Linking large numbers of individual national models: The case of the AGMEMOD partnership

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***Abstract*— The AGMEMOD Partnership seeks to capture the inherent heterogeneity of the agricultural systems existing by combining individual country models of 27 EU Member States and several accession countries into one single model while still maintaining analytical consistency. Although this approach facilitates the comparison of the impact of a policy across different Member States, it generates challenges in practical implementation, ranging from high communication and administration requirements to aggregation and consistency issues. This contribution provides insights into the different challenges posed to the scientists and discusses the key issues for maintenance and further development of such a complex system. Specific attention is paid to technical devices and tools as well as to the design of institutional settings for avoiding inconsistencies.**

***Keywords*— Linking Models, Policy Analysis, Partial Equilibrium Modelling, Common Agricultural Policy (CAP)**

WHAT IS AGMEMOD?

The starting point of the AGMEMOD[1] model was the understanding that a partial equilibrium (PE) model was required that captures the heterogeneity of the European agriculture across Member States (MS) while enabling at the same time projections and simulations of the common agricultural policy (CAP) as well as of national agricultural policies in a consist and harmonised way for the whole EU. The main objective was to develop an econometric model of the EU agricultural sector by combining individual country models for MS and possible accession countries built on a template so that it, and its commodity sub-models, would link-up to provide an integrated model for the whole EU. In the process multidisciplinary teams in each of the countries were involved in the building and verification of their own country models established on agreed rules for data, model design and underlying assumptions. Based on this concept, projections for each commodity, in each year out to a ten year horizon, for each country, and for the EU are produced which, in turn, also serve as a counterfactual baseline for the impact analyses of policy changes. AGMEMOD has been used in baseline projections and impact analysis (AGMEMOD Partnership (2008a)[1], AGMEMOD Partnership (2008b)[2], AGMEMOD Partnership (2008c)[3], AGMEMOD Partnership (2008d)[4], Bartova and M'barek (2008)[5]).

The original AGMEMOD Project (Project No. QLRT-2001-02853) involved institutes in the EU15 group of MS. In advance of the EU enlargement in

[1] AGMEMOD stands for "Agri-food projections for the EU member states". AGMEMOD was resp. is funded under the European Commission 5th and 6th Framework Programme, by contributions from the partners' institutes throughout the EU and through associated projects for the Institute for Prospective and Technological Studies (IPTS), part of the European Commission's Joint Research Centre.

May 2004, the AG-MEMOD partnership was expanded in 2002 to include research institutes from 8 of the 10 new EU MS and 2 institutes from, what were then the Accession States, who later became EU members in 2007. Currently, the Partnership is or is going to be extended to cover additionally Russia, Ukraine, Croatia, Macedonia, and Turkey.

PRINCIPEL MODELLING APPROACH

The AGMEMOD model is an econometric, dynamic, multi-product PE model wherein a bottom-up approach is used. Country specific models were developed to reflect the detail of agriculture at MS level and at the same time allow for their combination in an EU model. Such an approach should capture the inherent heterogeneity of the agricultural systems existing across the EU, while the analytical consistency across the country models will be obtained via a close adherence to templates. The various domestic commodity markets are linked by substitution or complementary in supply and demand (see Figure 1). The supply and utilisation balance is ensured via a closure variable. These sub-models also cover a detailed set of agricultural policy instruments in each MS.

To complete the building of the AGMEMOD sub-models, it is necessary to add an equation that describes the equilibrium for each commodity market at both the MS and EU levels. This condition implies that production plus beginning stocks plus imports will be equal to domestic use plus ending stocks plus exports. Given that the EU does not represent a closed economy, the Rest of the World can have important impacts. To account for such impacts, price linkage equations are used, to represent the inter-relationship between MS, and between the EU and the Rest of the World.

