



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# An Experiment in Transnational Agricultural Policy: The CAP and "Convergence"

Margaret Loseby and Luciano Pieraccini<sup>1</sup>

**Abstract:** This paper examines the evolution of national agricultural sectors in European Community (EC) member countries over the last decade of general economic turbulence. It assesses the degree of between-country "convergence" in trends in sectoral variables achieved under the influence of the EC's common agricultural policy (CAP). Principal components analysis is used to identify similarities and differences. Similarities were particularly noticeable between certain subgroups of countries. Despite considerable divergences in rates of inflation, an overall tendency towards convergence emerges for internal terms of trade and for real incomes considered as real value added per agricultural labour unit. The patterns of convergence emerging from this study show a certain parallel with those found in studies of convergence conducted at macro level. The result is considered as a positive achievement for the CAP, which appears to have inserted the agricultural sector into the process of economic integration foreseen by the founders of the European Community.

## Introduction

The common agricultural policy (CAP), whose defects are widely discussed, has nevertheless represented a unique experiment in economic policy cooperation that has survived the turbulence experienced in the world economy during the 1970s. In contrast, other projected common policies for the EC have advanced little.

The agricultural sector is subject to the same economic forces that have led some authors to oppose further centralization of economic policies. The agricultural sector has, however, to some extent been "protected" from those economic forces by the CAP. One significant measure of the CAP's achievements, therefore, might be provided by an attempt to assess the degree of convergence in the evolution of agriculture in the member states in the period of its operation. This paper aims at such an assessment.

As others have pointed out, the concept of "convergence" is ambiguous. In the following pages, two working definitions of convergence will be used. The first, for convenience denominated "trend" convergence, will be understood as a tendency for national growth rates of sectoral variables to move in the same direction at a similar pace. Since that definition fails to take into account the relative values of the variables in different countries, the second definition will be that of "absolute" convergence, understood as a tendency towards a faster rate of growth in those countries where the initial values of variables (in particular, income levels) were lower.

## Methodology

The analysis was conducted on indices published by the EC Commission, which use the 1973-75 average as a base, for nine member countries. The indices cover 1973-81. The variables considered in the analysis were as follows:

$X_1$  = the rate of inflation, measured by the GDP deflator;

$X_2$  = net value added at factor cost per agricultural work unit at current prices ( $VAN/ALU$  or nominal value added);

$X_3$  = internal agricultural terms of trade (i.e., the ratio between the index of producer prices and the index of factor prices, excluding labour costs) ( $TT$ );

$X_4$  = net value added at factor cost per agricultural work unit at constant prices ( $VAR/ALU$  or real value added);

$X_5$  = labour productivity, measured as the ratio between the index of final agricultural product at constant prices and the index of labour input;

$X_6$  = the productivity of inputs, measured as the ratio between the index of final agricultural product at constant prices and the index of intermediate consumption at constant prices; and

$X_7$  = the green rate (i.e., the index of the exchange rate between national currency and the agricultural unit of account).

The indices for the nine member countries relating to a selected variable at time  $t$  show the *change* that has taken place in the relative position of each country with respect to the base period for that single variable. A composite index relating to all the variables considered allows a more global description of changes in relative country positions. Analogously, for each variable, a composite

index relating to all member states allows comparison between developments in the evolution of each variable at an aggregate level.

In order to provide a synthetic description of those aspects, the principal components method was applied in two stages. In the first stage, the method was applied to the values in each year of the indices of the seven variables for each of the nine countries considered to show the overall changes that occurred (for the single variables at an aggregated nine country level and for the single countries with respect to the whole set of variables) over the whole period with respect to the initial base period situation.

The second stage consisted in the application of principal components method to the matrix, for each variable, of its index values in each of the nine years for each of the nine countries considered. Using that approach, we examined the changes in the relative country positions that occurred with respect to the base period in an average of the entire 9-year period.

Since in each of the applications executed the first component explained a very high proportion of the total variance, only the first component will be examined in this paper.

Turning to the first stage of the analysis and indicating by  $X$  the 9 by 7 matrix of indices relating to nine countries (rows) by seven variables (columns), the analysis may be carried out both by rows (countries) and by columns (variables) by proceeding to identify the eigenvectors associated with the eigenvalues common to the matrices  $X'X$  and  $XX'$ .

