An implementation of the agricultural sector model AGTRACES for Slovenia and Bulgaria

Martin Kniepert

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Abstract

This paper first concentrates on general questions of the layout of agricultural sector models. Particular modelling requirements and guidelines established for the development of AGTRACES are discussed in a general context. After that, the model is explained in greater detail, showing equations, examining the choice of elasticities, properties of elasticity matrices etc. In the second chapter the model is applied for Slovenia and Bulgaria. Thereby, the model specification is the same in each case. Considering the particular situation in the countries mainly with respect to achievements in the transformation process some adjustments are made, e.g. in that particular autonomous trends are introduced. A base run and various policy scenarios finally allow for some tentative policy conclusions.
1 Problem and methodology

1.1 Aims of modelling work

The Common Agricultural Policy (CAP) of the EU has been developed during the last 40 years to a quite sophisticated system of state interventionist policies. During all these years its fundamental objectives have not been changed, whereas the policy instruments were changed or adjusted. Many of these instruments proved to be rather inefficient. Facing increasing budgetary pressure, continuing international trade disputes, and adjustment needs with respect to the planned accession of CEECs, the Commission suggested to turn the CAP into a more market oriented policy that would allow agricultural production to become internationally more competitive, and agricultural policy less expensive. Still, the Commission insisted to maintain a ‘European Model of Agriculture’, which should not be dominated completely by market forces; social cohesion, rural development, ecological aspects, animal welfare etc. were supposed to have their place in the future of agricultural policies. Pre-accession strategies of the CEECs should have been guided by principles of a new, internationally compatible agricultural policy; the CEECs should not feel tempted to implement the less efficient instruments of market organisations in the first place.

When decisions were taken in March 1999 at the Berlin Summit the Commissions reform proposals were diluted to a certain extent. Political target prices, quota-systems, export subsidies, set aside schemes and other ‘traditional’ instruments of the CAP will play a major role for the years to come. Even though a more determined reform of the CAP should not have been misunderstood only as a pre-requisite of eastward enlargement – it would have been as sensible also without enlargement – it is clear, that the way to accession has been made more difficult now.

The contribution of economic analysis should be able to match the situation described so far. Economic models can generally be useful instruments to analyse and quantify economic developments and the behaviour of economic agents. They should help entrepreneurs and investors to base their decisions on rational analysis. Employment perspectives in agriculture should be estimated in order to provide guidelines for people who want to decide whether to qualify for a job in this field. In the given context it will also be important to shed light on the effects and efficiency of the instruments of market organisations. For the CEECs as countries in transition it is important to analyse various possibilities of adjusting to the CAP, which itself is to be seen as a moving target. Models should help CEECs to define their own position in negotiations and make it possible to base arguments on clear facts and rigorous analysis for both, the EU and the CEECs.

In order to be able to make this contribution, economic analysis relies heavily on data. For most CEECs data availability and reliability are rather limited. This is largely due to methodological changes that came along with the change from centrally planned economies to market economies. Obviously, there is a lack of experience in developing the required statistics that will only be overcome gradually. (This is of course something that might as well be said about a number of today’s EU countries). In this situation the work on models can help to enhance the understanding of what the purpose of statistical systems is and what the systematic ideas behind the mere compilation of data are. So, economic modelling can and should also contribute to the improvement of statistics.

1.2 General situation in modelling

A lot of work is being done on the improvement of theoretical foundations of modelling work. This concerns the choice of functional forms, the properties of elasticity matrices, and the like. Single
equation models are replaced by sector models showing the interdependencies between the various agricultural products. Partial equilibrium models are replaced by general equilibrium models providing for more theoretical rigour. A disadvantage of the finally highly sophisticated models lies in the difficulty to run them, to understand them, or to explain them to those who do not specialise in modelling. Therefore, these models will always be more or less black boxes. Large scale models could usually only handled by government institutions, having access to the required resources. Empirical research is usually conducted on a rather detailed level, using more advanced methods. Sector models, covering more than a single or only few commodities, usually draw on the experience gained with the more detailed work. So, the empirical basis for sector models is usually a ‘second hand’ experience. In that sense, the models are ‘stylised’.

Particularly at universities modelling is largely a matter of research on very particular problems that are at the cutting edge of economics; successful as this might have been with respect to the solution of theoretical problems, this modelling work did hardly trickle down to applied work in policy development. All too often this often is dominated by rather crude expert judgement or blunt lobby work.

