Modelling of the Slovak Agricultural Markets – AG-MEMOD Approach

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Paper prepared for presentation at the XIth International Congress of the EAAE (European Association of Agricultural Economists)
'The Future of Rural Europe in the Global Agri-Food System'
Copenhagen, Denmark, August 24-27, 2005

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Abstract

Slovak sectoral partial equilibrium econometric model based on AG-MEMOD approach is used to analyse the development of the selected Slovak agricultural markets after EU accession. Simulation results for cereals and meats are provided in this poster. 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, Slovak agricultural markets, EU accession, CAP

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 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.

Price support and direct payments are two major policy instruments of the CAP. Direct payments increased in Slovakia after accession. 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.

The objective of the poster is to analyse the impact of enlargement on agricultural prices, area harvested, production, consumption and trade for cereals, oilseeds and meats. 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.

2. The Model and Data

The model 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 ...).

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. 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. The coefficient reflecting to what extent direct payments affect production, therefore assumed to be equal 0.15. Distribution of impacts of direct payments on individual commodities is based on value shares of individual commodities in total value of production.

The following 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 for these payments is assumed to be equal 0.15.

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.

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. In agricultural sector weather conditions cause year to year price fluctuations, which is not present in our projections as short run pattern of weather fluctuations is difficult to forecast. 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. As a result, compared to 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).

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.

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.

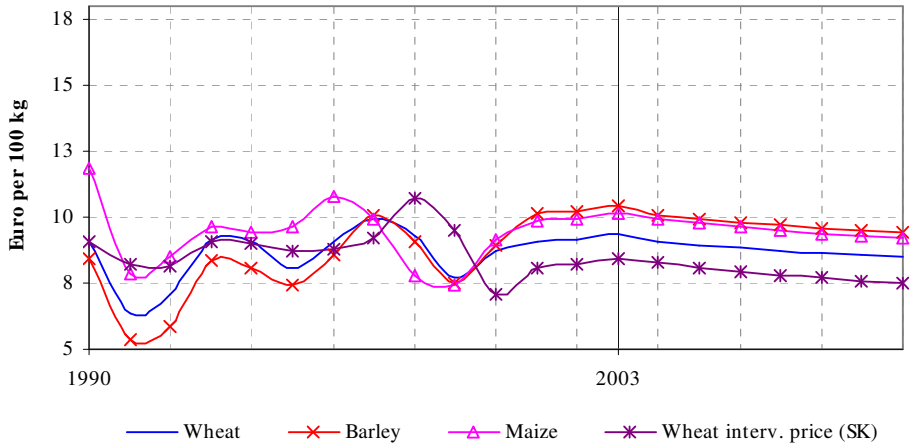

Figure 1. Cereals domestic prices and Slovak wheat intervention price (baseline scenario)

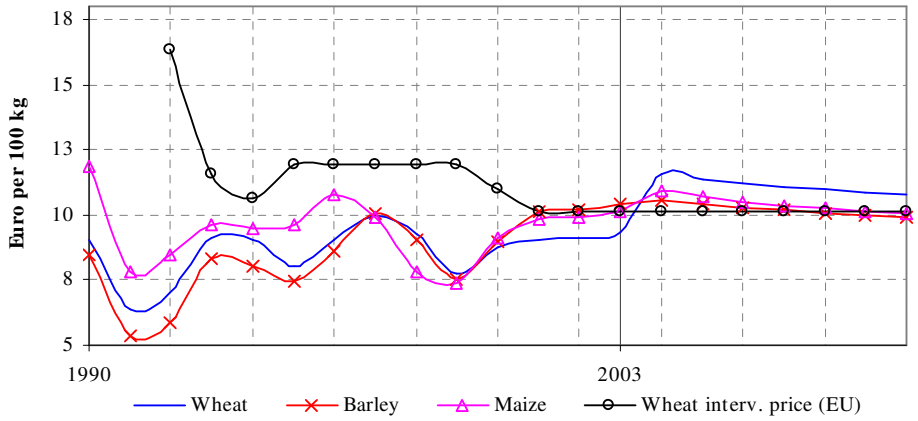

Figure 2. Cereals domestic prices and EU intervention price (A-SAPS scenario)

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

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.

High wheat price rise after accession 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.