In the first case, analysis by country, the following linear combination of indices relative to the seven variables is obtained:

$$(1) \quad sZ_1 = \alpha_{11s}X_1 + \alpha_{12s}X_2 + \dots + \alpha_{17s}X_7, [s=1, \dots, 9],$$

where  $s$  indicates country and the  $\alpha$ s are the elements of the eigenvector associated with the highest eigenvalue of the matrix  $X'X$ .

Substituting in (1) country by country the appropriate index values, we obtain the values of the first component for each of the nine countries.

Interpretation of the values of the first component is, however, complicated by their different scale as compared with that of the original indices. To overcome that problem, a normalizing procedure was applied, consisting of dividing the  $Z$  values by the sum of the  $\alpha$  coefficients to obtain a weighted average of indices, expressed in the same scale as the original data.

Thus, indicating by  $Z'_1$  the normalized principal component,

$$(2) \quad sZ'_1 = \Sigma \alpha_{1is} X_i / \Sigma \alpha_{1i} = sZ_1 / \Sigma \alpha_{1i},$$

where  $\Sigma$  indicates summing from  $i=1$  to  $i=7$ .

By comparing the values of  $Z'$ , we have an indication of the change that has taken place in the relative positions of the countries as regards the agricultural sector as it is represented by the chosen variables (i.e., an indication of the degree of convergence).

In the second case, analysis by variable, the first principal component for the  $i$ th variable is:

$$(3) \quad iW = \beta_{11D}X_i + \beta_{12F}X_i + \dots + \beta_{19DK}X_i, [i=1, \dots, 7],$$

where  $D$  is Federal Republic of Germany (FRG),  $F$  is France, and  $DK$  is Denmark, and its normalized form is:

$$(4) \quad iW'_1 = iW_1 / \Sigma \beta_{1i},$$

where  $\Sigma$  indicates summing from  $i=1$  to  $i=9$ .

The different values assumed by the index for each of the variables considered show the changes to which each has been subjected with respect to the initial situation.

Turning to the second, more detailed stage of the analysis, for each variable the matrix  $Y$  of order 9 by 9 of the index values in 9 years (columns) for nine member countries (rows) was considered. Principal components were applied to each variable by row (country) and by column (year) by considering the eigenvector associated with the highest eigenvalue respectively of the matrices  $YY'$  and  $Y'Y$ . For brevity, only the results of the first analysis, by country, are presented. The relevant first component, defined as:

$$(5) sU_{it} = {}_i a_{11s} X_{i73} + {}_i a_{12s} X_{i74} + \dots + {}_i a_{19s} X_{i81},$$

supplies, for the  $i$ th variable, the relative position of the  $s$ th country ( $s = 1, \dots, 9$ ) as a function of its evolution through time, and is a measure of between-country convergence (or otherwise) within the time period considered. A normalization procedure was applied, as before.

## Results

### Analysis by Variable

The evolution of the sectoral variables is indicated, as regards the position at 1981, by the results obtained for equation (4). This part of the analysis shows that for the EC as a whole, the sectoral variables that evolved with the strongest upward trend were inflation ( $X_7$ ) and nominal value added per agricultural labour unit ( $X_8$ ) (i.e., monetary phenomena). An upward trend, though less marked, is noticeable in depreciation of green rates ( $X_9$ ), dictated politically in response to inflationary pressures. Terms of trade ( $X_3$ ) and productivity of inputs ( $X_6$ ) show no strong trend, though both have tended to deteriorate. In response to the adverse effects of inflation on terms of trade, labour productivity ( $X_5$ ) has tended continuously to increase, but the net effect of all the factors has been a level of real value added per agricultural labour unit ( $X_4$ ) oscillating around that of the base period (1973-75 average).

### Analysis by Country

The analysis by country permits examination of changes in relative country positions from the base period to each year examined for all sectoral variables considered together (equation (2)) and for each sectoral variable in the "average" of the 9-year period (equation (5)). In the latter case, the changes in relative country positions are considered not in relation to a specific moment in time but rather in relation to the period as a whole; in that way, the effects of anomalies that might occur in a particular year are mitigated.

Considering first the results for equation (2) for the years 1976-81, we can rank member states in order of their contribution to the variability in the overall evolution of the sectoral indices representing EC agriculture.

A considerable divergence exists in the evolution of the sectoral indices between the two extreme cases, FRG and Italy, and a remarkable homogeneity exists between countries in three distinct groups: (FRG, Belgium, Luxembourg, and the Netherlands; France and Denmark (surprisingly); and the UK and Ireland). Excluding the UK, Ireland, and Italy, the remaining countries could perhaps be regarded as a broader, fairly homogeneous group.

