Introduction to the Agricultural Information System of Eurostat

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Summary

Eurostat has been involved in agricultural sector modelling for more than 20 years. For most of this period, however, it was the University of Bonn who developed and maintained the resulting models, under contract to Eurostat. The model as a whole was called the SPEL/EU-system and consisted of three parts: a base model, a short-term forecast model and a medium-term forecast model. With most of the data in the base model coming directly from Eurostat, it was Eurostat's eventual aim that it should be able to maintain this base model itself. To this end, development of the agricultural information system (AgrIS) was started in 1999. The AgrIS continues to use the concepts of the SPEL-system. The decision was taken, however, to rewrite the whole system with new software. Eurostat has chosen to develop AgrIS with the Microsoft development tools (Excel in combination with Access). Excel is used as a calculation engine and a navigation tool. Users can continue to operate the existing Excel functions, but have additional pre-programmed AgrIS-tools. All the data are stored in Access.

1) General introduction

Eurostat's Directorate F (Agricultural, environmental and energy statistics) is responsible for gathering a lot of information on agriculture. This data is stored in several separate databases and provided to the users through NewCRONOS. The aim of the Agricultural Information System (AgrIS) is to bring together all this data into one harmonized framework. When all the data are gathered and stored, AgrIS will be able to serve as a tool for checking the consistency of the agricultural statistics in Eurostat. AgrIS will incorporate not only NewCRONOS data, but also data from other sources (FADN and FAO). The AgrIS will also allow the present situation in the agricultural sectors of the EU as a whole and the Member States to be monitored and evaluated. Lastly, the AgrIS will serve as a tool for ex-post analyses of sectoral developments, providing a solid basis on which to make short-term and medium-term forecasts.

2) Overview of agricultural sector modelling in Eurostat

The starting point for agricultural sector modelling in Eurostat was the request by the European Commission (DG AGRI) for up-to-date information on the current situation and short-term development of agricultural income in the European Union (EU) Member States and the EU as a whole (Henrichsmeyer et al., 1995). To meet this demand, Eurostat decided to develop an appropriate agricultural model. At first, it was decided to develop an integrated information and model system under the name SPEL, which is a German acronym for Sectoral Production and Income Model for Agriculture. The work started in 1980 and was carried out by a research group at Bonn University in close collaboration with Eurostat. The work on the database resulted in the Base System (SPEL/EU-BS). These data served as a basis for the development in 1984 of the Short-term

Forecast and Simulation System (SPEL/EU-SFSS), which was designed to forecast short-term developments (based on a trend extrapolation) and to simulate the short-term impacts of agricultural price and income policies. The implementation of the short-term model led to the request for a medium-term forecasting tool on the effects of agricultural policy decisions. A Medium-term Forecast and Simulation System (SPEL/EU-MFSS) was developed in 1986 and improved several times in subsequent years.

3) Concept of the AgrIS-database

A logical start for explaining the AgrIS is its database, the short-term and medium-term forecast models being dealt with later on in this paper. The concept used by the Agricultural Information System (AgrIS) is based on the approach used in the SPEL system. The two main characteristics of the SPEL approach are the activity-based approach and the accounting-based approach (Wolf, 1995). Both approaches are taken over in AgrIS and are described below in more detail.

a) The accounting-based approach.

The accounting framework is based on the principles of the System of National Accounts and of the Economic Accounts for Agriculture (EAA). Both accounting frameworks make a distinction between *supply activities* and *demand activities*. This allows the system to draw up balances in which total supply is equal to total use. The accounting-based approach guarantees consistency in respect of both physical and monetary flows and comparability on the basis of EAA definitions. As in the SPEL/EU system, the EAA are the backbone of the AgrIS.

b) The activity-based approach.

As with the SPEL/EU system, the activity-based approach is the most important feature of AgrIS. It allows characteristic agricultural features like yields, areas and numbers of animals to be taken into account and describes the interplay between the different production activities. In addition, the intra sectoral flows (gross flows) can also be included.

The AgrIS database brings together the agricultural data available in the different domains of NewCRONOS. For the moment there are three domains of interest for AgrIS:

- The COSA domain: containing information on the Economic Accounts for Agriculture (EAA), the unit values and agricultural labour input statistics,
- The ZPA1 domain: containing quantitative information on crops and animals,
- The PRAG domain: containing prices.

In constructing AgrIS around these NewCRONOS data, three major problems have been encountered.

