SLOVAK AGRICULTURAL MARKETS UNDER ALTERNATIVE CAP SCENARIOS – AG-MEMOD MODELLING APPROACH

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Abstract
Slovak sectoral partial equilibrium econometric model based on AG-MEMOD approach is used to analyse the development of the Slovak agricultural markets after EU accession. Simulation results for cereals, oilseeds and meats are provided in this article. Two scenarios are analysed: non-accession baseline and accession with adoption of single area payment scheme. EU accession is expected to increase prices of most products, the biggest increase of prices will occur in animal sector. Because of higher prices consumption will go down. Decrease of consumption will be mitigated by income growth. Production will not increase substantially due to decoupling of direct payments. Trade balance for majority of products will improve.
Key words: partial equilibrium econometric model, EU accession, Slovakia, agricultural markets.
JEL classification: C51, Q11, Q18

1. Introduction

Accession of Central and Eastern European Countries (CEECs) into the European Union (EU) is one of the major political and economic events since the collapse of communism.

EU accession specifically influences agricultural sector. Changes in this sector are especially important as almost half of the EU budget is spent on agricultural production. In agricultural sector EU accession involves both changes in support level as well as support instruments used. With respect to support level most prices in Slovakia were below EU level before the accession. However the gap was closing in recent years. Direct payments also increased in Slovakia after accession. Price support and direct payments are two major policy instruments of the CAP. Direct payments adopted by Slovakia and other new Member States are significantly decoupled as Single Area Payment Scheme (SAPS) is adopted in the first years after accession. In 2007 it is expected that Slovakia will switch to Single Farm Payment (SFP) currently being introduced in the EU.

There are many studies that analyse the impact on EU enlargement and the Slovak accession into the EU. In agricultural economics these studies dealt with budgetary impacts of adoption of CAP, development of commodity markets, international trade and WTO and macroeconomic implications (Bozik, 2001; Bozik, 2003; Blaas and Bozik,2002; European Commission,2002; Banse, 2000; Banse et al., 2000; Hartell and Swinnen, 2000; Münch, 2000; Hertel et al., 1997; Tangermann and Josling, 1994; Anderson and Tyers, 1993).

While papers published in early 1990s predicted significant changes occurring to agricultural economy in both old and new member states after eastern enlargement of the EU, recent papers predict more moderate impacts. There are two reasons behind this adjustment of predictions. First, CAP of the EU went through significant reforms since early 1990s, reducing price support and replacing it with decoupled income support. Second, economic development and reforms in the CEECs reduced differences between new member states and old members.

The objective of the paper is to analyse the impact of enlargement on agricultural prices, area harvested, production, consumption and trade for selected commodities. We use a modelling approach of AG-MEMOD Partnership. The model is based on the EU Gold model (Hanrahan, 2001), developed by FAPRI University of Missouri and extended by Teagasc, Ireland. The 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. In this article we provide projections for cereals, oilseeds and meats.

The paper is organized as follows. The following section briefly describes model that we used for projections. This is followed by section on policy scenarios and model assumptions. The section five contains simulation results while the last section draws conclusions.

2. The Model and Data

The model was developed as part of the EU Fifth Framework Research Programme (AG-MEMOD project). It is a recursive, partial equilibrium econometric model. The model includes major agricultural commodities inter-linked through cross price elasticities, and cross elasticities of demand for land reflecting competition of different commodities for land as an input. There are also links between the crop and livestock sectors. Each sector is represented by supply and demand relationships that take into consideration the specific processes within each sector. These relationships are estimated

or calibrated. For calibration elasticities and coefficients from economic literature are used. Most CAP policies are incorporated in the model (direct payments, price intervention, quotas ...).

In the crop sector land allocation is modelled for certain crop categories, (cereals, oilseeds), or for specific crops such as potatoes and sugar beet. Land allocation decisions are driven by relative expected real gross returns. Market prices, direct payments, and relative rates of productivity growth affect land allocation. The land allocated to cereals and oilseeds is further divided into specific cereals (wheat, maize, barley) and oilseeds (rapeseed, sunflower, soybeans). Production and/or domestic supply is then a function of area harvested and yield. Yields are modelled as a function of prices and trend. Trend is assumed to capture technological development. Demand is mostly modelled as a function of own price, relevant prices of substitutes and complements and income. For most of the commodities the demand is divided into feed-use and non-feed-use. The closing identity for each crop is given by trade (exports and imports) so that the markets are balanced.

For animal sector, the stock of main animal categories is modelled. For each animal category, the equation of breeding herd inventory (inventory of cows, sows and ewes) is the key variable. It is usually modelled as a function of output prices, input prices, policies, own lagged variable and other factors. The remaining sub-categories are then calculated from the size of breeding herd inventory based on reproduction rate and taking into consideration the change of stocks. The animals available determine the number of slaughtered animals. Meat production is than determined from number of slaughtered animals and slaughter weight. Slaughter weight is modelled as a function of output price, input prices and other variables. Similar to the crop sector, closing identities are given by trade (exports and imports).

The interlinkage between crop and animal production is performed through prices of crop inputs in the case of animal sector, and through feed demands of animal production in the case of crop sector.

Domestic prices are endogenous and are represented by relationships that in most cases link them to EU market prices, Slovak self-sufficiency rate and self-sufficiency rate in the EU key market. The EU prices are exogenously given in the model. The exception to this general approach is the oilseeds model, where market prices are directly linked to import prices determined in world markets. For a more detailed description of the model see Hanrahan (2001); Westhoff (2000); Vancauteren and de Frahan (2002); Chantreuil, Gautier, Hess, Miglioretti and Levert (2002).

