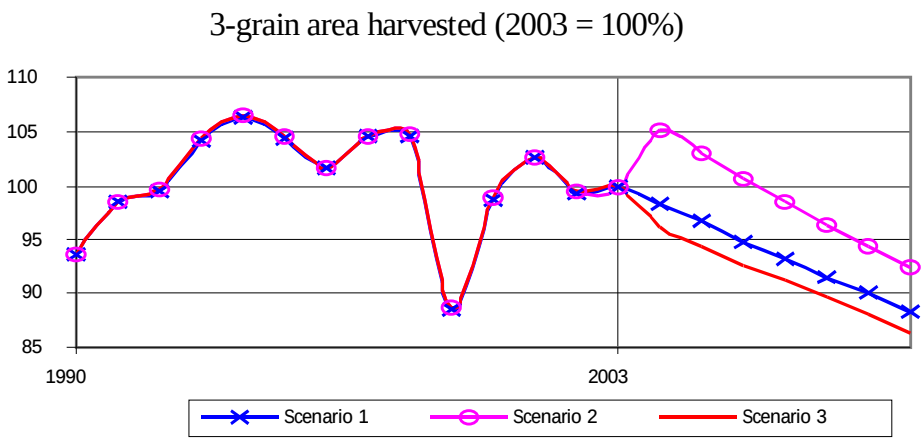


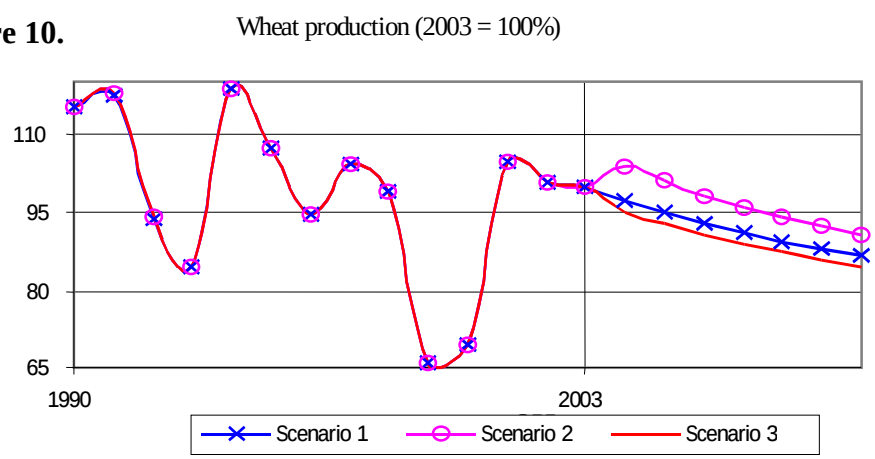
Figure 9.



Production

Figures 10, 11 and 12 show the development of wheat, barley, and maize production, respectively for all three scenarios (see annex III for more detailed results). For all three cereals, de-coupling (scenario 3) would cause a lower production as compared to production obtained if pre-accession policy instruments (scenario 1) would be applied. In contrast, introducing the current CAP but with lower intervention prices, and higher area payments (scenario 2), leads to opposite results. The production is always larger than in the baseline scenario.

Figure 10.



To a large extent, the development of cereal production over time mirrors the development of the grain area shown above. Wheat and maize production declines while barley production increases. The increase of barley production is also due to higher growth of per hectare yields as compared to wheat and maize yields.

Figure 11.