Firstly, there is the problem of errors and missing data. The AgrIS database contains a built-in function to detect these errors and missing data. By using the best fit of different trend calculations, the AgrIS provides a set of estimates for the missing data. The AgrIS proposals for the missing data are provided to national experts, who can choose whether or not to accept them into their series. Where

they are not accepted, national experts are free to provide Eurostat with a complete new set of consistent and plausible data.

The second problem concerns the non-availability in Eurostat of data required for AgrIS. In this case, a solution can only be found through direct co-operation with national experts. They will have to provide Eurostat with some estimates based on either technical data or farm accountancy data (FADN).

Once the AgrIS database is complete with time series data for the various variables, there is then the third problem of inconsistency between the different data sources. Since the backbone of AgrIS is formed by the EAA, all data that are provided by the other domains (prices, quantities) have to be brought into line. In order to achieve this, bilateral contacts with the Member States will be necessary. The AgrIS can, however, be a very useful tool to start this discussion with Member States.

4) Constructing the AgrIS database

Eurostat has chosen to use both Microsoft-Access and Microsoft-Excel in the construction of the AgrIS database. These tools have been chosen because they are part of the standard configuration used by Eurostat, which means that there is no need to buy specific software. Additionally, Microsoft software is common throughout the world, meaning that global users of AgrIS will, in general, already be acquainted with the software, enabling them to concentrate on the data analyses. The Access program is used to retrieve and store the data from NewCRONOS and other databases. Excel is mainly used as a navigation mechanism. The stored data can be viewed in Excel and the time series completed, where necessary, with either the AgrIS trend proposals or by data directly entered by the experts. Tables and graphs can then be prepared in Excel for reports.

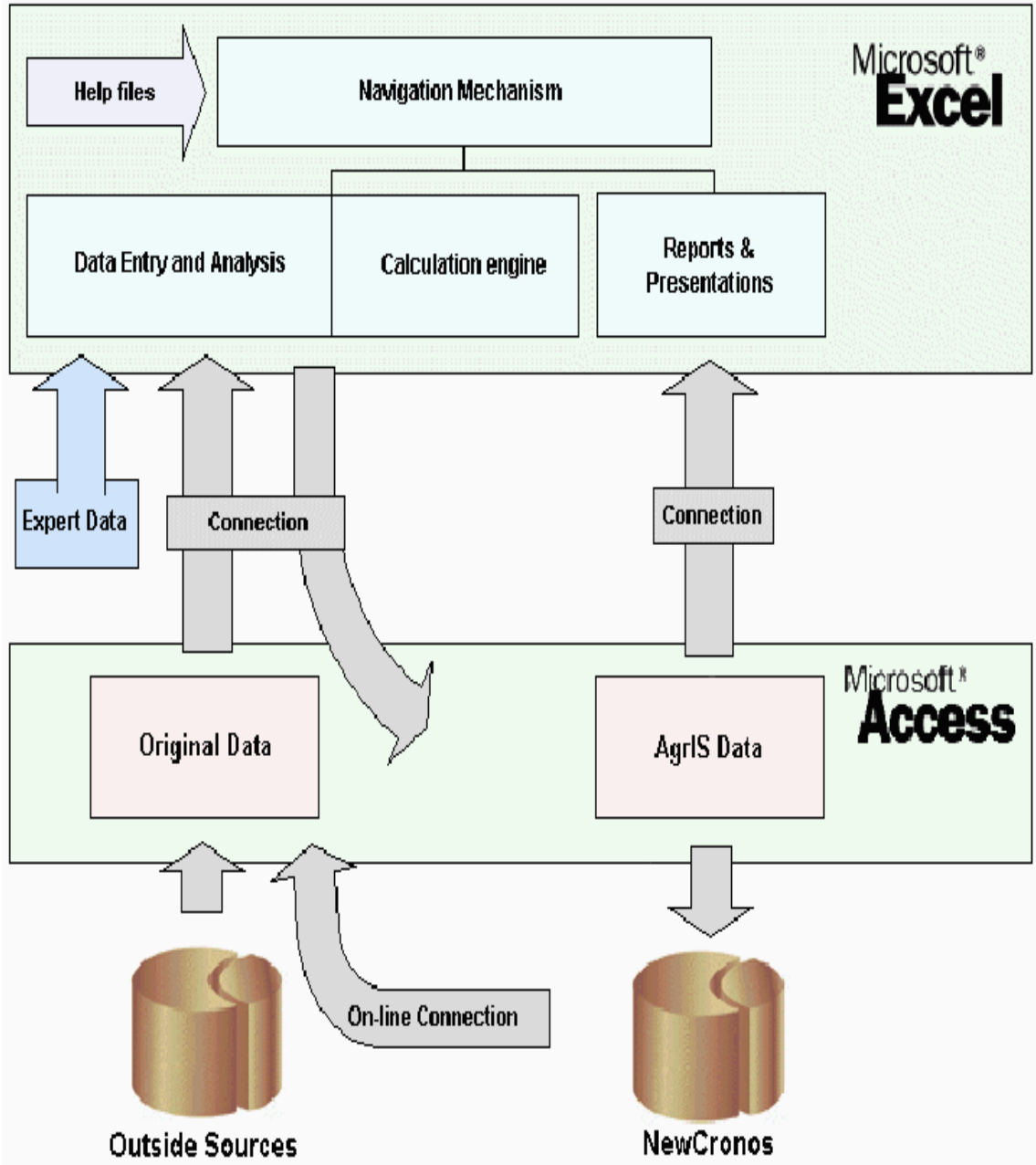
In changing from the former SPEL/EU-BS to the AgrIS database, Eurostat also wanted to make the data traceable, i.e. Eurostat wanted to keep a record of the status of the data. For this reason the data in AgrIS are labelled in the following three ways:

