

Assessment of CAP reforms on the Alentejo economy of Portugal

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1. Introduction

The EU Council of Ministers agreed a package of reforms to the Common Agricultural Policy (CAP), which affected 75% of the Community's farm output (Commission of European Communities, 1993). The reforms involved immediate price realignments for the main agricultural commodities to be phased in over the period 1992 to 1998, together with the commitment to more radical changes in the period from 1999 to 2006.

The Community committed itself to a fundamental change in the support system, with a switch away from assisting the agricultural industry through guaranteed prices to an agricultural production system designed to force European Union production levels down in the years to come. The Agenda 2000 Common Agricultural Policy reforms were finally concluded in March 1999 with broad cuts in the European Union institutional prices for beef (20%), cereals (15%) and dairy (15%) (AgraFocus, 1999). These reforms might have effects on the peripheral areas of the Community traditionally heavily dependent on agriculture.

This research work develops a framework to assess the effects of CAP changes and input/output price changes on the farming community; to examine the effects of the farming change on income and employment associated with farm policy changes on the regions Alentejo Litoral, Alto

Abstract

This research work develops a framework to assess the economic and social effects of Common Agricultural Policy changes (Agenda 2000) and input/output price changes on the farming community and to examine the effects of the farming change on income and employment on the regions of Alentejo Litoral, Alto Alentejo, Alentejo Central and Baixo Alentejo in Portugal.

This involves the development of models for the agricultural sectors of each region to forecast the impact of Common Agricultural Policy changes on agricultural output. Farming is a key activity in those regions, thus any output changes will have consequences for businesses supplying inputs and processing farm output. To estimate these secondary effects, this research work develops 'Johansen-type' models of agriculture and constructs Input-Output models for assessing the impact of Agenda 2000 on incomes and employment in those four rural areas in Alentejo region. These empirical models also assess the effects of agricultural output changes on businesses supplying inputs and processing farm output.

Résumé

Ce travail développe une méthodologie pour évaluer les effets économiques et sociaux des changements de la Politique Agricole Commune (Agenda 2000) et des changements du prix des intrants et des extrants sur les exploitations agricoles et pour examiner les répercussions du changement rural sur le revenu et l'emploi dans les régions de l'Alentejo Litoral, de l'Alto Alentejo, de l'Alentejo Central et du Baixo Alentejo au Portugal.

Cela implique la mise au point de modèles pour les secteurs agricoles de chaque région afin de prévoir l'impact des changements de la Politique Agricole Commune sur la production agricole. L'activité agricole est très importante dans ces régions, et par conséquent tout changement des extrants influera sur les entreprises qui fournissent les intrants et transforment les produits agricoles. Pour estimer ces effets secondaires, ce travail développe des modèles du type Johansen et des modèles d'intrants-extrants pour évaluer l'impact de l'Agenda 2000 sur les revenus et l'emploi dans ces quatre régions rurales de l'Alentejo. Ces modèles empiriques évaluent aussi les effets des changements de la production agricole sur les entreprises agroalimentaires qui transforment les produits agricoles.

Alentejo, Alentejo Central and Baixo Alentejo in Portugal. This involves the development of models for the agricultural sectors of each region to forecast the impact of policy changes on agricultural output. Farming is a key activity in those regions, so any output changes will have consequences for businesses supplying inputs and processing farm output. To estimate these secondary effects, input-output models are constructed for each region and the resultant multipliers used to estimate the overall income and employment impacts of farm output changes. The projections of the models are partially validated using surveys and reports on each region.

2. An economic model

Estimates of the impact of the recent CAP reforms on income and employment for each of the study areas are obtained by a two-stage process. First, the impacts of the forecasted price changes on local farm output are projected using a simple econometrically estimated model of regional agriculture. Finally, estimates of the local income and employment multipliers are prepared and used to project the global increases in wealth and jobs.