In recent years namely information technology has developed to an extent that the academic standards and applied work could be reconciled again. The number-crunching facilities of modern computers allow to run models that are in their complexity closer to the requirements of applied work. Still, there is large number of problems to be overcome. Access to data is often restricted to government officials or selected research staff; the reason for this lies obviously in the fact, that particularly data on support measures are considered to be politically sensitive.

Along with the increasing capacity of computers, the merger of applied and academic work is supported by the fact that policy arguments have to be based more and more on scientific evidence. Quantitative information will become a standard in the context of policy making. This is particularly true in an international context but also – due to the need to justify agricultural policy vis-à-vis rivalling pressure groups – in the national policy discussion.

1.3 Guidelines for the development of AGTRACES

Having considered what the requirements for agricultural sector modelling are in the given pre-accession situation and having given a brief overview over what kind of models exist already or are being developed by other institutions, the effort to develop yet another model will have to be justified by some marginal utility of the model that can be gained in just this situation. This utility should be maximised. For the model presented in this paper the following guidelines were established:

- The model should integrate the process of the improvement of statistics, modelling and policy analysis.

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3 Examples are the world food model of the FAO, the FAPRI-Model, Aglink of the OECD, SPEL at EUROSTAT; a notable exception was SWOPSIM which was developed by USDA and made accessible to a wider range of users with considerable success. ESM, which could have been a follow-up version of SWOPSIM for European requirements was either not promoted in that sense, or it was too difficult to handle. A single country version of ESM (????) has been designed to be handled easily and was applied e.g. by Kostov et al. (1999). Another notable exception is GTAP, which principally is accessible to researchers who, but rather difficult to handle and not really suited to the needs of policy.

4 AGTRACES (AGricultural TRade and ACtivities Evaluation and Simulation) can be read just as this abbreviation, and at the same time it can be understood as naming a tool which should help to trace general economic features of the agricultural sector and effects of policy instruments.
• The model should be based directly on official statistics, namely the Economic Accounts of Agriculture (EAA).
• The whole agricultural sector should be covered as it is defined by the EEA.
• In order to assure the possibility of cross country comparisons statistics of the model should follow international standards.
• To overcome data deficiencies information should be incorporated into the model set of data in various respects. Information from market developments (namely prices and quantities traded on the market) should thereby be complemented by information e.g. from gross margin calculations. Further, not only typically economic information should be used to establish the set of data but also technical information, such as yields, feeding ratios etc.
• The model is based on standard micro-economic theory, applying the usual restrictions on demand and supply elasticities.
• Policy relevant issues such as the general world market development, exchange rate changes, technology, demand development for agricultural commodities as non-food renewable resources and other general determinants should be covered.
• It should be possible to include the most important policy instruments, allowing to quantify their effects in scenarios.
• A widespread technology should be used in order to keep the model accessible also for those who are not modelling specialists but who are just interested in testing scenarios, or for those who are mainly working on statistics. Spreadsheet technology seems to be appropriate in that respect; the possibility to link them to existing databases would be of advantage.

Establishing these guidelines, it is clear that there are other models which are theoretically more sophisticated, which make use of more demanding and with respect to scientific requirements stronger and more reliable software packages etc. Here it should clear, that this paper does not deny the importance of these models. But it should also be clear that there is a trade off, whereby AGTRACES is supposed to have it’s virtues in other respects.

1.4 The data

In order to achieve internationally standardised sets of data FAOSTAT-data and EUROSTAT’s SPEL-data were used to develop an approach that would be feasible first of all for the CEECs and the EU but also for a ‘rest-of-world-country’. A systematic approach should allow to overcome data deficiencies by the application of consistency criteria and the combination of technical and economic data from different sources.

