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THE EFFECTS OF LABOUR SKILLS ON THE ECONOMIC ROLE OF PORTUGUESE WINE CO-OPERATIVES ¹

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Abstract

In the agro-food system, the vertical co-ordination in the form of co-operatives has considerable importance. In this paper, we present a function that synthesises the specific economic role of agricultural co-operatives. In the empirical research, we link the performance of the Portuguese Wine Co-operatives (PWCs) and the skills of the human resources employed by them. The results of the multinomial logit model show that the PWCs are able to improve their performance through the recruitment of skilled professionals in the areas of wine production, management and by delegating more decision-making powers from the Board to professional managers.

1 — Introduction

Firms and national economies in today's world face permanent movements towards globalisation and internationalisation. However, at the regional and local level, the agricultural raw material markets are increasingly characterised by vertical co-ordination ² of farmers and processors.

Throughout the world, co-operative organisations constitute a practical and common means of achieving such vertical co-ordination. Co-operatives play an important role in the European Union (EU) food system (table 1).

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² Vertical co-ordination can be defined as the alignment of direction and control across segments of a production/marketing system (King, 1992). The factors that are aligned and controlled are price, quantity, quality and terms of exchange (Sporleder, 1992).

TABLE 1
Agricultural products sold through co-operatives (%) in EU (1996)

	Pig meat	Beef/Veal	Poultry-meat	Eggs	Milk	Sugar-beet	Cereals	All fruit	All vegetables
Belgium	18	—	—	—	53	—	30	75	85
Denmark	91	66	—	52	94	—	60	70-80	70-80
Germany	27	28	—	—	52	80	45-50	40	28
Greece	3	2	15	2	20	—	49	57	3
Spain	7	8	22	25	27	22	20	45	15
France	85	30	30	25	47	16	68	40	25
Ireland	66	15-20	20	—	99,5	—	57	14,3	17,5
Italy	13	12	35	8	40	6,5	20	43	8
Luxembourg	37	38	—	—	81	—	79	—	—
Netherlands	34	16	9	14	83	63	65	76	73
Austria	20	25	70	—	90	100	60	18	28
Portugal	—	—	—	—	—	—	—	—	—
Finland	66	65	83	54	97	—	48	—	—
Sweden	78	76	—	33	99	—	75	20	50
U. Kingdom	28	—	25	—	67	—	24	67	26

Source: European Commission, Directorate-General for Agriculture (DG VI).

This role, however, differs from country to country, and from product to product in the agro-food *filière*. Co-operative activities are relevant in the marketing of several key agricultural products, namely, milk, pig meat, fruits and vegetables, being responsible in some cases for the marketing of almost the entire production. Geographically speaking, it is in the northern and central European countries that co-operatives play the most important role in economic activity. Available statistical information supports the conclusion that the co-operative vertical integration system provides, for different crops, satisfactory welfare conditions for participating European farmers.

In Portugal, detailed information about the quantities of agricultural products marketed through co-operative firms is scarce. However, we can say that, in order of importance, these firms only play a relevant role in the *filières* of milk, wine, fruit and vegetables. Despite of this importance there are very few studies either on the co-operative sector as a whole or in specific areas of organisation and management of co-operatives ⁽³⁾.

In the case of wine, the 116 existent co-operatives control about 50% of Portuguese wine-grape production, representing the output of some 70,000 growers. These figures tend to show that in order to have a more competitive wine sector, the co-operative sector has to be taken into account; in turn its own success depends on the recruitment of skilled professionals in the fields of wine production, management, marketing and by delegating more decision-making powers from the Board to professionals managers.

Using the traditional model of the firm, this paper presents a function that characterises the economic role of agricultural co-operatives in terms of differences between their cash flows and those of other forms of vertical co-ordination. Additionally, with the application of a multinomial logit model, it also analy-

⁽³⁾ Paiva (1999) provides an overview of the research undertaken in Portugal on the co-operative sector.

ses the impact of the human resources used in the recent economic performance of PWCs.

This analysis is organised as follows: section 2 shows the economic role of agricultural co-operatives. In section 3, the data and results relating to the link between the economic role of the PWCs and the skills of their human resources are analysed, using discrete choice modelling. Finally, some final remarks are drawn.