- The origin of the data: It is of interest to know if the data series are original (directly imported from NewCRONOS) or if the data series have been changed by a trend proposal of the system or by an expert.
- The identity of the expert: When experts have changed the data, the AgrIS wants to keep a track of the persons who have changed the data.
- The reference date: To let users know the date on which the data were last updated either by experts or in the latest extraction from NewCRONOS.

For these reasons Access storage in combination with the Excel navigation mechanism is a good solution.

The whole procedure is described in diagram 1 below. The data, which is originating from NewCRONOS and other data sources, is first loaded in Access. These original data can then be viewed and adjusted by experts in Excel. After this step the data are made consistent with each other. This is in a first step done with proposals from the system. These proposals must however be discussed with and approved by the experts in the Member States. When the data are accepted they will be stored in Access again. The data is then labelled with both the date of change and the origin (original, calculated or expert) and is ready to be sent to NewCRONOS. From this point the data is also available for users in the Member

States, who can either use the raw data or make use of some tools and predefined tables of Eurostat.



5) Description of the data in AgrIS

For one country and one year the AgrIS framework consists of a matrix with 108 columns and 147 rows. Not all the cells in the matrix are however filled. With twenty-six years of data (1973-1998) for the fifteen Member States and the European Union as a whole (EU15), there are currently a total of 416 matrixes in AgrIS. This number will increase significantly with the incorporation of data from Candidate Countries (sixteen?) that will result from the pilot project launched in January 2000. The AgrIS is prepared for this expansion.

In this paper details are provided on how the cells of these country matrixes are filled, to provide an idea on the amount of data coming directly from NewCRONOS and other databases and on how much data is calculated within the AgrIS framework. In so doing, it is possible to show how the data that is coming from different data-sources is brought together in AgrIS and how they are related to each other (see Annex 1).

a) NewCRONOS data

- *Matrix A*: The heart of the AgrIS is formed by the Economic Accounts for Agriculture (EAA). These data are produced by the Member States and gathered in the COSA domain of NewCRONOS. The EAA contain data on the value of output, intermediate consumption, value added, depreciation, taxes, subsidies, rent, interest, compensation of employees and agricultural income. These values are provided both in current and in constant prices. In AgrIS, matrix A consists of 2 columns and 84 rows.

- *Matrix B*: This matrix contains data on the physical output of crops and animals per unit (hectare and head). The most important source for gathering such data is the ZPA1 domain of NewCRONOS. Matrix B accounts for a large part of the AgrIS database, but only the diagonal is filled. This diagonal contains for each activity (49 in all in AgrIS) the production per hectare (crops) or per head (animals). Because one activity can produce more than one product (e.g. the activity soft wheat produces both wheat and straw), matrix B contains 49 columns and 58 rows.

- *Matrix C*: This matrix is in fact a vector consisting of one row representing the total level for each activity. Total areas are recorded for all the crop activities and the total number of heads for all the animal activities. The data for this vector come from the ZPA1 domain.

- *Matrix D*: This matrix corresponds to the so-called supply balance sheets of the domain ZPA1. These supply balance sheets give an overview of the total supply and the total use of agricultural products. The total supply is built up from agricultural output and imports. The total use on the farm and on the market consists of losses, changes in stocks, human consumption, animal feed, seed, industrial use, processing and exports. The whole matrix consists of 22 columns and 75 rows.