3. Deriving a regional model of agriculture

A regional model of agriculture follows an approach developed by Boyle and O'Neill (1990). The Johansen method is used to model the farm economies in each of the study areas. This approach describes the relationship bet-

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ween inputs and outputs in terms of percentage changes rather than absolute terms. The input-output relationships are expressed by means of a production function of the type presented in equation:

$$(1) \quad Y_i = (\epsilon_1 X_1 + \epsilon_2 X_2 + \dots + \epsilon_n X_n)$$

where:

Y_i is the percentage change in output of product i ,
 X_j is the percentage change in input j
and ϵ is elasticity of output with respect to input X_i .

Assuming that agricultural output and input prices are given and that farmers maximise short-run profits, then Hotelling's Lemma permits the derivation of a set of profit maximising supply and demand relationships for outputs and inputs in terms of product prices, input costs and the levels of quasi-fixed factors, such as capital and labour (Varian, 1984).

The Johansen approach solves this system of equations by linearising in terms of percentage changes. The solution of the equation system is obtained by matrix inversion:

$$(2) \quad Y = -A_1^{-1} A_2 X$$

If the profit-maximising levels of output are the dependent variables, then A_1 consists of a unit matrix, while A_2 is a matrix of the price and quasi-fixed factor elasticities. If the quantities of inputs and outputs are treated as endogenous variables and the market prices as exogenous, then the model can be used to evaluate the consequences of a price change on both the patterns of production and inputs.

To overcome problems associated between the exogenous variables and the error term, the elasticities are estimated from the profit function, which can be shown under certain conditions (Lau, 1978). In using the profit function to model production possibilities, there were two requirements: i) farmers had to behave as profit maximisers; and, (ii) the market for outputs and inputs had to be assumed to be competitive. Accepting these restrictions, then profits (H) could be defined as a function of the process for output and the variable inputs (P_i) and the level of quasi-fixed factors (Z). The profit function is then the dual of the production function if a number of so-called 'regularity' conditions is satisfied (Lau, 1978). By differentiating the profit function with respect to input and output prices, input demand and output supply functions are obtained (Varian, 1984).

The precise specification of the profit function is governed by the need to satisfy as many of the 'regularity' conditions as possible and to impose as few of arbitrary restrictions as possible on the parameters which describe the production technology. The translog function is considered to meet these requirements:

$$(3) \quad \begin{aligned} \ln H(P, Z) = & a_0 + \sum_{i=1}^n a_i \ln P_i \\ & + 0.5 \sum_{i=1}^n \sum_{j=1}^n a_{ij} (\ln P_i) (\ln P_j) \\ & + \sum_{k=1}^m b_k \ln Z_k + \sum_{i=1}^n \sum_{k=1}^m b_{ik} (\ln P_i) (\ln Z_k) \\ & + 0.5 \sum_{h=1}^m \sum_{k=1}^m c_{hk} (\ln Z_h) (\ln Z_k) \end{aligned}$$

where a_0 , a_i , a_{ij} , b_k , b_{ik} e c_{hk} are parameters, n denotes the total number of inputs and outputs and m equals the total number of quasi-fixed factors. For the profit function to be the dual of the production it must be linearly homogeneous in input and output prices and the cross-price coefficients (a_{ij}) must satisfy the symmetry conditions (Lau, 1978). Differentiating the equation (3) with respect to input and output prices yields a set of output supply and input share equations of the following type:

$$(4) \quad \begin{aligned} S_i = \left(\frac{\partial \ln H}{\partial \ln P_i} \right) &= \left(\frac{\partial H}{\partial P_i} \right) \left(\frac{P_i}{H} \right) = \\ & a_i + \sum_{j=1}^n a_{ij} (\ln P_j) + \sum_{k=1}^m b_{ik} (\ln Z_k) \end{aligned}$$

where S_i is the share of the input or output i in total profits. The elasticities required for the Johansen-type model can then be obtained from equation (4) as outlined by Sidhu and Bannante (1981). Strictly, the elasticity estimates are short-run in nature, because they are derived assuming that some of the inputs (Z_k) are fixed. The predicted price responses do not take into account the ability of farms to adjust the fixed inputs in the long-run. However, while Lau (1976) and Hertel (1987) have derived methods for estimating long-run elasticities, they are either i) only applicable where there is one quasi-fixed factor or ii) to functional forms other than the translog.