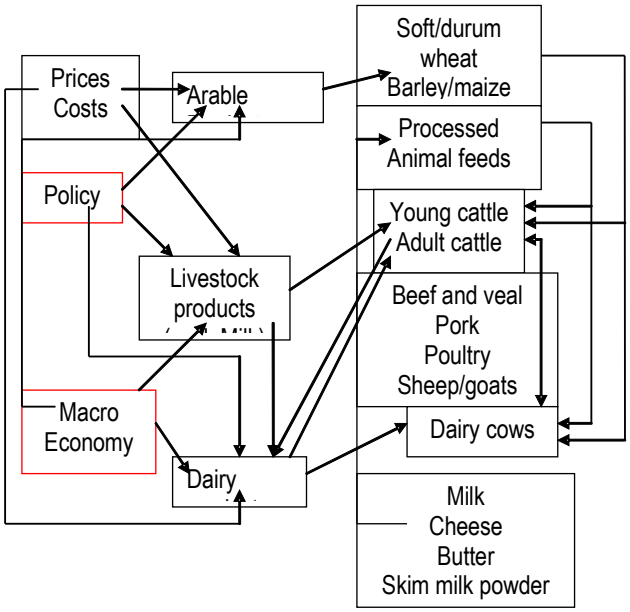

Figure 1: Linkages between commodity markets in the AGMEMOD model

For each commodity market and for each country, the functional representation that is actually used can vary. In principle, such deviations from the template can be made by all country research teams and should capture distinct market features at MS level. Where data limitations exist, the final functional forms are adjusted in response to the statistical and economic validation of the models. It should be noted that all the country models are under continuous revision. For country details see e.g. Chantreuil et al. (2005)[6], Esposti and Bianco (2005)[9], Leeuwen and Tabeau (2005)[10].

INSTITUTIONAL ISSUES

The AGMEMOD Partnership has demonstrated that it is possible to establish a country based agricultural market modelling system by linked individual country models. Getting the system up and running requires considerable time and other resources, but several organisational and technical features have helped to achieve the required progress, although these 'tools' were more often than not developed through a trial-and-error process.

Large scale, General Assembly, meetings of such a large research group is necessary to discuss model

features and to implement them in the country models, to reflect the agricultural situation in the different MS, to detect problems and errors in the general layout and to review and to evaluate the outcomes. But with the growing size of the research group problem solving and the steering of model development becomes more and more difficult, thus the importance of a Core Group, to streamline the project decision making process, increased. The Advisory Board is an additional important factor as is often helps to point out existing caveats, to overcome differences of opinion in how to deal with different issues and to set future priorities.

Invariably, communication in such a big group proves to be a stumbling block, and the establishment of a website to exchange information is a necessity. All the project's administrative information must be made available on line, along with continuing updates of modelling outputs. In the case of AGMEMOD these comprise the latest country model versions and data, but also the combined model version, related assumption files and data files. However, actual communication is handled by regular Newsletters. .

TECHNICAL ISSUES

To make the Partnership a successful endeavour required also the development and the implementation of a specific AGMEMOD technological environment. In the case of AGMEMOD this included the use of GAMS as a modelling language, which enabled the usage and establishment of further tools. To ease the modelling challenge for research partners that are less familiar with some modelling and programming issues, an implementation tool for models equations in EXCEL was developed, which additionally carries out intensive checks on violations of the required model structure and data problems (Dol (2008)[8].

Data-input and output can be handled in EXCEL-files and the generated data further used as gdx files. Excel allows outsiders some easy insights into AGMEMOD, while the gdx capability enables the use of additional tools, such as the creation of standard graphic output.

This two step approach provides easy extension possibilities for new regions and products. The easiest ways to introduce a new region is to begin with a template of the model for a country whose agriculture is quite similar. When this is running in the system respective combined environment the specification of the equations can be adjusted and the parameters can be estimated with the fitted data. A similar approach is useful with a new commodity. A template is set-up, estimated and implemented by a national team so that is can be replicated and re-estimated by other members of the Partnership.

However the implementation of a revised country version in the combined model must follow a strict procedure, in which the country team specifies its amendments. So the individual responsible for model combination can check the outcome and can verify problems related to the new version. Only if the evaluation results are judged to be satisfactory, will the new combined model be made available on the website for use by the wider partnership.

MODELLING ISSUES

From the modelling perspective linking the stand-alone country models via price transmission equations is an important issue as it is allows from price differentiation in level and changes across MS. Thus issues such as country differences in production and consumption relativities, differences in the rate of price convergence across EU12 MS, regionally variations in consumer preference and differences in transaction costs, can be addressed.

In this approach for each commodity one of the MS has to be established as a so-called key market and is seen to influence all other markets of the EU MS which are linked to the key price country's market. In the approach the choice of the key price country is a critical one as it often determines the price formation of the whole combined model. But distinctions in qualities and fundamental differences in the structure of production, e.g. specialist beef production systems compared with beef production as a by product of dairying, cannot be fully addressed in this way. In such cases further developments such as the inclusion of two key separate prices may provide a solution.