- *Matrix E*: This matrix consists of producer prices and the purchase prices taken from the PRAG domain. These prices are based on calendar year averages. The producer prices are used to value the quantities produced, corresponding to the EAA definition of production value. In the same way, purchase prices value the intermediate inputs used. When farm gate prices are missing, unit values can be used. These unit values can be found in the COSA domain of NewCRONOS and are provided by the Member States. The whole matrix consists of 2 columns and 90 rows.

b) Calculated data

- *Matrix F*: The physical input used by each of the 49 activities is calculated by dividing the input values supplied by the EAA with the prices from the PRAG domain. The distribution of the physical inputs over the activities will be done using data from the farm accountancy data network (FADN) and data from the database on standard gross margins (SGM). The whole matrix will finally consist of 49 columns and 33 rows.

- *Matrix G*: This matrix contains, on each activity level, aggregate data (e.g. total input, gross output and value added) and other EAA data (e.g. rent, interest, subsidies and taxes). The total matrix consists of 49 columns and 10 rows).

- *Matrix H*: AgrIS records the gross flows and because of this it is necessary to have not only the farm gate prices (Matrix E), but also the internal use prices. These internal use prices are used for valuing products used within the sector. These products mainly refer to cereals, fodder maize, grass and other crops, used as feedingstuffs, and manure used as fertiliser. Extra information from the Member States is necessary to calculate this data. This matrix is in fact a vector because it contains just one column.

6) Short-term early forecast tool

The short-term forecast tool consists of trend extrapolations on areas, number of animals, yields, inputs and prices. By multiplying these trend extrapolations with each other it is possible to generate for one or two years ahead, new EAA figures on output, intermediate consumption and thus income from agricultural activity.

The early forecast-project initiated by Eurostat in august 1999 had two major aims.

- The first aim was to show DG AGRI and the Member States trend based estimates of how income from the agricultural activity of family labour in the Member States and EU-11 or EU-15 would develop. Clearly, Eurostat is aware that these trend-based estimates are, in most cases, far from being indicators of what will happen. Member States were asked, therefore, to provide Eurostat with more up-to-date data, based on all information that was available in the first half of September. The Member States were asked to use the short-term forecast tool provided by Eurostat to adjust manually the trend estimations. The advantage of the program was that the results of the adjustments on income from agricultural activity could be looked at immediately. The adjustments made by the Member States were used by Eurostat to investigate why and to which degree trends deviated from reality.
- The second aim was to find out whether or not Member States thought that the short-term forecast tool developed and provided by Eurostat was user-friendly. In addition the Member States were asked to make proposals for improvements.

7) Medium-term agricultural sector model

On behalf of DG-AGRI, Eurostat has now been involved in medium-term agricultural sector modelling for more than ten years. The SPEL/EU-MFSS was designed for forecasts, simulations and policy-oriented modelling (Weber, 1995). More particularly, it was designed to simulate the response of the agricultural sector

to changes in the Common Agricultural Policy (CAP). The backbone of this model was formed by the Agricultural Monetary Statistics of Eurostat and more precisely the economic accounts for agriculture (EAA) of the 15 Member States.

As the SPEL/EU-MFSS model developed, it became increasingly clear that it had become too complex and difficult for people other than the developers of the model to handle. This was the reason that Eurostat issued a call for tender in 1999 for the development of a new medium-term agricultural sector model. The main objectives of the new model are that it should be a transparent, flexible and user-friendly instrument for CAP analysis and simulations. Besides this the model framework should not only reflect the current situation in the EU, but must also be able to reflect the agricultural situation in the Candidate Countries. For policy and statistical reasons the outcome of the model should be in line with the new EAA methodology.

For the next two years (2000 and 2001) the following steps are foreseen in the development of this new medium-term agricultural sector model.

- At first, the model specifications will have to be drawn up and implemented.
- The second step will be the design of a mathematical framework comprising the equations of the model.
- The third step will be to convert the mathematical equations into a programming language.
- The last step will involve output generation.

The whole model should be embedded in a user-friendly framework and controlled by a reference group. The minimum output requirements of the model are to have product balances for the CAP commodities and some important non-CAP commodities, farm income results, input use (land, labour, capital, intermediate inputs) and budget (EAGGF) for each Member State, Candidate Country and at the aggregated EU level. The model should also be able to capture crop-livestock interactions.

8) References

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Annex 1: Overview of the relations between the data in the AgrIS database