2 — The economic role of agricultural co-operatives in the context of vertical co-ordination

According to Perry (1989), the main determinants of vertical co-ordination are: technological economies based on physical interdependencies in the production process; transactional economies associated with the exchange process; and market imperfections, which include imperfect competition and imperfections caused by externalities and asymmetric information.

These determinants suggest the existence of four types of vertical co-ordination between farmers and processors (Rehber, 1998, pp. 3-4):

- i) *Co-ordination with no contract.* This type of co-ordination refers to a spot or open market transaction. In this relationship there is no written or oral contract between the firm and the farmer; the farmer sells his products to whomsoever will give him the best price. This type of integration provides a large degree of freedom to the farmer, but its main drawback is uncertainty;
- ii) *Contract farming or quasi integration.* In this case, each firm retains its separate identity but leaves one or more production and/or marketing decisions under the control of another firm. Contract farming or contract production, however, must be distinguished from the multiplicity of simple marketing contracts that exist. Specifically, the former entails relations between growers and private or state enterprises, replacing spot market transactions between farmers and processing or purchasing units. A standard farming contract regulates price, production practices, product quality, credit facilities and other relevant conditions in advance;
- iii) *Ownership integration.* In this type of integration, formerly autonomous farms lose their individual identity and become a single firm operated by one farmer. This firm either owns or leases the land, buildings and equipment and has its own employees, i. e. the production factors required to pursue its chosen activity;
- iv) *Farmer co-operatives.* An agricultural co-operative is an organisation usually owned and controlled by agricultural producers, and which is horizontally co-ordinated (constituting a sort of «club»), in order to achieve vertical integration. According to Sexton (1986a, p. 215) «because a co-operative projects its members either forward or backward in the marketing chain, it accomplishes many of the same purposes as does vertical integration.

If the benefits from vertical integration to agents i and j are denoted as $\beta(i)$ and $\beta(j)$, respectively, the two have incentive to integrate co-operatively if $\beta(i \cup j) > \beta(i) + \beta(j)$, and if $\beta(i \cup j) > 0$. The first condition, the strict superadditivity of benefits, has been identified by Pauly (1967) as necessary for clubs to form. Thus a co-operative is a horizontal club organised to accomplish vertical integration».

According to Sexton (1986b, p. 1167) «to explain co-operatives' role in a market oriented economy is simultaneously (a) to enumerate farmers' incentives to integrate vertically and (b) to identify reasons for co-ordinated (i. e. co-operative) rather than individual integration». In the context of economic theory, the role of agricultural co-operatives has been analysed using traditional models of the firm (Helmlinger and Hoos, 1962; Sexton, 1995), game theory models (Sexton, 1986a) or voting theory models (Zusman, 1982).

Assuming rationality, a farmer will only join a co-operative if he is offered more economic advantages than those offered by other forms of economic activity available to the potential member. Becoming a co-operative member involves a decision to both invest in the co-operative's assets and to patronise the co-operative. In contrast, the decision to patronise a non-co-operative firm does not require an investment in its assets. The co-operative must offer the potential member either higher revenues or lower costs than the competing non co-operative firms, while maintaining the level of asset-ownership cash flows. More precisely, it should maximise the present value of its asset-ownership cash flow and the total differential patronage cash flows. For m identical members (Peterson, 1991) this objective can be expressed as follows (4):

$$\text{Max}_{A, Fc} \frac{E[A + m*(Fc - Fn)]}{r} \quad (1)$$

where: $E(.)$ = the expected value operator; A = periodic ownership cash flow generated by a co-operative's assets, if these were operated as efficiently as in the non-co-operative firm case; Fc = periodic ownership cash flow generated by a potential farmer-member asset, if a co-operative is a patronised; Fn = periodic ownership cash flow generated by a potential member's farm asset, if a non-co-operative firm is patronised; r = the appropriate discount rate.

The objective of maximising the owner's wealth through the maximisation of its present value is similar to that of private firms only if the sources of cash flows are different. The latter type of firm seeks only to maximise asset owner-

(4) To simplify the notation a perpetual cash-flow is assumed.

ship cash flows for investors, while co-operatives seek to maximise both asset ownership and differential patronage cash flows ⁽⁵⁾.