Data used for modelling come from various sources. Key references to the data used in the modelling: VUEPP (Research Institute of Agricultural and Food Economics), Eurostat, OECD, FAO, Ministry of Agriculture of the Slovak Republic, Slovak Statistical Office, National Bank of Slovakia, Customs Statistics, the Slovak Academy of Sciences, FAPRI University of Missouri, European Commission. The projection period starts in 2002 for the most variables. The projections are made until 2010.

3. Policy Scenarios and Assumptions

The following two scenarios are assumed:
1) Non-accession baseline scenario (Non-Ac). Pre-accession policies observed in the last years are assumed to continue in the future.
2) Accession scenario (A-SAPS). This scenario assumes accession and introduction of SAPS in 2004. In addition to EU direct payments top-ups financed from the national budget are considered. Moreover,

Slovak domestic prices are assumed to converge in one year to EU price level (to key prices). Specifically they are assumed to change in 2004 and following years by an adjustment factor that is equal to 90% of the difference between domestic price in 2004 and its respective key price in 2004.

Decoupled direct payments are assumed to have a moderate impact on production. However, cross compliance, risk effect, alleviation of credit constraint and policy risk are main reasons why decoupled payments may have some limited production effects (Westhoff and Binfield, 2003). The coefficient reflecting to what extent direct payments affect production, therefore assumed to be equal 0.15. European Commission assumes zero effect of decoupled payments on production in its models, while OECD assumes from 6 to 10 percent effect of decoupled direct payments on production. On the other hand EU Gold model uses coefficient 0.3 (Westhoff and Binfield, 2003).

Distribution of impacts of direct payments on individual commodities is based on value shares of individual commodities in total value of production. Farmers use some of direct payments to invest in

commodities with the highest expected profit. Data on profitability of individual commodities are not available and value shares are, therefore, used as proxies. The flowing approach was applied for the distribution of decoupled payments:

The payments financed by the EU budget (25% in 2004, 30% in 2005 … of the EU level) are distributed to crop and livestock sectors according to their contribution to total production. The sectoral envelopes are then calculated per unit of production or per hectare. The coefficient of coupling (impact of direct payments on production) for these payments is assumed to be equal 0.15.

Following the proposal of the Slovak Ministry of Agriculture, major share of top-ups, which will be financed from the Slovak government's budget (up to 30% of EU level) are decoupled. They are distributed to arable crops (except potatoes, sugar beet and vegetables) and animal sector (bovine, sheep and goats), by taking in consideration their production shares. The sectoral envelopes are again calculated per unit of production or per hectare. The coefficient of coupling for these payments is also assumed to be equal 0.15 because they are not linked to production.

Part of the top-ups will remain coupled to production (to sheep and suckler cows). As a result it is assumed that they will have a larger impact on production. The coefficient reflecting their effect on production is assumed to equal 0.6.

Macroeconomic Assumptions

Regarding the predictions of macro variables after 2001 the following forecasts and data sources are used:

For inflation and for GDP growth rate, Eurostat forecasts are used: an average 5.2% inflation rate and a moderate GDP growth (3% on average) are projected.

For population developments UN forecasts are used that predict a very small population growth rate. For exchange rate of Slovak currency against dollar SAV (Research Institute for World Economy) forecasts are used. Starting in 2004, exchange rate of the Slovak currency against Euro is projected by maintaining the purchasing power parity (PPP) of the 2003 actual rate plus a one percent growth in value for every one percent difference between real rates of GDP growth of Slovakia and the EU15 (Balassa-Samuelson effect).

4. Simulation Results

4.1. Cereals: Wheat, Barley and Maize

Prices

During the whole transition period Slovak cereal prices were substantially below the EU intervention prices and below the EU market prices. For baseline scenario, nominal cereal prices (after 2001) are forecasted to decline on average by less than 1% per year (figure 1). Nominal price decline combined with positive inflation rate assumed imply a more than 1% decline of real prices of cereals. The model assumes that Slovak cereal prices are determined by the developments of the exogenous EU market prices.

In accession scenario trade barriers are eliminated and EU policies are introduced in Slovakia in 2004 year. As a result Slovak prices will converge to the EU prices. In the model, prices are assumed to converge in one year to EU price level by a factor equal to 90% of price difference between domestic price and EU market price. Accession will therefore increase prices of cereals compared to baseline scenario. Wheat, barley and maize prices are expected to increase by 27%, 5%, and 9% respectively (figure 2 and table 1).

Blaas and Bozik (2002) estimated that crop prices would increase by 19%. Seman and Doliak (2003) report 18% expected increase of wheat price, 4% expected increase of barley price and 3.8% expected increase of maize price.

Area Harvested

Area harvested is a function of expected gross returns of cereals relative to other commodities and on area allocated to competing crops. Expected gross returns further depend on prices, direct payments and yields. There is still a significant gap between Slovak cereal yields and those in EU but the gap is closing. Technological development is expected to increase yields in both baseline scenario and accession scenario. Yields in accession scenario are expected, however, to increase more than in baseline scenario due to the effect of higher prices in the EU. Direct payments have a positive but limited impact on relative expected gross returns.