The elasticities are estimated using individual farm business data. The sample comprises both cross-sectional and time-series data, it is necessary to modify the functional form of the translog function used, to avoid confusing changes in factor shares due to price changes with those due to changes in the sample of farms. One of the simplest procedures for doing this is to assume that differences in behaviour between individual farms could be captured by a variable intercept term, while responses to price and cost changes are presumed to be constant across all farms of the sample type. For a situation involving f farms, n outputs and inputs and m quasi-fixed factors, a translog profit function, seven output share equations, three input share equations and two quasi-fixed share equations are es-

estimated simultaneously using Seemingly Unrelated Regression Method, with the share of revenue from 'other crops', being estimated residually. In practice, it is impossible to fit a single equation through all the data, so instead the farms in the sample are split into one of four types and separate functions fitted for each farm type group in each of the study areas. In general, the fitted equations satisfy the conditions on 'monotonicity' (Higgins, 1981) and 'convexity' (Lau, 1976), but the proportion of variance explained is disappointingly low. Nevertheless, the magnitude and sign of the elasticities are generally as expected. To derive a set of workable elasticities, which could be used to predict the effect of policy changes on agricultural output in each of the study areas, it is necessary to obtain 'pooled' estimates by weighting the individual farm-type elasticities by the proportion of farms of each type in a given study area. In each case the elasticities were estimated for the 1992 data point. As the distribution of farm types differed among study areas, these consequent 'pooled' elasticities also differ among the four study areas.

4. Deriving regional income and employment multipliers

To forecast the impact of any changes in agricultural output on total income and employment in the study areas, economic multipliers for agriculture are estimated from the I-O tables constructed for each study area. Provided that a number of restrictive assumptions are accepted (Midmore, 1990), this approach has the advantage of being conceptually simple. To construct the I-O matrices for each of the study areas, the sector-by-sector table for Portugal has first to be aggregated into sectors for which reliable regional employment data may be obtained. This involves amalgamating the 49 original industrial sectors contained in the 1990 Portuguese I-O tables into the twelve principal digits SIC (Standard Industrial Classification) sectors, together with a single sector to represent 'households'. The twelve I-O table for Portugal is then converted to a regional matrix, using a technique developed by Jensen et al. (1979), refined by Johns and Leat (1986) and based on relative employment levels.

Conventionally, the national I-O table treats agriculture as a single industry in agricultural output due to expanded milk production and it shall be presumed to have the same impact on the demand for inputs from other industrial sectors as an equivalent increase due to cereal production. This is clearly not tenable. Accordingly, the decision was taken to disaggregate the agriculture sector within the I-O tables into eight enterprises, namely beef rearing, dairying, sheep production, hogs production, wheat production, corn production, rice production and miscellaneous output. The latter includes agro-environment payments. An earlier method put forward by Errington (1989) for estimating I-O coefficients for individual farm enterprises from regional

data was felt to impose too many prior restrictions on the production relationship. Instead a system of input demands and output supplies was directly derived from a 'dual cost function' (Varian, 1984). Since the technical coefficients in the I-O model describe the average factor cost, and since they are used to predict the total demand for a particular input and total output, the cost function may be used to derive the I-O coefficients for a particular enterprise. Considering a methodology derived by Lager and Schöpp (1985), a translog cost function is fitted to the original sample of farms and I-O coefficients are estimated for each of the eight farms enterprises independently for each study area. These coefficients are used to derive regional income and employment multipliers for the four study areas as outlined by Jensen et al. (1979). They are termed the 'type 2' multipliers, which take account not only of the direct and indirect effects of output changes, but also the effects induced by secondary changes in income and employment in the region caused by the initial output changes. The income multipliers show the projected increase in regional income due to a one-dollar rise in output of a particular sector. The employment multipliers show the total jobs created within the locality per additional job generated in that sector.