The main condition for constituting a co-operative is an imperfect or inefficient market. If the market is competitive, information is available and known by all, entry and exit are free and transactions costs are insignificant, and therefore the factors (agricultural products) are remunerated according to their marginal productivity. In such a market, there would be no source of differential patronage cash flows, i. e., F_c is equal to F_n , and co-operatives would not exist (Tennbakk, 1995; Rebelo, 1997).

Inefficient markets result in measurable economic losses in comparison with efficient ones. If co-operatives can counter market power, provide missing or improve uncertain information, exploit decreasing cost production technology, reduces excessive transaction costs and benefit from differentiated governmental tax treatment, then they can create economic value by recouping inefficiency losses.

In summary, the starting point for any assessment of the economic role of agricultural co-operatives should be whether or not co-operatives produce a set of net benefits for farmer members at least equal from those produced by non-co-operative firms.

From this broad perspective, and in the interests of improving the current performance of PWCs, it would undoubtedly be of value to analyse the contribution made by their human resources to the generation of the net benefits described above. In the next section, data relating to PWCs is used in an attempt to answer this question.

3 — The effects of labour skills on the economic role of PWCs

Portugal is a country with a marked aptitude for wine-growing, in which the activities connected with this sector have been fully documented over time. History tells us that vineyards were introduced into Portugal in about the 7th century BC. Currently, wine-growing activities are spread throughout Portugal and vines cover almost 6.5% of Portugal's agricultural area. On average, during 1993-1997, the wine production represented 16.8% of the Gross Agricultural Product, the highest figure of all the countries of the EU (Comission Européen, 1998), and among all Portuguese crops, by far, the most important one.

⁽⁵⁾ From a more general perspective, the performance evaluation of co-operatives should not be limited to differential cash flow. Co-operatives, in particular, are often thought to provide public goods. One of the roles that co-operatives play, as suggested by Nourse (1922), is that of competitive yardstick. Staatz (1987, p. 97) notes that "farmers, faced with unsatisfactory performance by invested-owned firms (IOFs), may form a co-operative firm whose purpose is to force the IOFs, through competition, to improve their services to farmers. In successfully enforcing competition, the co-operative generates benefits that it does not capture, but which accrue to the farmers-stockholders, as well to other farmers in the area". Other public goods include their ability to correct market failures by providing services for which a market does not exist. However, the public good characteristics of co-operatives also provide an incentive for members to become free-riders (Fulton and Adamowicz, 1993).

The 116 PWCs provide, on average, 50% of the total Portuguese wine production and almost all have their origins in the 1950s and 1960s and were created with substantial technical and financial support from the government. At the time, the support given to the creation of these organisations was justified in terms of the need to reduce wine production costs, maintain the quality of production, solve problems of stocking, and obtain by-products, so that the income of wine co-operative members could increase. That is, given the prevailing economic environment, public entities considered PWCs as the most appropriate form of commercial organisation able to reduce market inefficiencies, a situation that remains unchanged today, as the number of co-operative bankruptcies and mergers has been insignificant.

Generally speaking, PWCs are economic units of small dimension, geographically dispersed throughout Portugal, even though a larger number of them are concentrated in areas in which vineyards historically have played an important economic role, essentially in the oldest Demarcated Wine Regions.

In the long run, PWCs can only survive if they are able to offer additional net benefits, compared to other alternative forms of marketing of grape production, namely through the sale of grapes to private sector wine-manufacturing firms, with or without formal contracts or by individual vertical integration.

Due to the lack of previous empirical research and because it was impossible to obtain quantitative information that would enable us to compute differential cash-flows, we decided to conduct a survey of 116 PWCs, using a questionnaire previously elaborated and tested. Data collection took place in 1998 using direct face to face interview techniques. The response rate was 90.5%, corresponding to 105 co-operatives.

In general, the PWCs did not provide any other relevant services to their members, beyond the transformation of their wine-grape production, and we concluded that, in economic terms, their set of total differential net benefits derives almost entirely from the prices paid for the grapes. This raises a fundamental qualitative question, namely «are the prices paid to the members for the grapes they sell to the co-operative, smaller, equal or higher to those paid by other firms?». The survey shows that 12 (11.4%), 48 (45.7%) and 45 PWCs (42.9%), paid prices that, respectively, were smaller⁽⁶⁾, equal and higher to those paid by competitive firms. That is, PWCs have maintained membership levels and, in the long run, will continue so to do, if they can provide a differential (i. e. better) cash flow to members.

