CAPRI versus AGLINK-COSIMO
Two partial equilibrium models – Two baseline approaches

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Abstract— **The agricultural modelling world has generated several models aiming at the analysis of the response of the sector to certain changes in exogenous mainly policy variables. Among those, the CAPRI modelling system developed by a consortium centred on the University of Bonn and the AGLINK-COSIMO model, a joint product of the OECD and the FAO, are well known and accepted as comprehensive tools. This analysis focuses on a qualitative comparison of both models and particularly on the process of setting up the baseline. The baseline is a medium-term projection of agricultural markets reflecting current policies and those already decided upon. This projection in turn serves as the base for comparisons when analyzing scenarios. It is shown that CAPRI uses generic and automatic procedures whenever possible for conducting the database and the baseline, while AGLINK-COSIMO puts more emphasis on expert knowledge in this process. Both approaches are shown to have certain advantages while the conclusion that a combination of them would potentially improve both models will be drawn from this analysis.**

Keywords— **CAPRI, AGLINK-COSIMO, Baseline process**

I. INTRODUCTION

CAPRI (Common Agricultural Policy Regionalized Impact analysis) has been developed within an EU founded project (FAIR3-CT96-1849: CAPRI project 1997-1999) coordinated by the University of Bonn. It has been designed for the purpose of impact analysis of agricultural policies with a great focus on the EU CAP. Since the first version was applicable in 1999, the model has been further developed within two major projects. In the recent years, it has been applied to a number of policy questions, e.g. WTO scenarios [1], the CAP reform 2003 [2] or the reform of the CMO sugar [3]. Furthermore, it was applied in two projects dealing with trade liberalization options between the EU and the Mediterranean countries and the EU and the Mercosur countries respectively. From the latter emerged a conference paper presented on the 107th EAAE Seminar in Seville [4]. Over the years CAPRI has achieved a wide range of acceptance in the Agricultural modelling community.

The AGLINK part of the AGLINK-COSIMO model has been developed by the OECD Secretariat in close co-operation with OECD member countries and certain Non-Member Economies covering the developed countries in the world. The AGLINK project started with a pilot application of the model in conjunction with the OECD Agricultural Outlook cycle from 1992. Since then, AGLINK has played an important role in the yearly medium-term outlook activity of the OECD through the provision of a consistent analytical framework. Its ability to perform alternative scenarios has made it one of the key tools for the disposition of the OECD Secretariat and collaborating countries for forward-looking policy analysis.

In 2004 it was decided to extend the AGLINK model to a larger number of developing countries and regions, and to jointly undertake the annual medium-term outlook exercise in cooperation with the Food and Agriculture Organization of the United Nations (FAO). The project centred on this extension as well as the model component was called COSIMO (COmmodity SImulation MOdel). The general programming structure of COSIMO was taken over from AGLINK while the behavioural parameters for the new country modules were taken from its predecessor at FAO, the World Food Model. AGLINK-COSIMO is by nature scarcely represented in scientific literature but finds a number of applications within governments especially in the EU and Canada.

Both, CAPRI and AGLINK-COSIMO show a number of conceptual differences. CAPRI is very detailed for agriculture in Europe, where supply is modelled with aggregate programming models at

NUTS 2 level, working with exogenous prices defined at Member State level. This regional differentiation is commonly seen as the strength of CAPRI because there are not many models competing on that level. To get rid of exogenous prices in the model, the European supply part is coupled with a global spatial market module (a Multi Commodity Model based on the Armington Approach [5]). The module represents flexible and regular systems of supply, human consumption, feed, and processing functions, thus allowing for the calculation of welfare changes for producers, consumers, the processing industry, and the public sector. 28 trading blocks are considered, partly further disaggregated to single countries, and 46 commodities are reflected. The behavioural functions' parameters are taken from literature, but are calibrated in a way that homogeneity, curvature, symmetry, and adding-up restrictions are fulfilled globally [6]. Currently this market module is build of 37000 single equations.

AGLINK-COSIMO can be compared with the market module of CAPRI but it relies on a Net-Trade approach and therefore is not able to represent bilateral trade flows. The main commodity markets modelled in AGLINK-COSIMO do have complete representations of supply, demand, trade and prices. Demand is further broken down into feed, food, other use and for some countries also biofuel demand. Most of the model equations are written in double log form with elasticities steering the model response. The model currently covers about 60 regions, 40 commodities and uses about 15000 equations. In contrast to CAPRI it is of a recursive dynamic structure that allows for showing the adjustment path from the base to the final simulation year.

Both models recently included a representation of the new developments in the biofuel sector, in CAPRI as exogenous demand for agricultural products from the biofuel industry and in AGLINK-COSIMO even with a representation of the biofuel market with endogenous price equilibriums. Furthermore, both models try to capture the relevant agricultural policies in place in the represented regions.

For detailed model descriptions documentations are available in [6] for CAPRI and in [7] for AGLINK-COSIMO. In this analysis the focus is not on the differences between the models as such but rather on the process of projecting the model baselines.

II. THE BASELINE APPROACH IN CAPRI

Since the CAPRI database is conducted with the help of several other databases, which become generally available with a certain delay, the base year, (a three year average) in CAPRI is usually found to be 3 or 4 years in the past from today. The baseline is projected from this date 11 years into the future. Setting up the baseline includes several steps. There is a distinction in the process between regions represented in the supply module and those in the global market model. The methodology for the first group is much more sophisticated than the one for the latter. Restricted trends are undertaken for all EU27 regions using the information from the time series available (trends), supply and demand shifts of those policies which change from the base year to the baseline, the DG-AGRI Baseline (of the ESIM model) and restrictions to make sure that markets are closed. Results are calibrated exactly to the DG AGRI baseline (on Member State level), as the EU commission is a major client of CAPRI.