This research work collected data from various sources. The first sources are Agricultural Statistics, Agricultural Portugal, Agricultural Census, Population Census, Employment Census, Agricultural Production and Regional Accounting published by Instituto Nacional de Estatística. The second sources are Farm Accounts Surveys for various years published by FADN Services in Lisbon. The third sources are Portuguese Input-Output tables published by the Central Planning Department of the Ministry of Economy. The fourth sources are economic reports published by the Ministry of Agriculture and other governmental agencies. Finally, this study has also used information collected from surveys, reports, rapid audits from farmers and their associations and visits to each of the study areas.

5. Results

The impact of the CAP reforms on agricultural production over the period 1992 to 1998 (scenario 1) differs between study areas, as shown in table 1. The effects of reform, when there were no supply constraints on agricultural production (scenario 1A), revealed that production declines in all the study areas. The impact of scenario 1B, which assumes that milk production is constrained and that the quotas have not changed over the period 1992 to 1998, leads to moderate declines in agricultural production in all the study areas (table 1).

The first scenario (1C), under constrained agricultural production, leads to declines in output, income and employment in agriculture and their food processing industries for the study areas, as shown in table 1. The results indicate that under a milk quota system there is a negative im-

Table 1. *Agricultural output and local income and employment under price scenario 1*

Commodity	Alentejo Litoral			Alto Alentejo			Alentejo Central			Baixo Alentejo		
	1A	1B	1C	1A	1B	1C	1A	1B	1C	1A	1B	1C
Change in agricultural output million of Euro	-5.14	-3.94	-3.94	-4.51	-0.57	-0.57	-10.67	-0.83	-0.83	-6.25	-3.91	-3.91
Change in agricultural output as % of 1992 output	-8.90	-6.90	-6.90	-9.60	-1.20	-1.20	-11.20	-0.80	-0.80	-10.50	-6.60	-6.60
Change in overall income, million of Euro	-8.42	-6.46	-10.91	-7.23	-0.95	-1.62	-17.24	-1.27	-1.82	-9.13	-5.51	-9.18
Change in employment, jobs (1)	-442	-350	-470	-517	-25	-44	-1102	-56	-71	-693	-475	-561
Change in employment as of % 1992 labour force	-5.9	-4.6	-6.2	-7.1	-0.3	-0.6	-9.7	-0.5	-0.6	-8.1	-5.6	-6.6
Change in employment, jobs (2)	-912	-1022	-1237	-910	-195	-178	-1857	-159	-181	-1122	-722	-801
Change in employment as of % 1992 labour force	-18.1	-13.5	-16.4	-12.4	-2.7	-2.4	-16.4	-1.4	-1.6	-13.1	-8.5	-9.4

Source: Model Results
(1) Change in employment was based on separate labour: output ratios for each of the agricultural enterprises
(2) Change in employment was based on separate labour: output ratio for the agricultural industry as a whole

Table 2. *Agricultural output and local income and employment under price scenario 2*

Commodity	Alentejo Litoral			Alto Alentejo			Alentejo Central			Baixo Alentejo		
	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C
Change in agricultural output million of Euro	-21.6	-25.5	-25.5	-10.9	-14.3	-14.3	-19.8	-25.4	-25.4	-21.1	-24.9	-24.9
Change in agricultural output as % of 1992 output	-37.8	-44.5	-44.5	-23.1	-30.2	-30.2	-20.8	-26.6	-26.6	-35.3	-41.9	-41.9
Change in overall income, million of Euro	-33.8	-35.1	-64.8	-16.9	-17.6	-36.4	-31.1	-32.1	-51.9	29.5	-32.1	-52.6
Change in employment, jobs (1)	-2320	-1985	-2806	-1123	-798	-1362	-2172	-1582	-2096	-2486	-2293	-2884
Change in employment as of % 1992 labour force	-30.7	-26.3	-37.2	-15.4	-10.9	-18.7	-19.2	-13.9	-18.5	-29.1	-26.9	-33.8
Change in employment, jobs (2)	-4455	-4121	-4941	-2160	-1835	-2399	-3479	-2888	-3403	-3618	-3424	-4016
Change in employment as of % 1992 labour force	-59.1	-54.7	-65.5	-29.6	-25.1	-32.9	-30.8	-25.5	-30.1	-42.4	-40.1	-47.1

