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The Internationalization Determinants of the Small Agro-Food Firms: Hypotheses and Statistical Tests

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Abstract

The purpose of this paper is to establish a link between competition perceived by the small firm manager and the decision to export. Using a sample of 335 small agro-food firms as a basis to our study, the statistical model presented shows a negative connection between the high perceived quality competitiveness and the fact that a firm exports.

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1. Introduction

Confronted with globalization of the economy, some firms are content to internationalize their business operations as opposed to aiming at globalization. This is particularly true of the small agro-food firm (SAFF), many of which are increasingly trying to market a proportion of their production on the export market. Indeed, the statistics produced by SCEES (French Ministry of Agriculture Department of Economic and Statistical Studies) show that these firms would appear to be quite dynamic in the export market sector (reasonably high export / turnover ratio):

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- 4.1 point increase of export ratio (from 16.8 to 20.9%) between 1988 and 1997 in agro-food firms with a payroll exceeding 500;
- 4.6 point increase (from 13.6 to 18.2%) in agro-food firms presenting a payroll from 50 to 500;
- 1.2 point increase (from 10.6 to 11.8%) in agro-food firms presenting a payroll from 20 to 49;
- 6 point increase (from 9 to 15%) in agro-food firms presenting a payroll from 10 to 19.

The establishment of agro-food firms within a given geographical area is a special feature of this type of firm as it can be highlighted to help qualify the product type. Thus, the location of the firm for the manufacture of local products would appear to function as a potential lever for the internationalization of a SAFFs product(s) (Couderc & Remaud, 2000). Similarly to Bonnacorsi (1992), this point leads us to postulate that the marketing of various quality products is intimately connected to the export phenomenon of these firms. While the small-agro-food firm is not able to compete with large firms in terms of marketing consumer products, quality could well be one of the competitive keys supporting the validity of the export strategy.

This paper's aim is analyzing and explaining the connection, in the case of the small agro-food firm, between the act of exporting and the manager's perception of high quality competition for the products manufactured. Stretching the study a little further, we seek to establish the factors accounting for these two supposedly positively connected variables.

Going over the existing literature enabled us to test the research hypotheses. Having done that, by presenting the sample of selected SAFFs and an econometric model, we developed the methodological aspect of the study. Finally, the results of our research are given and discussed.

2. Research hypotheses

The works of authors, having taken an interest in the internationalization of these firms' business, are largely devoted to the connections linking the size of the firm to export ratio (Calof, 1993; Zou & Stan, 1998; Wolff & Pett, 2000). While most studies reveal the positive connections between these two variables, others tend to adduce the factors accounting for the internationalization of small firms. This is the case with Calof (1994) or Bonaccorsi (1992) papers' for which the size of the firm is not a barrier to export.

The first hypothesis we tested is directly related to the proposals of Bonaccorsi (*ib*., p. 631): "*International competitiveness of small firms is much more based on*

general competitive factors such as product quality, rather than on explicit marketing strategies and policies". Pursuing the idea that the manufacture of local products can be used as a lever for exporting in small agro-food firms, we assumed there was a positive connection between product quality competitiveness perceived by the manager and his business on the export market. However, this paper offers no judgement regarding the meaning of the relation between these two variables.

Hypothesis 1: Competitiveness perceived by the small agro-food firm manager of the quality of the products he/she manufactures is positively related to the export phenomenon.

Developing upon various works devoted to the role of human resources, Manolova et al., (2002), attempted to broaden the basic grounding accounting for the internationalization of small agro-food firms by looking at them from the angle of their human capital. Human capital in these firms is crystallized around the manager of the firm, whether he is the owner of the firm or not. The components contributing towards this capital are experience, competence (aptitude), perception of the environment, market choices from a geographical point of view, age and educational background of the manager. The results of the research led by these authors show that [the firm managers] managerial competence and perception of the environment are the human capital factors that have the greatest interactive effect on export operations in small agro-food firms. On the other hand, demographic factors such as the age and standard of education of the firm manager, together with geographical orientations, would appear not to differentiate the firms in terms of export market operations.

Developing on the works of these authors, we offer three hypotheses to account for the internationalization of small firms based on the assumption that the phenomenon is related to a strong element of quality competitiveness.

Hypothesis 2: age (H2a) and standard of education (H2b) have no positive connection with the internationalization of small firms.

Hypothesis 3: a managerial behavior on behalf of the manager has a positive connection with the internationalization of small firms.

Hypothesis 4: the manager's perception of increased competition has a positive connection with the internationalization of small firms.