The changes in relative country positions for each of the variables permit further investigation of similarities and differences between member countries. Divergence between FRG and Italy is confirmed for only three variables—inflation, nominal value added, and green rates. Homogeneity between groups of countries is substantially confirmed between FRG and the Benelux countries as far as both monetary and real variables are concerned.

The results lend some support to the unexpected outcome that a degree of homogeneity exists in the development of French and Danish agriculture, particularly as regards terms of trade, green rates, and productivity of inputs, though less so for the other variables (notably less for real value added).

Overall, a greater degree of variability is to be found amongst the monetary variables (in particular, inflation and nominal value added) than amongst the real variables. A high degree of "trend" convergence in terms of trade is apparent, which must be attributed to the CAP. The CAP is mainly a price policy and, working through the mechanisms of green rates and support prices, has achieved that remarkable result in the face of strongly divergent trends in inflation rates.

Nevertheless, the between-country differences in magnitude of trends in labour productivity (converging positively) and in input productivity (converging negatively) have contributed to "trend" divergence, both in nominal and in real value added per agricultural labour unit. The "trend" divergence in real value added, is, however, relatively limited, ranging from the extremes of -8.2 to +5.7 percentage points. Moreover, two of the three countries in which real value added increased (Italy and Ireland) are countries where initially real income was low as compared with other member states. Thus, it appears that in this variable there has been a tendency to "absolute" convergence.

## Convergence Between National Agricultural Sectors and General Economic Convergence

To place the results in a more general perspective, we investigated whether the results are specific to the agricultural sectors or whether they reflect trends that pervade other sectors of the national economies.

Whilst several studies of economic convergence between EC countries have been conducted for macroeconomic indicators, no studies relating to specific productive sectors are known to the authors. Comparable data from the macro studies is limited to per capita income, the evolution of which may be confronted with value added in per agricultural labour unit in the agricultural sector.

Baker (1982) finds a fairly static degree of divergence in levels of GNP per capita between EC member states between 1973 and 1979. Hallett (1981), on the other hand, reaches a slightly different conclusion. Measuring divergence as the difference between the index numbers obtained for each country's GDP in relation to the EC average (a concept approximating to our definition of "absolute" convergence), Hallett finds no increase in overall divergence between 1970 and 1979. Instead, he finds a tendency to convergence amongst a group of six countries (FRG, Belgium, Netherlands, Luxembourg, France, and Denmark) for GDP per capita measured in current prices and exchange rates, which becomes even more marked if GDP is calculated at purchasing power parity values.

Although Hallett's results are not directly comparable with those reported here, a certain parallel can be traced, particularly as regards the affinities noted between FRG and the Benelux countries and between France and Denmark. Income trends in agriculture have followed apparently similar patterns of convergence as those for overall national income.

### Conclusions

The present attempt to assess the degree of convergence between the agricultural sectors of EC members during the 1970s has shown that divergence was particularly strong for the group of nine countries as a whole as regards inflation and nominal value added per agricultural labour unit, though within certain subgroups the degree of divergence was much less.

Instead, a remarkable degree of convergence was observed in terms of trade, which must be attributed to operation of the price-oriented CAP.

The interaction of terms of trade with other variables produced differences in the direction of trends in real value added per agricultural labour unit. The trends, however, appear to have contributed to "absolute" convergence, in that the stronger growth rates are found in countries where the level of income was initially lower. Those results, together with the apparent similarities noted in patterns of between-country convergence for agricultural incomes and incomes in the economy as a whole, appear as positive achievements for the CAP.

Given the peculiarity of agricultural price regulation and the implied imposition of prices in agricultural trade, one would find it interesting to compare the analysis for the agricultural sector with similar analyses for other economic sectors where prices are determined by market forces.

### Note

<sup>1</sup> Università della Tuscia and Centro di Specializzazione e Ricerche Economico-Agrarie per il Mezzogiorno, respectively.

### References

- Baker, S., "Convergence and the Relationship between Members of the European Community: Some Indices," in Dossier, D. *et al.*, *The Collaboration of Nations*, Martin Robertson, Oxford, 1982.
- Hallett, E.C., "Economic Convergence and Divergence in the European Community: A Survey of the Evidence," in Hodges, M. and Wallace, W. (Eds.), *Economic Divergence in the European Community*, G. Allen and Unwin, London, 1981.