Due to mainly decline of real prices, the total cereal area harvested will be declining in the baseline scenario to be 9% lower in 2010 than in 2001. Maize area is projected to experience the largest decline as profitability of maize relative to barley and wheat worsens.
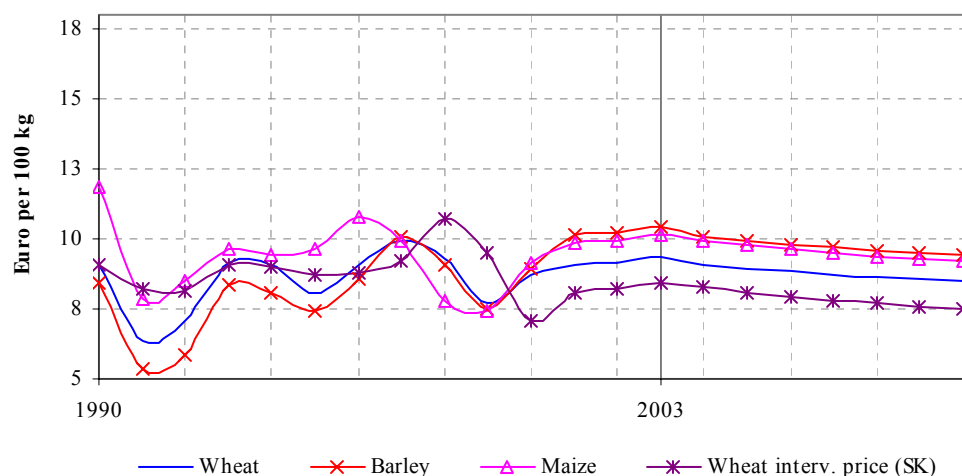

Figure 1. Cereals domestic prices and Slovak wheat intervention price (baseline scenario)
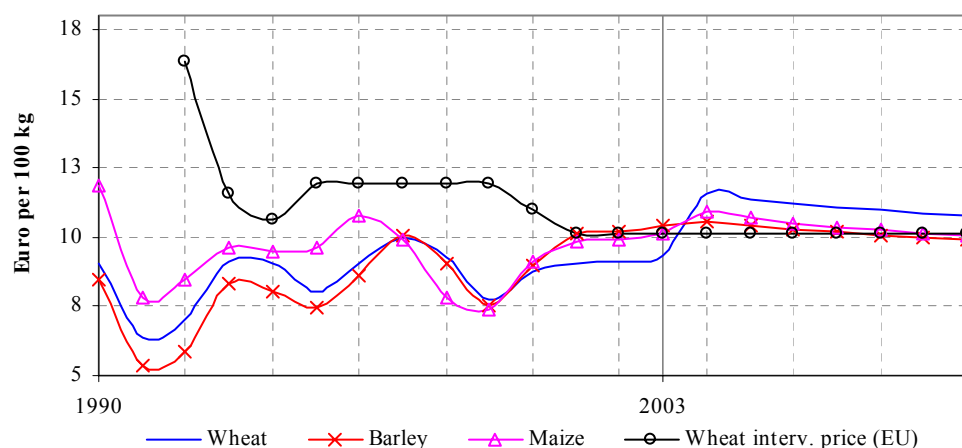

Figure 2. Cereals domestic prices and EU intervention price (A-SAPS scenario)

Table 1. Expected Slovak domestic price changes caused by EU accession

	% change (A-SAPS versus baseline)		% change (A-SAPS versus baseline)
Wheat	27	Beef meat	173
Barley	5	Pork meat	-24
Maize	9	Chicken	54
Rapeseed	53	Sheep meat	258
Sunflower	60	Milk	26
Soybeans	8	Butter	46
Potato	-20	SMP	1
Sugar	49	WMP	19
		Cheese	52
Crop product average	24	Animal product average	67

There is not expected a significant change in cereal area harvested in accession scenario. The positive effect of cereal price increase is offset by a negative effect on production from decoupling. The area for all three cereals in the first years of accession will be slightly below the area in the baseline scenario. In later years, area harvested will increase because of increase of direct payments. Towards the end of projecting period cereal area harvested in the A-SAPS scenario is expected to exceed its baseline level by 0.5%. Over time there is an expected shift from barley and maize to wheat. After accession high wheat price rise increases the profitability of this crop relative to barley and maize (figure 3).

Production

The expected yield increase offsets the decline in cereal area. As a result total cereal production will be increasing in baseline scenario to be 14% higher in 2010 than in 2001. Barley and wheat production are projected to be higher by 22% and 18%, respectively in 2010 as compared to 2001. In contrast, maize production is projected to go down by 3% due to a relatively large decline in area harvested, which could not be offset by yield increase.

For A-SAPS scenario cereal production largely reflects the development of the cereal area harvested (figure 4). In the first years after accession the production is lower than in the baseline scenario, but exceeding it after 2006 year. Higher cereal prices after accession lead to higher yields. As a result, the total cereal production for A-SAPS scenario will be up by around 1% in 2010 as compared to baseline scenario. This increase is larger than the projected increase of the cereal area.
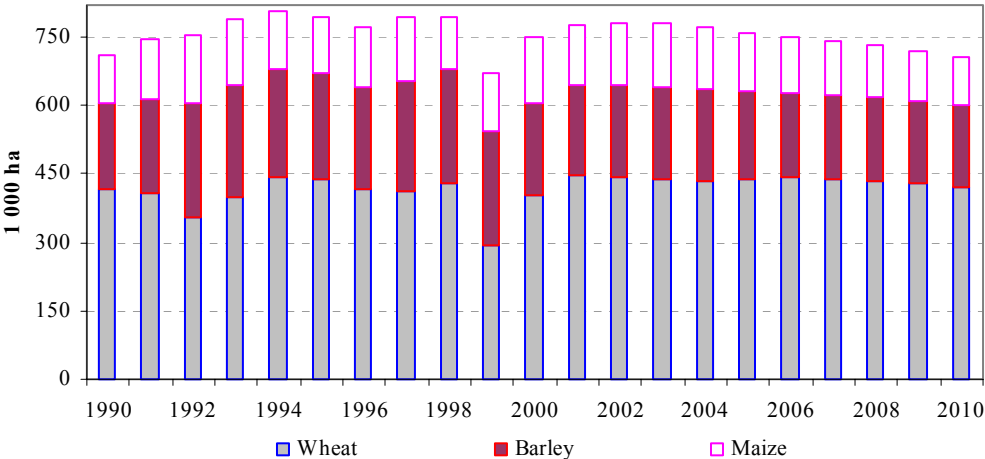