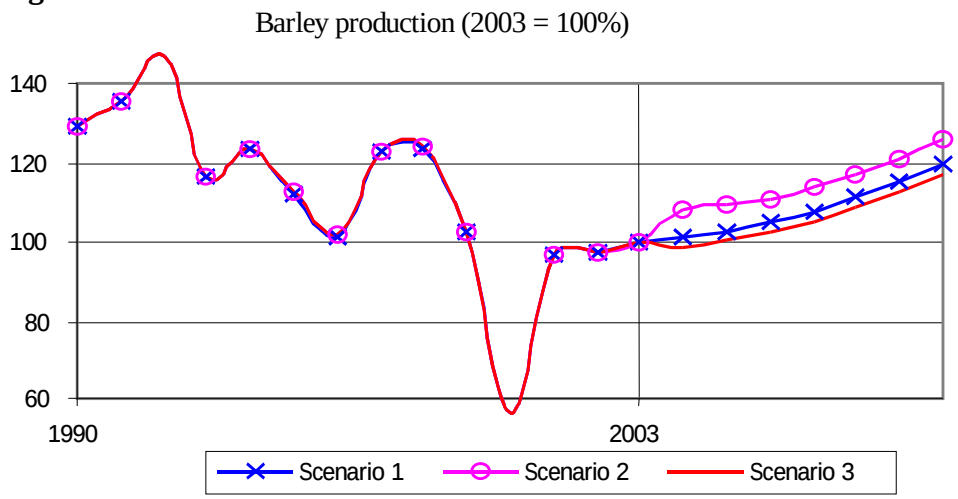
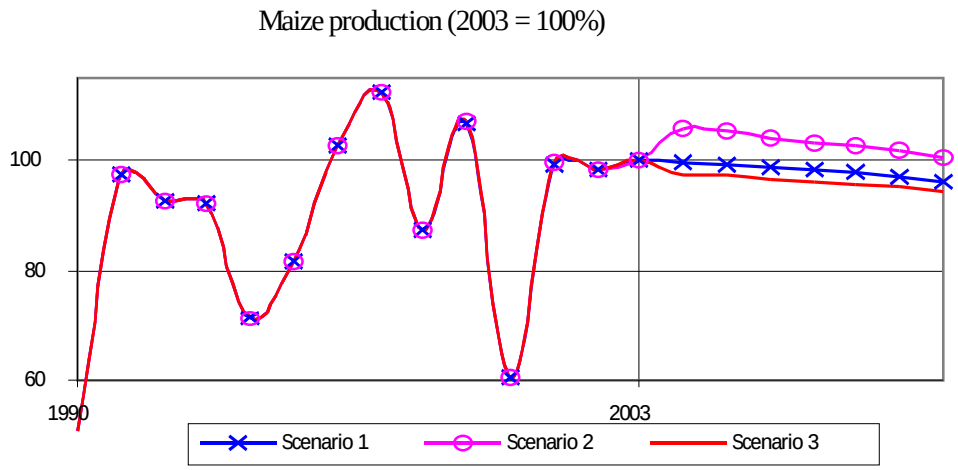


Figure 12.



Ending stock

Intervention prices are one of the main factors that determine the level of ending stock. The higher is the intervention price the more likely it will be the case that the intervention authorities will intervene to bring price back to a desired level. As figures 13 and 15 show, this is the case of wheat and maize stocks (see annex IV for more detailed results). After 2003 the intervention prices are assumed to increase in scenarios 2 and 3 alongside the CAP, while in the baseline scenario they are assumed to remain unchanged. The effect of this is clearly seen in the above mentioned figures. Wheat and maize stocks increase substantially for scenarios 2 and 3. For baseline scenario the stocks stay approximately at 2003 level. Note that the stock level for scenario 2 is always below the stock level of scenario 3. This is because of lower intervention prices assumed in scenario 2 as compared to scenario 3.

What concerns barley ending stock, it increases sharply after 2003 for all three scenarios. In contrast to wheat and maize, this rise is not caused by increase of intervention price. Rather, it is as a result of the increase in barley production and other factors (lagged stocks).

Figure 13. Wheat ending stocks (2003 = 100%)

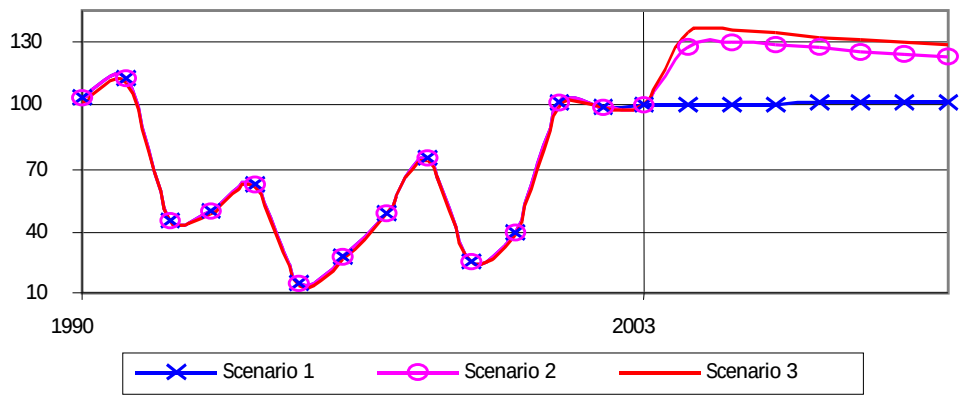


Figure 14.