To evaluate the impact of the structure of human resources in PWCs on the behaviour of the qualitative variable (or *event*), the differential price co-operatives pay for their members' grapes (Y), information was collected regarding the number of co-operative employees in the following categories: (1) professional managers with delegated powers, including directors and management with decision-making autonomy (X_1); (2) technical staff with graduate qualification in fields associated with wine production (X_2); management specialists (either economists and/or mana-

⁽⁶⁾ In the long run, this unfavourable situation can only persist if there were no alternative buyers of grape-growers.

gement graduates) without delegated decision-making powers (X_3); sales staff (X_4); non-graduate, production-related staff (X_5); and non-graduate administrative staff (X_6). From the information provided by the descriptive statistics (mean, standard deviation, minimum, maximum, and the number of co-operatives with zero observations for a given variable), as summarised in table 2, we can conclude that:

Although a diversity of situations exists, we typically confront micro-enterprises employing, on average, 18 persons, of which 11% are professionals with higher education;

A large majority of co-operatives (73%) are managed on a voluntary basis, and have no management staff with delegated powers, thereby manifesting low levels of professionalism in management;

For the control of the operations related with the production of wine, generically, the PWCs use experts (on average, 1 per PWC). However, there are 22 (21%) PWCs that have no specialists in this sector;

In the area of co-operative management, only 33% of the co-operatives employ professionals with a degree (for example, graduates in economics or in co-operative management);

Traditionally, in industries such as wine-production, whose product is still in the *maturity* phase of its life cycle, the marketing of the product plays an important role. This does not seem to be the case in PWCs, since only 30% of them have staff with formal expertise in this area;

Employees with no higher education constitute 89% of all those employed, with 79% of all employees working in the production area, and 21% in administration.

TABLE 2

Descriptive statistics relating to human resources in PWCs (N.º)

	Mean	Standard deviation	Minimum	Maximum	N.º of coops without
Managers with delegated powers (X_1).....	0.305	0.557	0.000	3.000	77
Production experts (X_2).....	1.000	0.665	0.000	3.000	22
Economists/managers (X_3).....	0.333	0.474	0.000	1.000	70
Sales staff (X_4).....	0.447	0.772	0.000	4.000	73
Production staff (X_5).....	12.857	12.783	1.000	73.000	0
Administrative staff (X_6).....	3.419	2.616	0.000	20.00	1

Source: Survey of 105 PWCs.

On the basis of the situation referred to above, and due to the nature of the data obtained in order to analyse the effects of labour skills on the economic role of the PWC, a multinomial logit ⁽⁷⁾ (MNL) of the following form was estimated:

$$\text{Prob } (Y_i = 0,1,2) = F(X_1, X_2, X_3, X_4, X_5, X_6) \quad (2)$$

⁽⁷⁾ See Greene (1993) for details of multinomial logit analysis.

The multinomial logit is used when the dependent variable takes on more than two discrete outcomes. In this case, Y assumes values 0, 1 or 2, if the co-operative pays a smaller, equal or higher amount relatively to that paid by non-co-operative firms for the grapes they buy. Multiple equations are estimated jointly in order to make an efficient use of the information available, and the coefficients for each possible outcome are interpreted with respect to a reference group, in this case the co-operatives that paid a smaller price for grapes.

In equation (2) the function $F(\cdot)$ is the logistic distribution, defined by (3):

$$\text{Prob}(Y = j) = \frac{e^{\beta_j X_i}}{1 + \sum_{k=1}^7 e^{\beta'_k X_i}} \quad (3)$$

$$\text{Prob}(Y = 0) = \frac{1}{1 + \sum_{k=1}^7 e^{\beta'_k X_i}}$$

where the coefficients are estimated with the maximum likelihood method.

The results of the logit regression are reported in table 3. For each event, the MNL coefficients in the table indicate the impact of each independent variable on the probability of each event with respect to the baseline case (i. e. the payment of a lower price), and are interpreted as affecting the odds ratio, as expressed by equation (4):

$$\ln \left[\frac{P_{ij}}{P_{i0}} \right] = \beta'_j X_i \quad (4)$$

The pseudo R^2 , which is a measure of goodness of fit analogous to the coefficient of determination in conventional regression analysis, is 21.94%⁽⁸⁾. The model chi-squared (44.62) provides evidence (at 1% level significance) against the hypothesis that all slope parameters (12) are equal to zero. The estimates of slope MNL coefficients indicate, on (log) odds, the relationship between the characteristics of human resources employed by PWCs and the performance of the prices paid for grapes from their members.