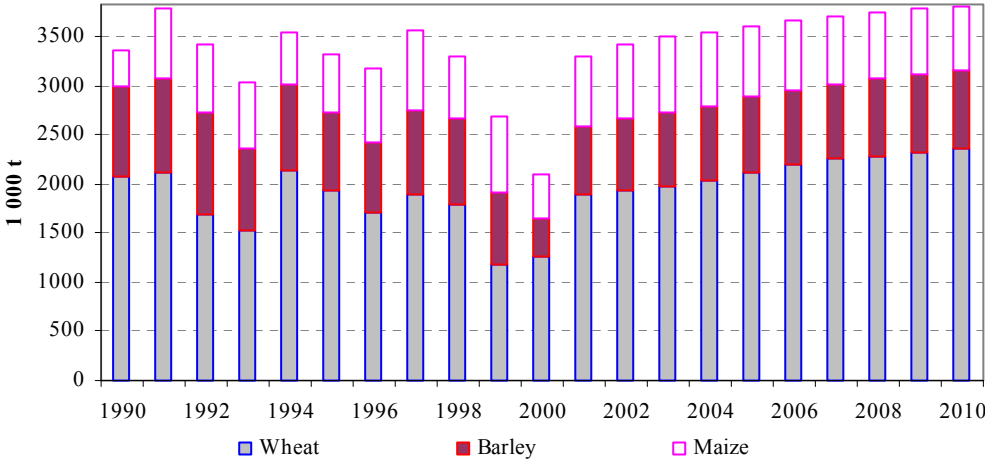Figure 3. Wheat, barley and maize area harvested (A-SAPS scenario)

Figure 4. Wheat, barley and maize production (A-SAPS scenario)

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Consumption

　　Overall cereal consumption is projected to increase in the baseline. In 2010 the domestic cereal use will expand by 25% as compared to 2001. An increase of use of cereals is explained by real GDP per capita growth and real price decline. Increase of demand for cereals will be mainly driven by its human consumption component. Less favourable development of animal production will lead to only limited increase of feed demand. Wheat, barley and maize use are projected to increase by 31%, 6% and 28% respectively in 2010 as compared to 2001.

　　After accession consumers will loose as a result of the rise in cereal price level. Cereal consumption is projected to be lower by approximately 3% compared to baseline scenario. The most affected crop is wheat, which will experience the largest price increase. The consumption of the other two cereals remains almost unchanged. Feed consumption is expected to decline more than non-feed consumption especially towards the end of the forecasting period. This development is due to decline in animal production after accession. The development of the cereal consumption for the accession scenario is shown in figure 5.

Trade

　　In the baseline scenario favourable development of market surpluses leads to a positive trade balance for wheat and barley. In contrast, decline in maize production and increase in consumption leads to deterioration of its trade balance. Trade balance for wheat improves in accession versus non-accession scenario as consumption declines and production increases. However, relative to baseline scenario, reduction of barley and maize area harvested after accession and therefore also reduction of production will deteriorate barley trade balance.
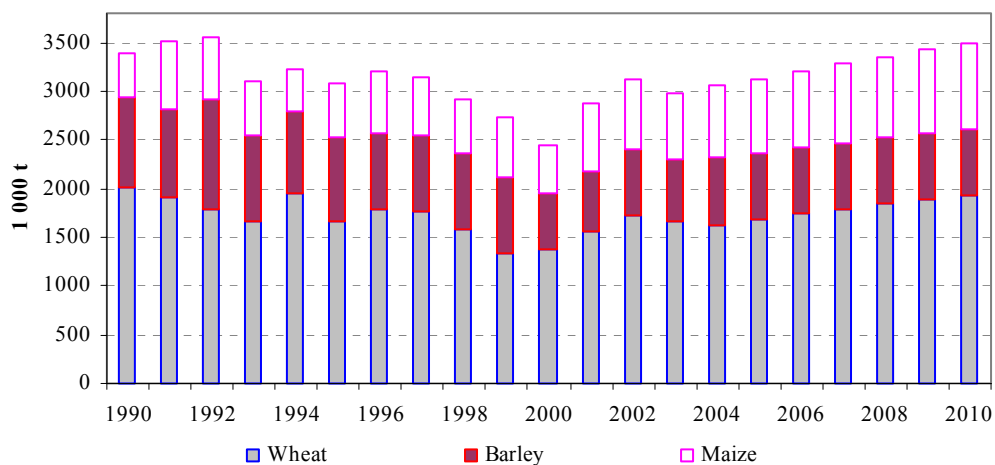

Figure 5. Wheat, barley and maize consumption (A-SAPS scenario)

4.2. Oilseeds: Rape seed, Sunflower and Soybeans
Prices

　　Rapeseed and sunflower prices were below the EU market prices during the transition period. They are expected to remain below EU level in the baseline non-accession scenario. On the other hand, soybean price was above the EU price at the beginning of 90s, but later declined to reach a level about 8% below the EU price in 2001. Nominal oilseeds prices are expected to decline by 2% per year on average after 2001 (figure 6). This implies that real prices will decline even more.