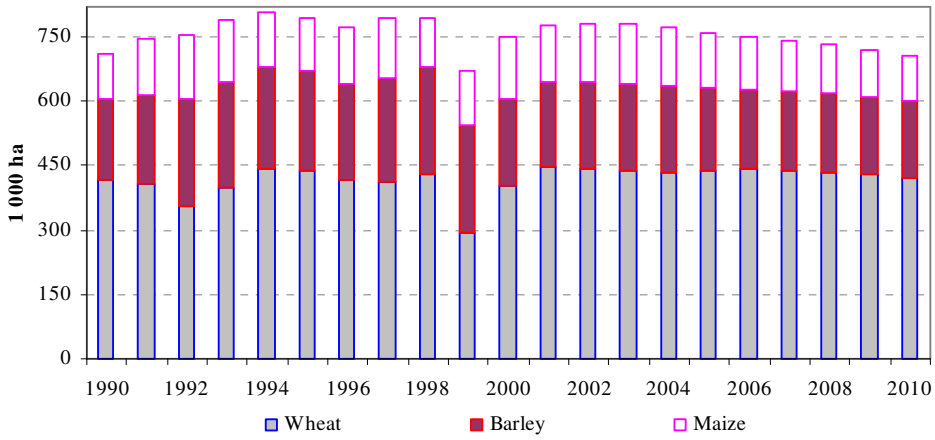

Figure 3. Wheat, barley and maize area harvested (A-SAPS scenario)

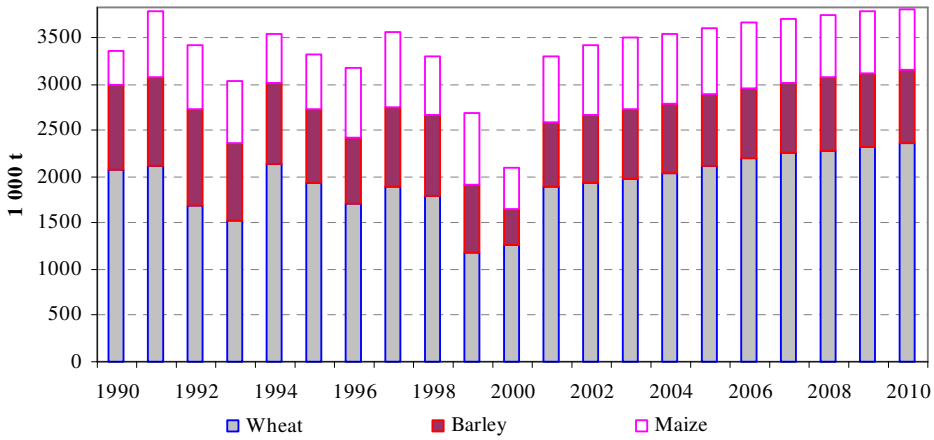

Figure 4. Wheat, barley and maize production (A-SAPS scenario)

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.

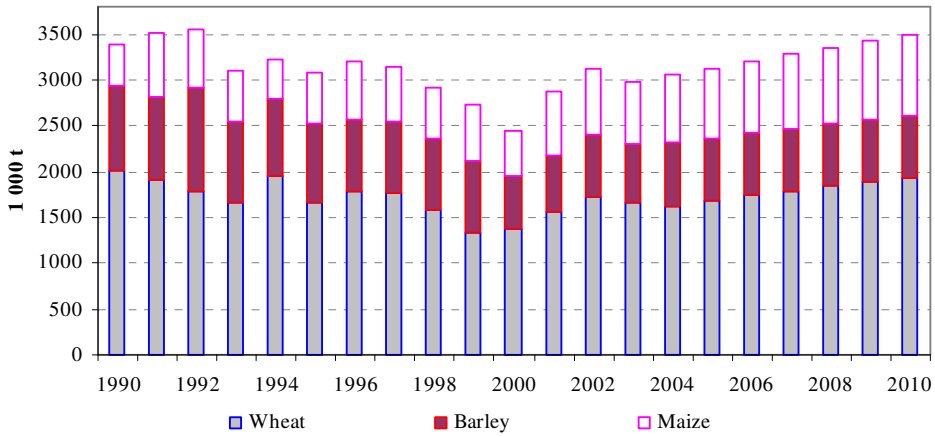

Figure 5. Wheat, barley and maize consumption (A-SAPS scenario)

4.2. 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 6).

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%.

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 7).

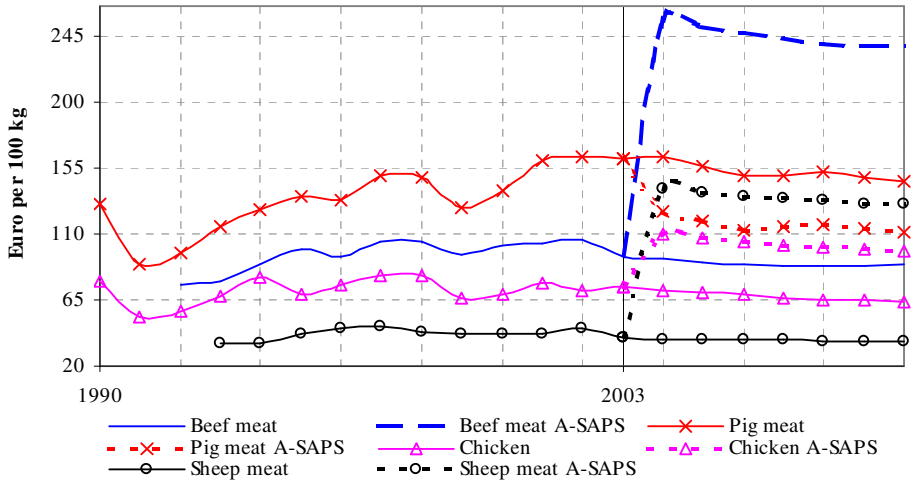

Figure 6. Beef, pork, chicken meat and mutton domestic prices for baseline scenario and A-SAPS scenario