As a systematic approach the main features of the SPEL-system were adopted, although on a much less detailed level. Essentially this means that the complete agricultural sector as defined by the EAA is covered, whereby the sector is split into 23 activities for which main and joint output is calculated. At the same time inputs used in the agricultural sector as they are bought from other sectors are allocated to the different activities. Agricultural output that is used within the sector as input (feed, seed etc.) is allocated to activities as well. In order to cover the complete feed requirements also imported feed is covered together with the commodity balances of all other commodities. Dividing such an activity-based EAA by the number of animals or the area used delivers average gross margin calculations.
FAOSTAT data where converted into this approach. Technically this was possible without greater compromises; problems did arise due to the lack of price data and technical coefficients so that default values had to be used in a number of cases or additional sources had to be used (OECD; national sources). Even though making use of FAOSTAT data in this way proved to be a feasible way to run first-draft versions of the models, it turned out that it would be easier to compile the data sets with local experts from scratch. Still, there are a number of deficiencies in the data, namely on the input side. The simple allocation of many inputs used in the sector, of depreciation etc. by scaling according to the value of production does not necessarily lead to convincing gross margin calculations. Results from income calculations are therefore to be taken as preliminary only.

1.5 Model structure and equations

The demand and supply functions used in the model have constant elasticities throughout. The advantage of constant elasticities is their relative simplicity which follows the guide lines of the modelling exercise conducted here. To make it easier the equations are presented here only for a few activities and/or commodities; all other equations follow the same rules accordingly.

On the supply side first the levels (LV) of activities is determined, being depended on producer prices (PRP) and there respective own and cross price elasticities. The following example refers to Wheat (WH) and pigs (PM). (* denotes multiplication and ^ the ‘to the power of’ sign.

\[ \text{LV}_\text{WH} = \text{const} \times \text{PRP}_\text{PM}^{0.3} \times \text{PRP}_\text{PM}^{0.1} \]

By simple multiplication with one (or more) productivity rates the resulting quantities of commodities are calculated. For most activities this is only a single commodity, but for some activities there are more commodities such as for the activity ‘milk cows’ which produces milk and beef. Beef and veal (BV; there is no distinction made between these two) has in tum three activities as sources: Male cattle for fattening (BV), calves (IB), and milk cows (MC).

Wheat (WH) yield from the activity wheat (WH) is denoted as WHWR, whereby the first two letters refer to the commodity, the second two letters to the activity, ‘R’ denotes the ratio between these two categories concerned, and ‘Q’ to the total quantity of this commodity being produced in this activity. For the productivity ratio of beef from the activity milk cows the notation is therefore BFMCR. The total quantity of beef produced from various activities is denoted as BVPRQ. In the same way the

\[ \text{LV}_\text{WH} = \text{const} \times \text{PM}_\text{PRP}^{0.3} \times \text{PM}_\text{PRP}^{0.1} \]

In both countries we could make use of sets of data that where developed by local experts together with ASA/Bonn as a basis for the economic accounts of agriculture. With respect to production, the ASA approach follows the SPEL-System; it does not include commodity balances so that it had to be completed in that respect. Apart from that particularly for Bulgaria a number of questions arose with respect to the data that would have to be discussed in detail with official statisticians. For the time being some corrections where made based on the judgement of the research team.

The following formal presentation uses the same notation for the variables as they are being used in the MS-Excel implementation. This notation had been developed to allow an efficient handling of larger numbers of time series developed. In so far, the notation deviates somewhat from conventionally used mnemonics in the economic literature. On the other hand it will be easier to get acquainted with the Excel-implementation itself. To get acquainted with it is suggested to make use of a ‘tutorial’ which is much smaller than AGTRACES with respect to the number of activities and commodities but covers all the essential characteristics of it.
input ratios can be expressed: CFMCR is the technical ratio of compound feed input to the activity milk cows.

\[ WHPRQ = WHWHQ = WHWHR \times LVWH \]
\[ BVPRQ = BVBVQ + BVMCQ + BVIBQ = BVMCR \times LVMC + BVBVR \times LVBV + BVIBR \times LVBV \]
\[ CFBVQ = CFBVR \times LVBV \]

The demand for food (FO) is determined on a per head level (NU), multiplied with the exogenous number of population (POTT). As explaining variables own and cross prices are used as well as per head income (NACG). In the current model there is no difference between producer (PRP) and consumer prices (NUP). Still, the model is organised in such a way that – possibly changing – differences between these two prices could easily be introduced as mark-ups.

\[ WHNUQ = const \times WHNUP ^{-0.2} \times PMNUP ^{0.2} \times NACG ^{0.1} \times Trend ^{0.05} \]
\[ WHFOQ = WHNUQ \times POTT \]
\[ WHNUP = Markup_{NU} \times WHPRP \]