　　Oilseed prices are expected to increase in A-SAPS scenario. Compared to baseline scenario, accession will increase rapeseed, sunflower, and soybean prices by 53%, 60%, 8% respectively (figure 6, table 1). Oilseed prices are expected to increase substantially more than cereal prices. European Commission (2002) projects a similar pattern. It estimates a higher increase of oilseed prices in CEECs than that of cereal prices. Seman and Doliak (2003) also report a relatively high increase of rapeseed price, 37%.

Area Harvested

In the baseline non-accession scenario oilseeds area harvested will slightly decrease because of decline of returns of oilseeds relative to cereals (nominal oilseed prices decrease more than nominal cereal prices).

After accession total oilseeds area harvested will follow baseline non-accession scenario. The positive effect of oilseeds price increase is offset by a negative effect of decoupling of direct payments from production under SAPS. This holds despite the higher direct payments in absolute terms because the impact of decoupled direct payments is limited. Within the oilseeds significant adjustments are expected. Sunflower area will expand by around 6% by 2010 while rapeseed area will stay almost unchanged compared to non-accession scenario. Soybean production is less competitive. Its area is expected to converge almost to zero (figure 7).
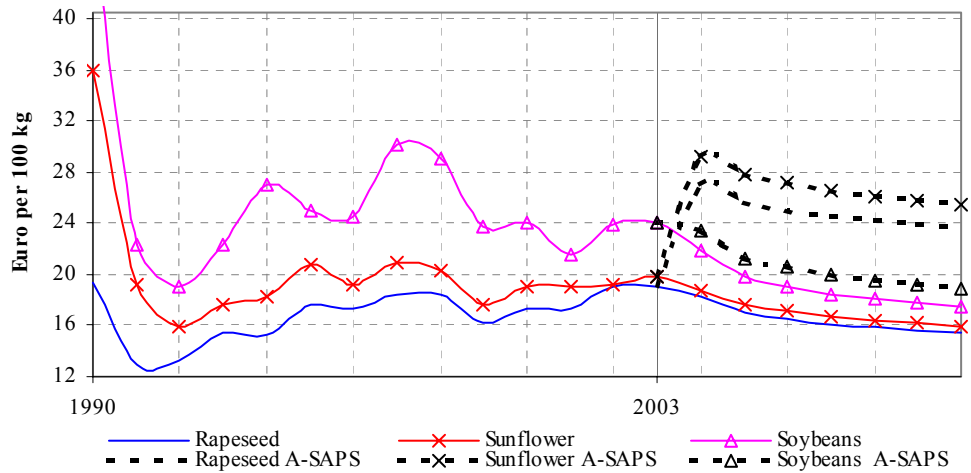

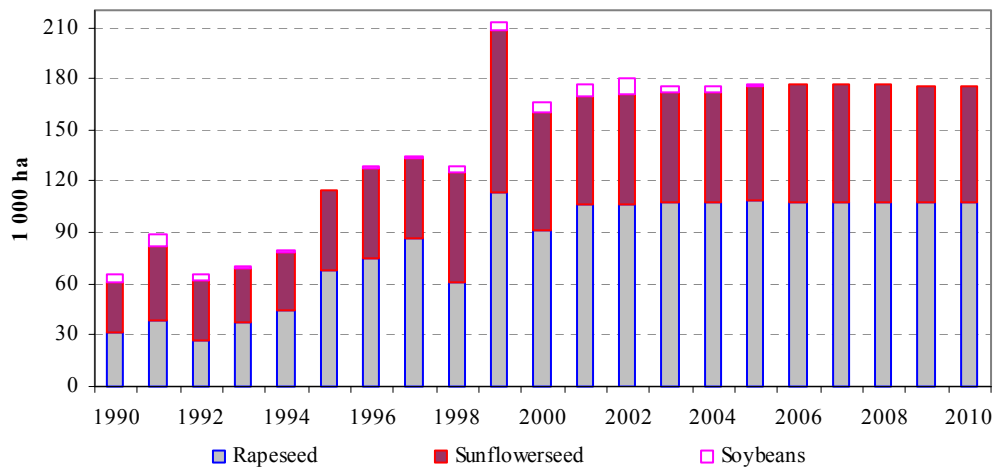Figure 6. Rapeseed, sunflower and soybean prices for baseline scenario and A-SAPS scenario

Figure 7. Rapeseed, sunflower and soybean area harvested (A-SAPS scenario)

Production

Oilseeds yield is expected to increase and will offset the decline of area harvested. As a result the production is projected to expand in the baseline scenario. Compared to 2001 the production will expand by 4% in 2010.

Higher prices after accession lead to higher yields. The total oilseeds production is expected to expand in A-SAPS scenario. Compared to baseline scenario the oilseeds production is expected to increase by 18% in 2005 and by 15% in 2010. Sunflower production increases by around 22%, rapeseed follows with 14-19% expansion, while soybean production goes down to almost zero (figure 8).

Consumption

Oilseeds are mostly used for production of oil. Oilseed meal, which is used as animal feed is a by-product of crushing of oilseeds. Demand of processing industry for oilseeds depends on returns obtained from processing.

Consumption of oilseeds is projected to remain relatively unchanged in the baseline scenario. There is an initial increase in oilseed consumption that is followed by a decline due to lowering of real returns from processing. However, overall consumption in 2010 will still be about 22% above 2001 level. Specifically, consumption of soybeans, rapeseeds, and sunflower expand by 36%, 26% and 7% respectively. The expansion of rapeseed use is mainly caused by its feed component. The other two oilseeds are driven primarily by non-feed demand.