The projection results at EU27 level are taken as given when calibrating the global trade model. The calibration step on the one hand defines bilateral import and export flows from these countries to other trade blocks, as well as development in production, feed use, processing and human consumption for the different regions of the world not covered by the EU projection tool. These developments are currently almost exclusively based on projections by the FAO and FAPRI. The process is based on a highest posterior density estimator [8] which tries to minimise the deviations of all variables in the market module from support values while satisfying all equations of the module.

In theory, the whole process is, having all input data available, more or less a push button exercise. In practice each data update is connected to some debugging of errors, but it still has the advantage of being a relatively fast procedure that ensures that the resulting baseline numbers are consistent with the model equations. A critical point is that the received results require a critical check by experts of the different markets and countries in order to make sure that the numbers are reliable. This plausibility check is currently not done systematically which is clearly a weak point here.

III. THE AGLIMK-COSIMO BASELINE

In undertaking projection work with the joint AGLINK-COSIMO model, the individual country modules modelled in AGLINK are calibrated on baseline projections received from participating countries through a system of annual questionnaires. The questionnaires replies are then taken over to the database which is separated by country and realised in excel by country experts in the OECD secretariat. The database is much more up to date using the latest updates from the actual market season which serves as base year. That means the Outlook 2008 uses 2007 as base year. The COSIMO module does not use questionnaires to obtain single country projections. Those are received by applying the last year's model using updated macro data, policies and prices. After each single country database is finished, single country models are calibrated such that the database is reproduced. After that, the AGLINK and the COSIMO country modules are merged during the baseline process and the entire model is solved simultaneously to generate a common baseline. In this process, all the different country modules are linked to find equilibrium. This baseline is first reviewed by staff at both the OECD and the FAO, and subsequently by country experts in the OECD's Commodity Working Groups, before becoming a key component of the annual Agricultural Outlook activity.

This process uses a lot of expert knowledge and does not rely on automatic procedures as much as CAPRI. Various people review the final numbers to guarantee a certain degree of reliability of results. This comes with costs of human resources and a huge amount of time since the whole process lasts about 4 month.

IV. DIFFERENCES AND SIMILARITIES

From the description of the two baseline processes it becomes apparent that there are differences and similarities. One of the key differences, which has not yet been pointed out is that in the CAPRI baseline data is fitted to the model equations, while AGLINK-COSIMO fits the model as much as possible to projection data. In CAPRI initial projection data that stems from various sources is only used as prior information, since it does not fulfil model equations. The AGLINK-COSIMO baseline takes the national databases as given and calibrates all behavioural functions to it using an error term in almost all equations. When the country models are merged and world prices become endogenous, deviations from the projection data are on the one hand intended but greater differences are removed by re-calibrating certain parameters. This gives more emphasis to the data received by the OECD countries while CAPRI puts a greater emphasis on model equations and micro theory.

Figure 1 gives an overview on the two baseline processes which supports the conclusions that are drawn in the next section.

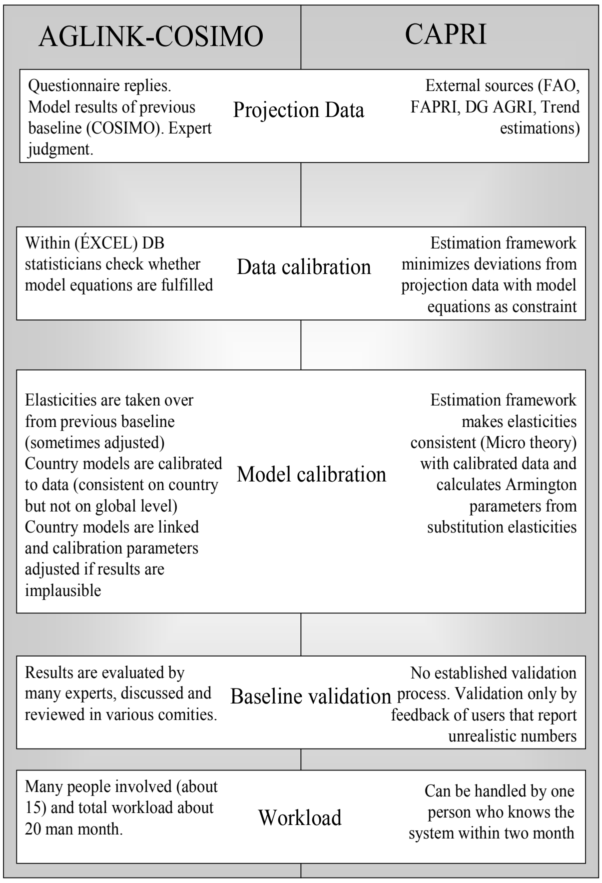

Fig. 1 Two baseline processes - Overview

V. CONCLUSIONS

Obviously the strength of the baseline process of the one model is the weak point of the other one. Where CAPRI uses a lot of automatic procedures that allow a few people running the system with a minimal workload, the OECD baseline is the result of a greater network and manpower putting their expert knowledge into it. This is to some extend a natural result since the OECD-FAO network centred on the AGLINK-COSIMO model is bigger and shows a stronger interest in supporting the system as it is the case for the CAPRI network. Nonetheless, there is potential for both Networks to learn from the respective baseline process. Some of the calibration procedures in CAPRI would help speeding up things in AGLINK-COSIMO, while the review process of projected numbers in AGLINK-COSIMO shows elements that could be adopted by CAPRI. For example, the Capri Network would benefit from a yearly meeting to discuss the latest projections and the inclusion of highest posterior density estimators using the questionnaire results as prior information and model equations as side restrictions could speed up the AGKLINK-COSIMO baseline process.

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