Source: Model Results
(1) Change in employment was based on separate labour: output ratios for each of the agricultural enterprises
(2) Change in employment was based on separate labour: output ratio for the agricultural industry as a whole

impact on agriculture and the regional economy in all the study areas. The differences in economic structure are also reflected in the differences between study areas regarding the impact on income and employment which result from changes in the agricultural output. The Alentejo Litoral and the Baixo Alentejo areas have more integrated economies than the other study areas. Therefore, evidently changes in farm output are projected to have a much greater consequence on the regional economy in the Alentejo Litoral and the Baixo Alentejo economies than on the regional economy in the Alto Alentejo and the Alentejo Central areas. These model results have been compared with rapid audits recorded and reports from farmer groups, farmer associations and governmental agencies. Although there are some differences, these are not sufficiently great to invalidate the results.

The second price scenario (scenario 2) that is studied is concerned with investigating what will happen if there is a partial convergence between European Union and world prices. Three scenarios are run by the mode from 1999 to

2006. This research assumes that the scenario 2A only represents the price cuts proposed by Farm Ministers at the Berlin Summit in March 1999 adjusted to cover the period from 1999 to 2006. It is assumed that any reduction price support will be compensated by a corresponding increase in the agri-environment payment. The impact of this is simulated by assuming that "Miscellaneous output", which includes items like income from forestry and other agri-environment payments, is increased by an amount equal to the reduction in price support. The scenario 2B considers that the budgets costs released by any reduction in price support could be paid as a social transfer payment to farm households. Farm households will not use the extra income to support the farm business, but they treat as extra consumption income. The scenario 2C assesses the possible consequences for income and employment in processing industries of declining agricultural output,

which mirrors scenario 1C.

The effect of scenario 2 in all the four study areas of the Alentejo region of Portugal is a severe decline in agricultural production and local income and employment, as shown in Table 2. The Alentejo litoral area and the Baixo Alentejo area might have the strongest decline in agricultural production, income and employment from 1999 to 2006, if Agenda 2000 is totally applied to all these agricultural areas (table 2). Model results also show that the Agenda 2000 might have negative effects on the whole Alentejo region traditionally heavily dependent on agriculture.

6. Conclusions and implications

The overall objectives of this study was to assess the impact of the recent reforms of the Common Agricultural Policy on peripheral regions of the community in respect of the farm labour force and the rural community development. These impacts were assessed paying attention to the linkages between agriculture and the rest of the local eco-

nomy with the aim of identifying the direct and indirect income and employment effects arising the recent Common Agricultural Policy.

The methodology developed provides some potentially interesting insights regarding the linkages between the agriculture sector and the rest of the economy in rural areas. In particular, changes in agricultural production are likely to have significant effects on income and employment in Alentejo Litoral, Alto Alentejo, Alentejo Central e Baixo Alentejo regions; that is sufficient to be ignored. At the same time, the study suggests that the wider impacts of proposed shifts in public assistance to agriculture, away from support to direct income and agro-environment payments, may be negative at the local level. This indicates a need to review the consequences of such policy shifts more closely before initiating them on a large scale.

Model results show that the recent Common Agricultural Policy reforms will significantly reduce the relative rates of economic and social development in all four study areas and, as a consequence, the progress towards greater economic and social cohesion within the whole Alentejo region will be impeded. Finally, this study clearly shows that shifts in the balance of European assistance to agriculture from price support to income support will have major adverse effects on agricultural production, income and employment in all the four study areas in the Alentejo region of Portugal.

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