In a similar way the demand functions for feed (FE) are specified. The total demand for compound feed is determined by the number of animals (i.e. the levels of the respective activities) in that it is multiplied with exogenous feeding (CFPMR, CFMCR etc.) rates. As examples maize (MA) and coarse grains (CG) fed to pigs (PM) and male cattle for fattening (BV) are considered in the following. Since the total demand for compound feed is determined by the levels of the animal activities and the respective feeding ratios, feed prices (FEP) do only play a role with respect to the composition of feed. For this reason the elasticity matrix for feed i) does have to be homogenous of degree zero, ii) it has to fulfil the criteria of symmetry and iii) adding-up.

\[ CFUTQ = CFMCR \times LVMC + CFPMR \times LVPM \]
\[ WHF EQ = const \times MAFEP ^{-0.2} \times CGFEP ^{0.2} \times CFUTQ \]
\[ MAFEQ = const \times MAFEP ^{0.2} \times CGFEP ^{-0.2} \times CFUTQ \]
\[ CFUTQ = WHF EQ + MAFEQ \]

In the same way as the demand for compound feed, the demand for silage is being determined. The fact that minor quantities of silage can be produced from various activities as joint products is in fact neglected in the model insofar as prices are not considered to play a role in this context. Except for the activity ‘Silage, Gras etc.’ where silage is the main commodity, silage from other activities is produced along with the respective main product. The composition of silage is therefore mainly determined by technical coefficients, not by prices.

\[ SIUTQ = LVMC \times SIMCR + LVPM \times SIIB \]
\[ SIFEQ = ICFEQ \]

Seed (SE) and waste (WA) are determined as fixed, exogenous shares of total production.

\[ WHSEQ = WHSER \times WHPRQ \]
\[ WHWAQ = WHWAR \times WHPRQ \]

‘Other’ (in fact, non-food, industrial) uses of agricultural products are considered mainly dependent on GDP (NAGD), on a trend, on own price and in some cases on cross price elasticities. Prices are on this level are again assumed to be equal to producer prices. The following example is on oil crops (OC).

\[ OCOTQ = const \times OCPRP ^{-0.3} \times NAGD ^{0.3} \times Trend ^{0.1} \]

Processing by the food industry is not considered in the current application of the model on Slovenia and Bulgaria; all commodities are used as raw equivalent. Having calculated all uses they can be
added up to total utilisation (UTQ). Production (PRQ) minus utilisation then equals net trade. Stock changes are assumed to be negligible for the purpose of modelling.

\[ \text{WHNTQ} = \text{WHPRQ} - (\text{WHFOQ} + \text{WHFEQ} + \text{WHSEQ} + \text{WHWAQ} + \text{WHPKQ} + \text{WHOTQ}) \]

For the purpose of this project the model has been implemented in single country versions, making the assumption that world market prices are given and domestic prices follow world market prices except for a possible difference resulting from policy intervention. Under this ‘single-country-assumption’, surplus can be exported at any time (in case of domestic price support this would of course require export subsidies) and deficits could be overcome by importing the respective quantity from the world market (possibly providing for some tariff income).

The layout of the model would now principally allow to link various countries, and ultimately close the model with a ‘rest-of-world-country’. Thus, net-trade of all countries would have to add up to zero.

\[ \text{SYWHNTQ} + \text{BGWHNT} + \text{EUWHNT} + \text{XWWHNTQ} = 0 \]

Changes in exogenous variables such as yields or per head incomes would then lead to a surplus or deficit in net-trade, i.e. to a disequilibrium on world markets. Therefore prices have to adjust to bring a new equilibrium about. Technically this is being done by using the MS-Excel solver using net-trade = 0 as restrictions and prices as variables.

Principally, the ratio between world market prices and domestic prices is calculated in two steps. Thereby, the total difference is split up in a share which is due to quality differences, transport cost etc. on the one hand a policy induced price gap on the other hand.

\[ \text{BGWHPRP} = \text{WLWHNTP} \times \text{BGXR} \times \text{BGWHNTPW} \times \text{BGWHPRPW} \]

As a rule, EU export prices are taken as reference prices for the world market. Border prices (NTP; in ECU) are multiplied with the exchange rate, the quality price ratio (denoted NTPW) and with the producer support ratio (PRPW).