Higher prices for oilseeds after accession will reduce the demand by around 16% in period 2005-2010 as compared to the level in the baseline scenario (figure 9).
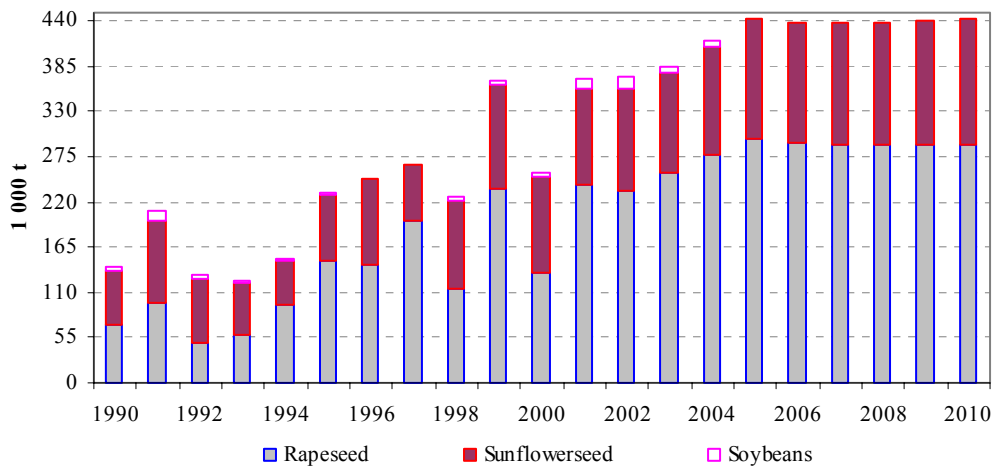

Figure 8. Rapeseed, sunflower and soybean production (A-SAPS scenario)

Trade

Higher supply of rapeseed and sunflower relative to domestic use creates surpluses in the domestic market. Positive trade balance is expected for rapeseeds and sunflower while negative for soybeans.

Positive trade balance is also expected in A-SAPS scenario and at a higher level than in the baseline scenario. After accession higher expected prices will drive production up while consumption will be pushed down.
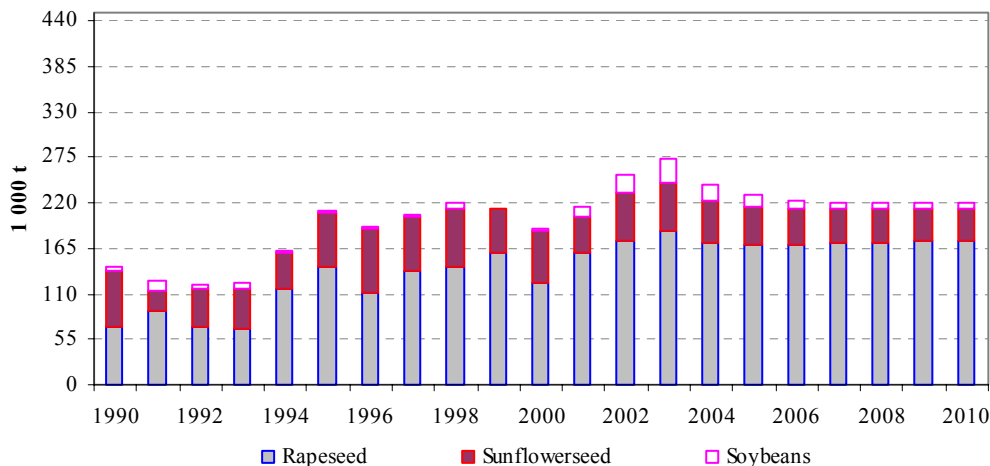

Figure 9. Rapeseed, sunflower and soybean domestic consumption (A-SAPS scenario)

4.3. Meat and Animal Numbers

Prices

Prices of animal products are modelled as a function of EU market prices, which are exogenous in the model. Domestic prices were significantly below the EU market prices before 2001. The difference between EU and domestic prices were larger for animal products than for crops. On average beef and mutton prices did not reach 50% of the EU level. On the other hand, the pork price was on average above the EU price. In the baseline scenario the projected prices follow the past trend and their projections are relatively stable (figure 10).

After accession convergence will result in an increase of prices of animal products, except for pork. Beef, sheep and chicken prices are expected to increase by more than 54% (table 1). Pork price is expected to be reduced by around 24%. Seman and Doliak (2003) report smaller increases of prices of animal products after accession. According to them, beef, pork, poultry and sheep meat prices will increase by 10%, 1%, 1% and 23.8% respectively. Blaas - Bozik (2002) provide larger figures. They estimated that as a result of accession, animal prices would increase by 25%.
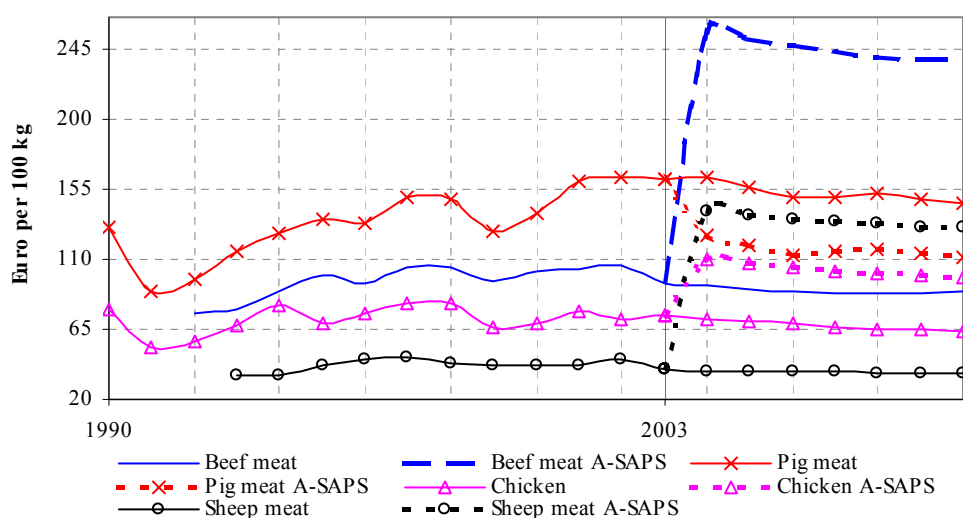