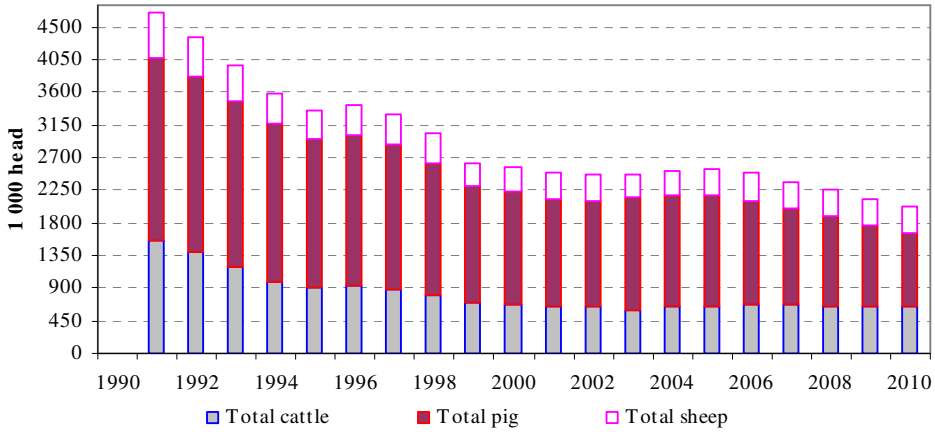

Figure 7. Animal numbers for A-SAPS scenario

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 pork is 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.

After accession the positive trend in meat production will continue but at a lower rate (figure 8). 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.

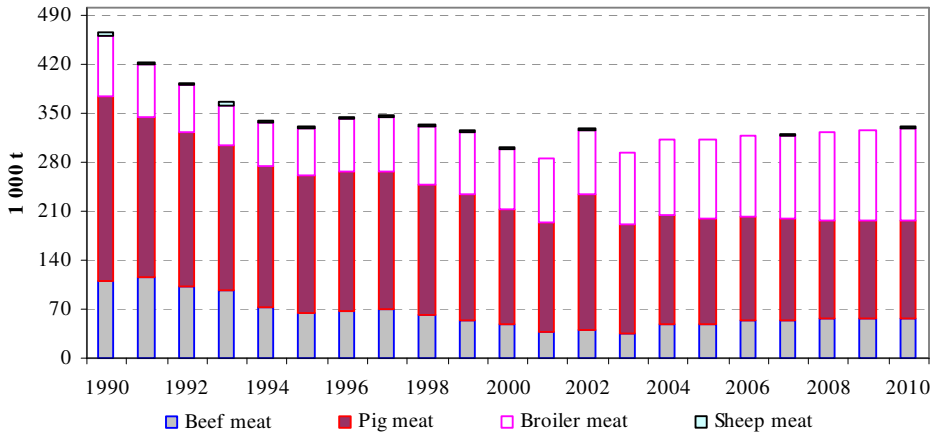

Figure 8. Meat production for A-SAPS scenario

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%.

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 9.

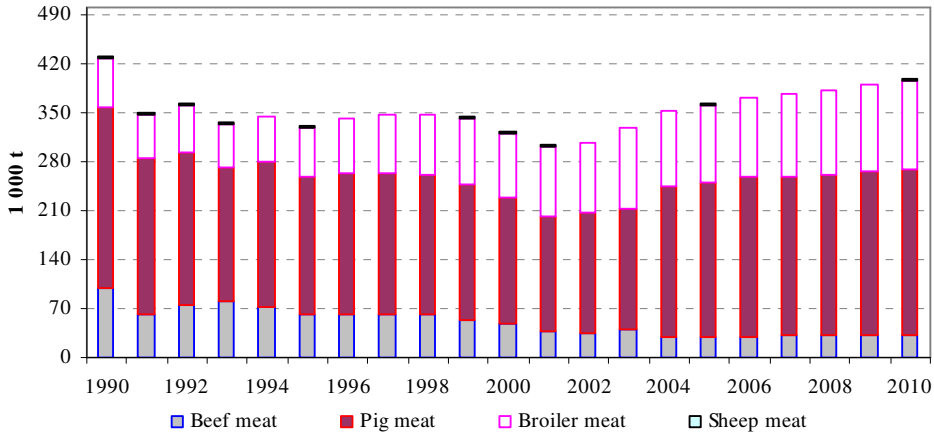

Figure 9. Meat consumption for A-SAPS scenario

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.

5. Conclusions

The impact of the Slovak accession into the EU on selected agricultural commodities is analysed. 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.

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. Its price is higher than the EU price and its production is 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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