### 1.6 The elasticities

Although it certainly is to be considered a disadvantage of the model that elasticities are constant the simplicity of the functional forms used seems to be adequate when reconsidering the guidelines that were adopted when developing the model. Models with these functional forms are fairly easy to understand, the economic logic of the model leading to particular results is thereby easy to communicate to a wider, not very specialised audience.

The choice of elasticities is largely based on econometric work in the two countries in earlier research. In addition, these elasticities where compared with other sources in the literature and adjusted by ‘expert judgement’. Theoretical properties of the matrices such as homogeneity, symmetry, and adding-up were applied in the case of arable land allocation and feed demand. Thereby it can be taken for granted that total arable land use does not change due to price changes. The influence of prices on land use lies in the allocation of land to the various crops. Correspondingly total feed demand is linked linearly to the number of animals; prices only determine the composition of feed. For food demand it was decided to leave some deviations from these properties which in fact should be removed in a later version. The elasticities used are close to elasticities taken for the APAS model, implemented in the context of the same project.\(^7\) The APAS as a partial equilibrium model has a similar structure as AGTRACES. Not to use different elasticities is of course quite obvious. In the context

\(^7\) cf. Stwors, C. et al. (1999) The author is very grate for comments and explanations concerning the work with APAS.
of the ACE-Phare project it was thereby also made possible to compare the two model results, for which the reasons could be confined to fewer differences of the models.

2 The model at work

2.1 General features of scenarios

The scenarios for the modelling exercise presented here were developed very much along the lines of other scenarios that were run in other models being applied for Slovenia and Bulgaria in the same ACE-Phare project. Due to different commodity coverage and aggregation some additional assumptions had to be made. In trying to replicate some of the results systematic differences between the models could be detected and discussed.

The scenarios calculated show differences in the impact of policy instruments on the i) the development of production, ii) on various uses (food, feed, industrial uses etc.), iii) on the net trade development, iv) farmers income, v) budgetary cost and other relevant indicators. These impacts are considered in a changing agricultural environment in that productivity changes and some autonomous trends are assumed. The scenarios are calculated for the years 1997 (as base year) up to 2006.

Base scenarios cover the development as it can be expected for the years until 2006 in case there are no changes in agricultural policy. Changes with respect to the base year 1997 are only due to expected technological changes (yield and feed efficiency increases), GDP per capita changes (as a proxy for changes of household income) and a few autonomous trends (the latter only for Slovenia). World market prices were considered to be constant after 1998 so that the model results should not be considered as forecasts; the main interest lies in the comparison of the policy-scenarios.

As policy scenarios options are covered as they are prominently discussed in the context of EU-accession and/or the milleniums round of the WTO. Namely, these are i) price liberalisation scenarios, ii) scenarios considering the EU accession, i.e. of the implementation of the CAP, and iii) scenarios assuming a stronger integration into the CEFTA and thereby exposition to market pressure and/or opportunities from other CEFTA-countries. Productivity changes, the development of per head GDP etc. are exogenous to the model and the same as for the base run.

2.2 A closer look on Bulgaria

On the general situation in Bulgaria

During the first years of transition the Bulgarian agricultural sector had to face several severe changes with respect to it’s political and economic environment. Having been a strong exporter mainly into countries of the former USSR it had to suffer severely following the economic crisis in these countries. Only gradually trade could be re-oriented to western countries. Another disrupting effect arose from the radical restitution of huge agricultural complexes to the former owner of land and animals. A survey from 1993 showed the average size of more than 1.75 Mio. private farms to amount to just 1.47 ha. In 1997 private farms were cultivating about 80% of total cultivated land. Particularly the stocks of animals decreased severely since the beginning 90s. This development has not yet come to a halt, although some signs of recovery become evident along with the overall stabilisation of the economy. Restitution of land is now planned to be finalised by the end of 1999. Foreign trade policy is supposed to be brought into line with WTO standards, e.g. in that discriminatory license regimes, export bans were lifted etc. (cf. Bulgarian Ministry, 1998,9f).
Special features of the Bulgarian scenarios

The current price situation in Bulgaria is characterised by a lack of price transmission between domestic and international markets. For most commodities this leads to prices that are considerably below international prices. In part the differences might also be attributed to product quality. But primarily it is the lack of price transmission due a weak institutional development of markets and the lack of infrastructure that are responsible for low prices. In a base run scenario price transmission coefficients (domestic prices/border prices) have not been changed. The only changes that take place are induced by yield increases and the increase of feed efficiency.