Figure 10. Beef, pork, chicken meat and mutton domestic prices for baseline scenario and A-SAPS scenario

Animal Numbers

Because of decline of real price, pig sector is expected to contract. Sow numbers are projected to go down by 25% in 2010 compared to 2001 in baseline scenario. Most of the decline will take place at the end of the projecting period. Fattening pigs are projected to decline by 9%. On the other hand sheep numbers will remain stable.

Total cattle number will slightly decline, in 2010 by 3% relative to 2001. It is due to real price decline, productivity increase and production quota constraint. Specifically, dairy cows are projected to decrease while suckler cows are projected to stay unchanged.

After accession, decoupling of most of the direct payments under SAPS will have a negative impact on animal numbers. A small share of direct payments that will remain coupled to production (part of the top-ups) will not exert a significant effect on number of animals. A negative effect of decoupling is offset by a price increase resulting in an overall expansion of total cattle number from 2 to 4% relative to the baseline. Number of sheep expands by around 2-5% compared to baseline scenario. Due to decline of pork price, pig numbers are expected to decline by 2% in 2005 and by 30% in 2010 (figure 11).

Meat Production

In the baseline non accession scenario total meat production is expected to expand by 12% in 2005 and by 19% in 2010 relative to 2001. Specifically pork production increase only by 5% and by 2% in 2005 and 2010 respectively as compared to 2001. The reduction of pig numbers is offset by an increase of the slaughter weight. Beef and chicken meat are projected to increase by more than 20%. An increase in slaughter weight offsets the reduction of cattle numbers. Beef meat production expands

between 23% and 30%. Chicken meat is forecasted to increase between 20 and 44%, while sheep meat production remains stagnant. Because of the share of pig meat close to half of the total meat production, the overall increase in meat production is smaller than an increase in beef and chicken meat production.
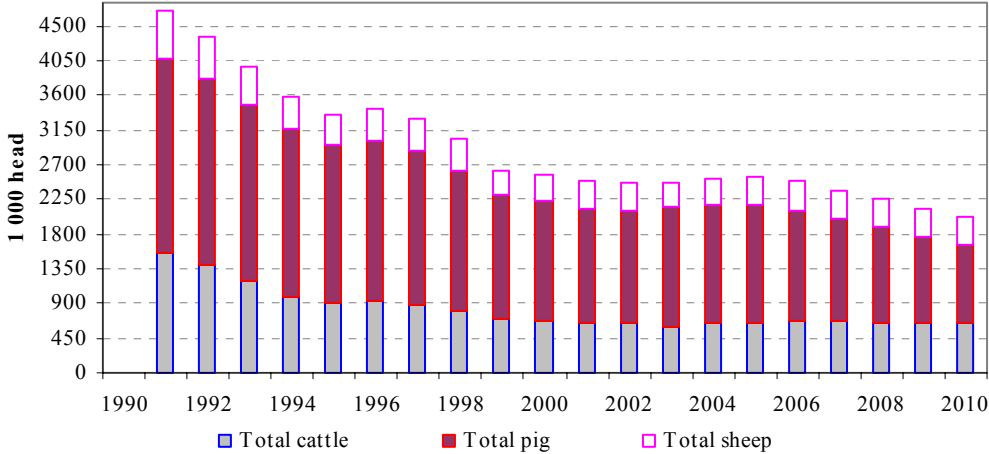

Figure 11. Animal numbers for A-SAPS scenario

After accession the positive trend in meat production will continue but at a lower rate (figure 12). Relative price changes will alter the distribution of animal production. The production of beef, chicken and sheep meat will increase while the production of pork will decline. Relative to non-accession baseline scenario, accession improves the production outlook for beef, chicken and sheep. Price incentive induces higher animal productivity as well as animal numbers, thus positively affecting production. The production of these three meats will increase between 1 and 12% relative to the baseline. The largest gains will be observed in beef and sheep sectors. In contrast, pork production decreases considerably (between 7 and 12%) as pork price declines after accession.