Barley ending stocks (2003 = 100%)

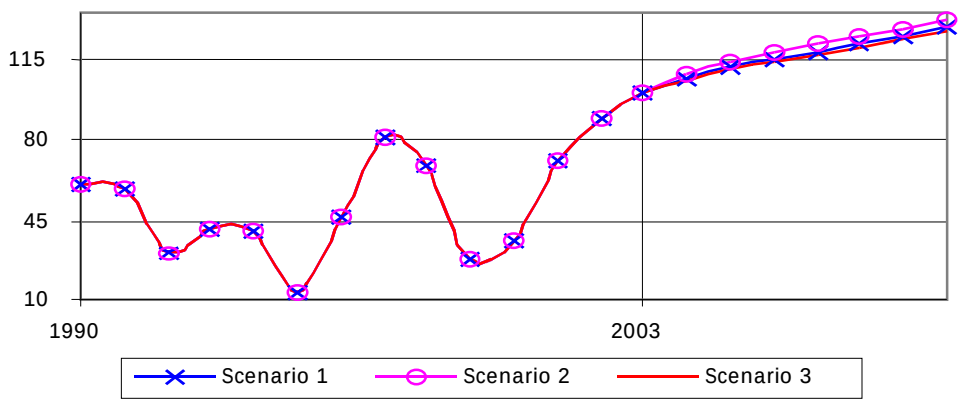
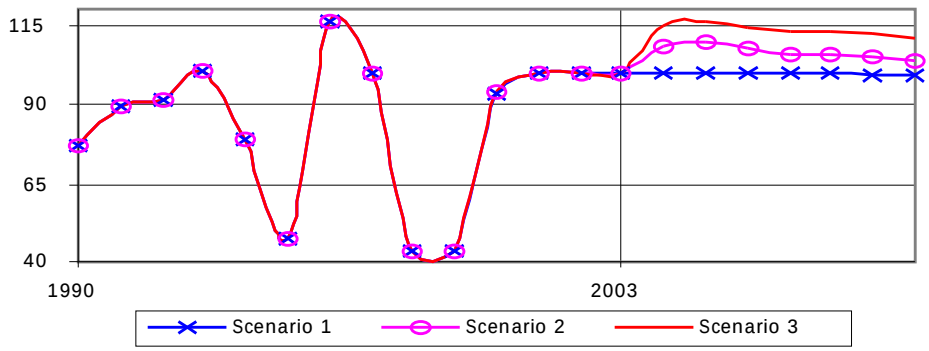


Figure 15.

Maize ending stocks (2003 = 100%)



Conclusions

The current paper assesses the impact of Slovak accession into EU on cereal sector as well as it tests the reliability of the model, which was developed as part of the AG-MEMOD project. Three scenarios were considered. A baseline scenario, which is used for comparison, purposes (scenario 1). This scenario assumes that pre-accession policies will be applied until 2010. A scenario with agenda 2000 policies applied after 2004, but with decreased intervention prices and higher compensation payments (scenario 2). Finally, the third scenario assumes decoupling of compensatory payments after 2004 (scenario 3), which was part of the mid term reform of the CAP.

In general, the responses of the model to shocks are in accordance with the expectation. The obtained simulation results to a large extent are not in conflict with economic theory. However, several adjustments had to be made in order to obtain these outcomes. Some estimated coefficients needed to be dropped and instead coefficients from other country models (mostly from Belgian Model) or from other sources had to be used. Second, trend variable caused quite unrealistic results for some variables, most notably for ending stocks. As a result, the trend variable was either dropped out from the model or its coefficient was adjusted. Third, because of unavailability of data for some variables (mostly for policy variables), their corresponding coefficients could not be estimated; rather they had to be chosen ad hoc, or from models developed by other countries.

Abstrakt

Vytvorili sme sektorový, dynamický model parciálnej rovnováhy: Model sa používa na analýzu vývoja slovenského trhu s obilím a niektorých aspektov vstupu do EÚ. Skúma sa ako slovenský trh s obilím reaguje na dočasné aj permanentné šoky.

Kľúčové slová: obilniny, ekonometrický model, EÚ, Slovensko, CAP

References:

Chantreuil F.- Gautier P.- Hess-Miglioretti A. - Levert F., 2002, *French model manual,*38 pp.

Hanrahan K.F., 2001, *The EU GOLD model 2.1: An introductory manual*
AG-MEMOD seminar, Athens, November 2003

Pokrivcak, J. - Bartova, L. - Ciaian, P., 2003: *Model for grains in the Slovak Republic*, AG-MEMOD seminar, Bratislava, March 2003

Pokrivcak, J. - Bartova, L. - Ciaian, P.: *Modelling of the Slovak Crop Production,*
AG-MEMOD seminar, Athens, November 2003

van Meensel, J. - de Frahan, B.H.*: Effects of alternative MTR scenarios on Belgian agriculture,* 45 pp.

Vancauteren, M. - de Frahan, B.H., 2002: *The Belgian and Luxembourg template for the EU Gold Model: An introductory Manual,* 42 pp.

Kontaktná adresa:

Ing. Ján Pokrivčák, PhD. – Katedra ekonomiky, FEM SPU v Nitre, Tr. A. Hlinku 2, 949 76 Nitra, tel.: 037/ 65 08 593, e-mail: jan.pokrivcak@uniag.sk

Oponent: prof. Ing. Peter Bielik, PhD.