As follows from the explanations on the importance of price transmission for the Bulgarian agricultural sector, a policy scenario in which the price gap between domestic and world market prices is narrowed cannot exactly be called a ‘price liberalisation’ scenario as it is usually being done in the case of Slovenia or the EU where this term indeed refers to a removal of price support policies. Still, this kind of scenario – the first policy scenario carried out here – reflects the development to a more market based, price driven economy. It also reflects a growing integration into international markets.

A second policy scenario quantifies the effects of a gradual price adjustment to prices of the EU as they are expected to prevail in the year 2004. This should not express the expectation that Bulgaria would enter the EU by that year; the question in point is only what a price adjustment to EU levels until then would bring about.

Some results of the scenarios

The increase of yields has been assumed to be rather limited for the time following 1997; increases of production in the base run are therefore limited to only 7% on average. As expected, the increase of price transmission has a stimulating effect on the agricultural production when producer prices were below border prices and vice versa. According to the modelling results the change is not very strong. Only for grain maize the cumulated effect of yield increase and increased price transmission is a little bit more than 20%, all the other production changes are well below 20%.

For Bulgaria an increase in feed efficiency has been assumed for all scenarios. Although the levels of animal production do not decrease, compound feed use is reduced to a level of 93% by the year 2004. In the scenario for increasing price transmission, where the levels of animal production increase in general, the feed requirements increase when at the same time the composition of compound feed is changing. Notably when looking at cereals it can easily be seen how maize (of which the price is increasing) is substituted by wheat and other grains (of which the prices are decreasing). Due to the stronger increase of animal production in the EU-price scenario feed demand is even higher and according to differing price ratios again a different composition is calculated.

Following an increase of per head income total food demand is increasing as well. Income elasticities are assumed to be different, largely following the pattern known from the Engel-curves, resulting in a higher increase of commodities that are consumed when basic needs are already met and a lower increase of commodities such as potatoes and bread. In the scenario using border prices as domestic prices these income induced changes are again changed due to price induced changes. As can be seen from the output table the EU-scenario follows largely the pattern of the liberalisation scenario, notably with the exception of pork, milk and beef, where EU-price distortion results in own and cross price effects. Further demand depressing effects can be detected for rice, sugar, fruit and wine.

Income effects of price changes are principally covered by the selection of elasticities. See the respective chapter on price elasticities.
For the base run the changes in the net trade position are mixed. An increase in the net trade position is induced by a yield increase, whereby those commodities with no or a little yield increase are losing market shares. In the liberalisation scenario and in the EU scenario changes in self-sufficiency are mixed and fairly moderate, except for milk and beef, where EU prices bring about increases of self-sufficiency from about 100% to about 150%. Since after accession most prices would be above the international border prices of Bulgaria it is obvious that production will be stimulated beyond what is experienced under a mere improvement of price transmission. Still, the outcome of the model does not show a dramatic increase of production by the years 2004.

2.3 A closer look on Slovenia

General situation in Slovenia

Except for a few commodities average productivity in the Slovenian agriculture is rather low compared to EU-standards. The agricultural policy up to independence of Slovenia in 1991 actually hindered productivity development in the agricultural sector in that small scale farmers who make up a large share of Slovenian agriculture were not allowed to develop by growing and making use of economies of scale. Today, Slovenian agricultural policy is characterised by a fairly high price support for some of the main commodities. This is expected to change since Slovenia committed itself to open agricultural markets gradually to other CEFTA members when it became member of CEFTA itself. Particularly neighbouring Hungary is able to exert considerable pressure on Slovenian markets, leading to import prices being in some cases well below EU border prices. Gross margins e.g. for grain maize turned negative in 1997. Except for hops Slovenia is a net importer of all major agricultural commodities; self-sufficiency e.g. for wheat reaches a degree of just 47% in 1997. The food industry is developing fairly well and can be competitive in most cases.

Except for demands put forward in favour of price support the policy discussion in Slovenia is shifting increasingly to the possibilities of maintaining agriculture namely in less favoured areas by direct payment schemes. Mountainous areas make large share of agricultural area in Slovenia. Countryside stewardship is thereby considered not only as important in that it maintains a valuable asset for alpine tourism; the historically developed landscape is also considered as a cultural heritage for which the Slovenian population is likely to accept a certain financial burden.