⁽⁸⁾ The pseudo R^2 is calculated as $1 - [\log(Lu)/\log(Lr)]$ where L_u and L_r is the maximum of the likelihood function when maximised with respect to all parameters and to the intercept only, respectively.

TABLE 3

Multinomial logit analysis of the effect of human resources on the PWCs economic role
(MNL coefficients)

Variables	Y=1 (same prices)	Y=2 (higher prices)
Constant	0.6128 (0.793)	(*) -2.3889 (1.026)
Managers with delegated powers	1.3674 (1.222)	(**) 2.0158 (1.113)
Production experts	(*) 1.7653 (0.776)	(*) 2.9824 (0.847)
Economists/managers	(**) 2.1967 (1.159)	(*) 2.5164 (1.206)
Sales staff	0.3213 (1.327)	-1.5840 (1.402)
Production staff	0.0261 (1.045)	0.1630 (0.110)
Administrative staff	-0.4555 (0.324)	-0.3352 (0.327)

(*) Significance at 95%.

(**) Significance at 90%.

Chi-squared — 44.64.

Pseudo R² — 0.2194.

The values in parentheses are standard errors.

Coefficients for group 0 are normalised and set equal to zero.

Based on the value and significance of the respective parameters, the results show that a positive relationship exists between, on the one hand, the (log) odds that the co-operative is able to pay a price equal to that paid by competing non-co-operative firms and, on the other, the structure of human resources employed both in production and management/administration. In the case of those co-operatives that pay a higher price, in addition to the relationship between the variables referred to above, there also exists a positive relationship between prices paid and the employment of managers with delegated powers. The remaining variables have no influence on the behaviour of the dependent variable.

In summary, although the PWCs are economic units of small dimension, the fact that they have qualified staff both at management and production levels positively affects their capacity to fulfil their economic role, i. e., the relative probability of being able to pay grape prices equal or higher than those paid by their competitors.

4 — Final remarks

In the food system of the EU, vertical co-ordination among farmers in the form of co-operatives is the preferred means adopted by farmers to market their produce.

The objective of this paper was to present a model able:

- a) To summarise in a single function the economic role of agricultural co-operatives; and
- b) To provide the basis for the empirical analysis of the contribution made by the human resources employed in PWCs.

Data obtained from a questionnaire submitted to a large sample of PWCs led to the conclusion that, generally, the sector consists of micro-enterprises whose net benefits, transferred to their members, come mainly from the prices paid for grapes. In their wine production and administrative sectors, PWCs essentially employ staff without higher education qualifications. The few with higher education qualifications are mostly involved in wine production, middle management and marketing. However, the majority of PWCs are managed on a voluntary basis by a board of directors, with little or no delegation of decision-making power to other managerial staff.

The partial regression coefficients that have a statistical significance in the logit model show that the relative probability of PWCs paying their member's grape prices:

- a) Equal to those offered by competing non-co-operative firms, is positively related with the employment of professionals with a higher educational level in the areas of wine production and overall management; and
- b) Higher than those offered by competing non-co-operative firms (and in addition to the above relationship), there is a positive relationship with the existence of full time managers with delegated decision-making power.

That is, our results show that PWCs can increase the probability of improving their performance (both in terms of membership and net benefits provided) through strategies of increasing recruitment of skilled professionals in the areas of wine production and management and by delegating more decision-making powers from the board to professional (i. e. qualified) managers.

Co-operatives are complex units as far as decision-making process and control are concerned (Vitaliano, 1983), since human resources are an endogenous component of this process. In this context, and without questioning the validity of the main conclusions, we are convinced that the best perception of such a complex problem requires additional research in areas such as:

- 1) The definition and testing of other performance indicators to evaluate different co-operative strategies, as an alternative to the differential cash-flows (similar or higher prices) approach used in this paper;
- 2) And an examination of the connection between strategies, property rights and human resources.

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