Meat Consumption

Real price decline and real per capita GDP increase both positively influence consumption of animal products in the baseline scenario. Overall total meat consumption is expected to be up by 13% in 2005 and by 25% in 2010 compared to 2001. Of this beef will expand by around 18-30%, pork by 7-15%, chicken by 23-40% and sheep meat will expand by 11-20%.
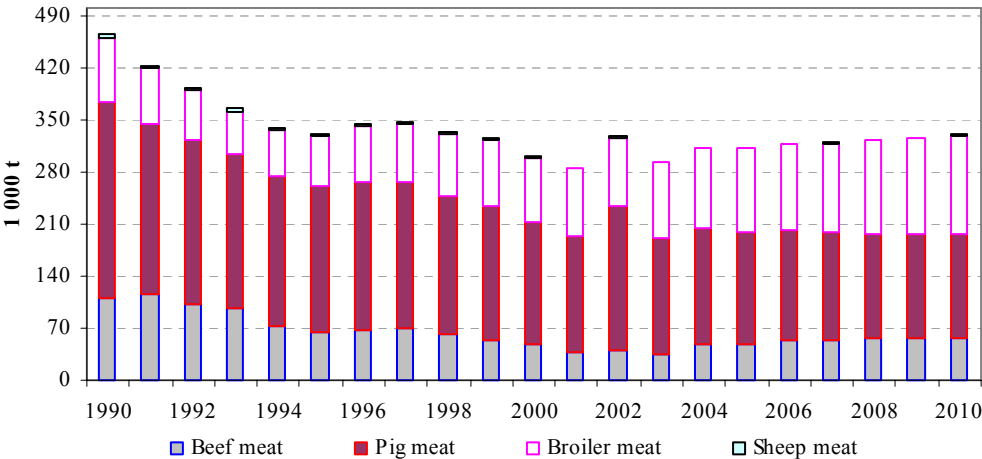

Figure 12. Meat production for A-SAPS scenario

Consumption increases in accession scenario by around 5% relative to the baseline. Consumers are expected to switch from other meats to pork. Because of price increase consumption of beef,

chicken meat and mutton actually contracts. The most significant decline will occur for beef by around 32% relative to baseline scenario, followed by mutton (by around 25%). On the other hand consumption of pork increases as pork prices are expected to go down after accession. As a result, the share of pork consumption in the overall meat consumption is expected to increase from 50% in the baseline scenario to around 60% in A-SAPS scenario. See figure 13.

Trade

Trade balance for chicken is expected to improve while that for other meats to worsen in non-accession baseline scenario. Beef trade balance is expected to stay positive, however.

In accession scenario the trade balance for meats is expected to improve as a result of lower consumption and higher production. Pork is an exception. Its domestic supply declines and consumption increases resulting in negative trade balance.
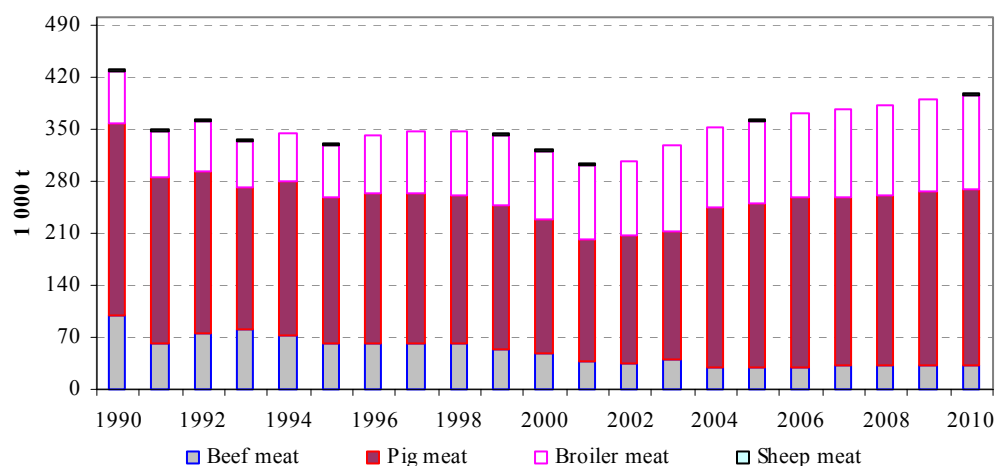

Figure 13. Meat consumption for A-SAPS scenario

5. Conclusions

This paper analyses the impact of the Slovak accession into the EU on selected agricultural commodities. Two scenarios are simulated: non-accession baseline scenario (N-Ac) and accession (A-SAPS). Non-accession scenario is included as a benchmark. Accession scenario assumes that Slovakia will join EU in 2004 and implement single area payments scheme (SAPS) until the end of the projection period of 2010.

In the baseline scenario real prices for almost all crops are projected to decline. As a result, the area cultivated for majority of crops goes down too.

The decline of real prices has a positive effect on consumption. Per capita consumption for majority of crops increases. Trade balance for cereals is expected to improve while for oilseeds to worsen.

In animal sector worsening terms of trade lead to a decline of animal numbers and to decline of production of majority of animal products. Consumption of animal products is projected to increase as real prices decline. Production decline combined with an increase in consumption of animal products are expected to cause the deterioration of their trade balance.

Scenario A-SAPS assumes decoupling of a majority of direct payments. Decoupled direct payments have a small impact on production. Price level increases after accession have a more important impact on agricultural markets. Majority of prices before accession were lower than EU prices. The largest difference was for animal products. Pork is an exception to this rule. Due to accession crop prices are expected to increase by around 24% and animal prices by around 67% (table 1). First, higher prices will lead to higher yields per hectare or animal, which will have a positive production effects. Second, higher prices will have a negative effect on consumers. They will reduce consumption after accession compared to baseline scenario. This opposite developments in production and consumption will produce a general improvement of agricultural trade balance after accession.

Main factors that lead to differential performance of different crops and animal categories are competitiveness, profitably and/or the combination of both of these two factors. The profitability is

affected by change of yields as well as by price changes. Pork production is non-competitive. Before accession price of pork was higher than the EU price and its production is therefore expected to decline after accession. In the case of soybean, maize and barley, combination of both factors - low competitiveness and decline of relative profitability with respect to competing crops - are expected to lead to decline of their importance. Their relative profitability against competing crops is projected to decline and the difference of their prices with respect to key prices is much smaller as compared for instance to rapeseed and sunflower. The remaining sectors are expected to perform better, reflecting their higher competitiveness.

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