Still, traditional market organisations will most likely continue to play a certain role in the future of Slovenian agricultural policy. This is backed by recent decisions of the EU Summit to maintain a quota system e.g. for milk at least up the year 2006 (even if a review might be planned for 2003). To ensure a high level of the quota is therefore of considerable interest from a Slovenian agricultural perspective. It should also be born in mind that the position of Slovenia as net importer of agricultural commodities applying protectionist policies always provided for a contribution to the state budget. Therefore, the issue of compensation payments following the removal of protectionist price policies does not only arise from the perspective of farmers facing lower incomes but also from the perspective of the state itself facing lower tariff income.

Special features of the scenarios in Slovenia

The base run scenario has been developed carefully including the introduction of some autonomous trends that could not be captured by the economics of the model itself. As explained above the general structure of the model focuses on price effects on commodity markets. Thereby, the impact of structural developments might not be depicted adequately. This deficiency can be overcome by introducing the respective changes by autonomous trends based on ‘expert judgements’. Of course, also these expert judgements have their economic rational. To include this rational into the model
itself would go beyond the scope of the current model. A further refinement of the model in that respect would certainly be of advantage; on the other hand, this is currently not only out of reach due to resource constraints but it would also have to lead to an increase of complexity of the model that would destroy the simplicity of the model and its virtues in the easy handling of it. So, the introduction of autonomous trends seems to be the appropriate compromise.

As a first policy scenario a price liberalisation scenario has been developed. Markets are opened gradually in this scenario whereby EU border prices are taken as reference prices and price transmission to the domestic market is 100% i.e. domestic prices are equal to EU border prices. A second scenario captures the expected effects of a further integration into CEFTA which – as explained above – leads to domestic prices even below EU border prices for some of the commodities. In a third scenario, EU-prices as expected for the year 2004 are introduced. At the same time direct payments are introduced to compensate for price decreases as they occur when acceding the EU. The compensation payments are also assumed to have a certain stimulating effect on production; technically this is captured by applying an incentive price that includes the nominal market price plus half of the per unit compensation payment.\(^9\)

Some results of the scenarios

In the base run the general trend in production shows an increase mainly due to productivity increases, namely for those commodities where Slovenia might catch up to EU-standards; since this is not to be expected for maize the increase is limited here. With the EU-scenario some price decreases are introduced but the changes are mainly due to changing price ratios. As expected price liberalisation leads on average to a decrease of production even though the change of price ratios also leads to increases for some commodities. The CEFTA scenario (the CE-scenario in the appendix) shows in some cases even stronger decreases of production, since Hungary is able to compete on levels below world market prices.

Changes in food demand are determined by absolutely changing prices and namely by price ratio changes. Whereas in the base run food demand is stable or shrinking somewhat due to small price increases induced by exchange rate changes the overall food demand is increasing in all other scenarios. Following the changes of price ratios the composition of feed demand is changing in the liberalisation scenario but still, overall demand is decreasing due to decreasing animal numbers. Since the competitive pressure from Hungary in the CEFTA scenario is not assumed to be as strong in the livestock sector as in the cereals sector and not as strong as in the world market oriented price liberalisation scenario, feed demand is higher in the CEFTA scenario than in the liberalisation scenario.

In the base run the net trade situation is not expected to change decisively. And again, as expected, there is a tendency to deteriorate in all other the scenarios, whereby the CEFTA-integration scenario affects the sector most.

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\(^9\) With respect to price elasticities and to the kind of functional forms AGTRACES is quite similar to the APAS model. Commodity coverage and aggregation are only slightly different. As far as possible the same data were used. Whereas the productivity development has an endogenous component in APAS it is completely exogenous in AGTRACES. So, the model differences are only of minor importance and the modelling results should be more or less the same. And indeed, the models provided fairly similar results if not almost identical results. This is namely true for the supply side. On the demand side some differences became obvious which find there explanations in the distinct treatment of food, feed, etc. in AGTRACES. Still, the differences in the overall outcome do not question the reliability of the respective models.
3 Conclusion and perspectives

Conclusions concerning modelling

One of the aims mentioned at the beginning of this paper could clearly be achieved: The aim of developing a tool that allows to analyse and quantify complex aspects of agricultural sector developments whereby this tool should also be fairly easy to handle. Making use of all the features of modern spread sheet technology such as menu driven scenarios etc. it is possible to use AGTRACES not only by modelling experts. The possibility to run different scenarios allows to decompose overall developments into it’s components: Namely the impact of technology changes on the one hand, and the impact and efficiency of policy instruments on the other hand can be made explicit respectively. This should help to rationalise agricultural policy discussions.