Also there is still the ongoing challenge of endogenising the exogenous world market price. To achieve that objective, experiments to estimate the world market price, specified as a function of such

drivers as EU net-exports, demand shifters such as the world GDP and population as well as by policy variables such as export refunds, have been conducted. However, the results have been mixed with greater success for some commodities than with others. Hence, the introduction of a full country model for the rest of the world (ROW) is required.

A big issue for the AGMEMOD Partnership is and will be the ongoing collection and updating of model data and the related re-estimation of equations. In principle data referring to the commodity production and the supply and demand balances as well as the exogenous macroeconomic data and policy data are compiled from 1970 onwards, but actual time series length vary a lot. Even more, data series are prone to errors, gaps and outliers. All these caveats are not only shown in the data for specific countries but especially in the aggregated data for the EU or subgroups with net-trade figures for the EU capturing all data problems. To ease the problem, checks are required, both by the national teams and by applying tools which compare model data with a different source. The situation with be improved by the inclusion of the AGMEMOD database into the wider METABASE data archive, which will allow for a comparison against different data sources.

Beyond the solving of the issues mentioned above, big challenges lie ahead for the AGMEMOD Partnership, including regularly extending the combined model by introducing new countries and new commodities, a process now eased by technical means. However, greater country and commodity coverage might increase the number of person involved in the AGMEMOD Partnership.

The survival of an extended Partnership requires that the necessary resources are found to finance the continued provision of market knowledge and country expertise for all the country models involved, and that this is seen as an integral part the Partnership. One possibility could be to follow a two-tier approach, with the wider Partnership developing the country models and examining some research questions, while smaller sub groups of partners deal with specific impact analyses. An alternative to the this approach would be one where the model and the data are managed and maintained by an outsourced organisation, while the further development and the extension of the country models are handled by researchers. The organisational template used by consortia such as GTAP could be adopted. However, it is clear that both approaches will require financial resources.

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REFERENCES

1. AGMEMOD Partnership with Bartova, L.; Robert M'barek, R. (eds.) (2008): Impact Analysis of CAP Reform on the Main Agricultural Commodities. Report I. AGMEMOD - Summary Report. Sevilla. http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1509.
2. AGMEMOD Partnership with Bartova, L.; Robert M'barek, R. (eds.) (2008): Impact Analysis of CAP Reform on the Main Agricultural Commodities. Report II. AGMEMOD - Member States Results. Sevilla. http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1505.
3. AGMEMOD Partnership with Bartova, L.; Robert M'barek, R. (eds.) (2008): Impact Analysis of CAP Reform on the Main Agricultural Commodities. Report III. AGMEMOD – Model Description. Sevilla. http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1577.
4. AGMEMOD Partnership (2008): Modelling and Analysis of the European Milk and Dairy market (AGMEMOD-Milk). Den Haag, in manuscript.
5. Bartova, L.; M'barek, R. (2008): Commodity Modelling in an Enlarged Europe. November 2006 Workshop Proceedings. AGMEMOD Report V. Sevilla. http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1566.
6. Chantreuil, F., Hanrahan, K., Levert, F. (2005): The Luxembourg Agreement Reform of the CAP: An analysis using the AG-MEMOD composite model. In: 89th EAAE Seminar: 'Modelling agricultural policies: state of the art and new challenges', 3-5 February 2005 - Parma.
7. Chantreuil, F., and Levert, F. (2007): AGMEMOD database documentation. AGMEMOD WP3 P1 D3 document. http://www.agmemod.org/fp6fl/deliverables/D3/AGMEMOD-WP3-P1-D3.pdf

8. Dol, W. with M'barek, R.; Bartova, L. (eds.) (2008): Impact Analysis of CAP Reform on the Main Agricultural Commodities. Report IV. AGMEMOD - GSE Interface Manual. Sevilla. http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1511.
9. Esposti, R., Lo Bianco, A. (2005) Analysing the Impact of the CAP Reform on the Italian Crop production with the AG-MEMOD Model: the Case of Durum Wheat. In: 89th EAAE Seminar: 'Modelling agricultural policies: state of the art and new challenges', 3-5 February 2005 - Parma.
10. Leeuwen, M. van, Tabeau, A. (2005): Consequences of 2003 CAP Reform for Dutch Agriculture. In: 89th EAAE Seminar: 'Modelling agricultural policies: state of the art and new challenges', 3-5 February 2005 - Parma.

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