Another aim of the efforts that have been undertaken lies in the improvement of data availability and reliability. Modelling (in it’s narrow sense of modelling policy scenarios as it is being done by most partial or general equilibrium modellers) and the development of statistical data are considered to be promoted best in an integrated process. For this reason a data set has been chosen as ground work for AGTRACES that is rather demanding with respect to detail and consistency. The experience of the work on Slovenia and Bulgaria proves this approach to be right. In a number of cases questions could be raised during the modelling work that did or will later lead to revisions of statistics.

With respect to theoretical rigour and empirical validation the models developed here have a number of deficiencies that should not be denied. Namely, i) the simplicity of the functional forms leading to problematic results particularly in the case of heavy changes as we are faced with in the transition economies, ii) the choice of elasticities not only based on empirical research but to a certain extent also on ‘expert judgement’ neglecting in some cases the theoretical requirements that elasticity matrices should comply with, and iii) the fact that prices and technological developments were not endogenised in the model are issues that ask for further improvement.

Policy conclusions

Even if in some cases the calculated results might rather raise further questions instead of providing conclusive answers - and by no means this would have to be considered as a failure of the modelling exercise conducted here - there are some policy conclusions that can be drawn from these preliminary results.

For Slovenia it became obvious that the agricultural sector (namely cereals, beef & veal, and cow milk) will be more affected by the ongoing CEFTA-integration than it would later be affected by an EU-integration. So, there is a danger that downward adjustments will take place to an extent that will later have to be reversed again with the EU-accession. So, it could be suggested to find agreements with Hungary that would organise the integration in such a way that adjustments will take place up (or down) to levels that can be expected for the time after the EU-accession for both, Hungary and Slovenia. Adjustment costs could be minimised that way. Another point of concern is the question of compensation payments. Since prices are in some cases higher in Slovenia than in the EU, accession would lead to income losses for many farmers. The usual argument of the EU Commission denying the eligibility of farmers of candidate countries for compensation payments because of price increases coming along with EU-accession does therefore not apply for the Slovenian case. Similarly, being a net importer of agricultural produce in general, Slovenia will lose tariff revenues, once it joins the EU. So here the situation is different as well from the situation in other candidate countries. It can expected that this will play a role during the negotiations.

For Bulgaria, the expected changes occurring with an EU-accession are rather limited. So, the Bulgarian agricultural sector will hardly be able to export large quantities of agricultural produce to
the EU15 countries, let alone put serious pressure on EU15 markets. This is true, even though Bulgaria used to be a net-exporter in the trade with the neighbouring countries of the former CMEA. But, the transformation of agriculture is still on its way, farm structures and market institutions have not been developed sufficiently to really make use of the resources that principally could be used in Bulgaria. Since the internal difficulties to overcome all these problems are huge, EU accession would rather help to stabilise the overall situation within Bulgaria than have any major impact on trade performance.

The conclusions drawn here are of course not supposed to be understood as a last word on the issue. Rather the opposite is true; this modelling exercise should be understood as a work in progress. Some questions might have been answered appropriately. But, what would be more important would be if it became possible to raise new questions more accurately than it was possible before.

**Literature**


OECD (1999), CAP Reform – Agenda 2000 Agreement, COM/AGR/CA/TD/TC(99)37, Paris

**Figure 1: Activity based Economic Accounts of Agriculture**

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**activity based EEA**

**sector EAA**

where:
- **\( x \):** Productionen
- **\( y \):** variable input
- **\( i \):** Index, Aktivities \((i = 1 \ldots I)\)
- **\( j \):** Index, Products \((i = 1 \ldots J)\)
- **\( h \):** Index, inputs \((h = 1 \ldots H)\)

**Source:** Own figure
Figure 2: Intra- und extra-sectoral relations

Source: own figure, Böse, Kruse (97:29)