In addition to these different hypotheses, we introduced two other hypotheses in connection with the characteristics of the small firm. The first of these hypotheses ties in with previous studies devoted to the connections between the

size and internationalization of the firm (Calof, 1993). The size of the firm was measured according to the turnover it generated.

Hypothesis 5: internationalization of the small firm is positively connected to the level of its business operations.

This last hypothesis makes reference to the structure of the firm's ownership. While a certain number of small firms will doubtless not grow (Marchesnay, 1988), others enjoy a genuine financial and shareholding life cycle (Ang, 1991; Couderc, 2000). Assuming that considerable financial means are required for a firm to be able to export, and given that it is increasingly difficult for these firms to raise the necessary capital themselves, we have proposed the following hypothesis:

Hypothesis 6: internationalization is positively related to the opening of the small firm's capital.

All of these hypotheses were tested on a representative sampling of small agro-food firms in Languedoc-Roussillon ([i]) (France). The tests were based on an econometric model described hereafter.

3. Methodologically related aspects

3.1. Data

The database used in this study is based on SAFFs from Languedoc-Roussillon region (France). These small firms were included in a larger study of agro-food firms undertaken in 1998 within the frame of INRA-DAPP[ii]'s research program (Development factors of agro-food firms in Languedoc-Roussillon).

The sample of SAFFs is representative of the firms in this sector on a regional level. The SAFF database used for this study, therefore, is a subset of this sample, and consists of exclusively "SAs" (public companies) or "SARLs" (private companies) with payrolls ranging from 6 to 55 (fixed term + full time over one year). The study was completed by way of a questionnaire filled out on the occasion of one-to-one meetings. Developing the questionnaire also led to the obtaining of other, more qualitative details. Co-operative wineries were not included in this subset due to the variables to be analyzed. Indeed, the variables of this type of firm would not have been compatible with those retained for the purpose of this study (capital structure, management and running methods) unless they had been re-processed prior to entry in the study. After removing the missing values, our database was actually based on 335 observations (empirical work is based on this number of observations). Because of the scale of this

database, we were able to test a certain number of the variables mentioned in the study hypotheses.

3.2 The dependant variables

In this study, two endogenous variables were taken into account:

- A decision to export variable *d* worth 1 when the firm exports, and 0 when it does not export.
- A *COMPQUAL* ordered variable revealing information on the perception of the firm manager as regards the "quality competitiveness" of the products produced by his/her firm. Practically speaking, the *COMPQUAL* variable can be of three types:

$$COMPQUAL \begin{cases} = 1 & \text{Very low + low competitiveness} \\ = 2 & \text{Average competitiveness} \\ = 3 & \text{High competitiveness} \end{cases}$$

The *COMPQUAL* variable therefore gives information as to the competitiveness of the firm. It is reasonable to believe that the manager of the firm has the best possible information concerning the competitiveness of his/her business. By saying this, we are taking up Penrose's (1959) theory whereby the competitive edge of firms, and particularly small firms, is largely instigated by the firm's manager. Pursuing this idea a little further, if the manager is limited in his/her ability to digest the information he/she receives, one can then interpret *COMPQUAL* as a subjective evaluation of this competitiveness.

3.3. The independent variables

The determining factors of *COMPQUAL* quality competitiveness and the causes of export decisions, *d*, were researched equally as much in terms of the manager's characteristics, the characteristics of the firm itself, and in the nature of the environment the firm is confronted with. All of the explanatory variables, including descriptive statistics, definitions and methods are given in Appendix 1. We propose, however, to give some details of these exogenous variables.

Firm manager characteristics

Overall human capital: the effect of the firm manager's overall human capital is approached through his/her standard of education. The group of managers with the highest qualifications (*EDUC =1*) was used as a reference group.

Specific human capital: the manager's age *AGE* was introduced so as to appreciate the effect of professional experience and the role of the generation

effect. The purpose of this variable was to understand the effect of knowledge acquired as a result of the manager's decision following completion of studies.

The manager's behavioral nature: an *ENTREUP* indicator was introduced, worth 1 if and when the manager's behavior is considered as entrepreneurial. The indicator was worth 0 if and when the managers' behavior was found to be patrimonial or managerial. The small firm manager's behavior could easily be described more subtly.

Firm characteristics

Firm ownership structure: in a short-term analysis, capital structure (*CAPITAL*) can be introduced as an explanatory dimension, which is then considered as exogenous. Using this CAPITAL structure, the firms can be categorized according to an analytical grid developed by Le Vigoureux (1997) between *CAPITAL = 1* independent, *CAPITAL =2* open capital and *CAPITAL=3* controlled firms. *CAPITAL=1* was retained as the reference modality.

Life of the firm: *LIFE* of the firm was used to check the life cycle effect of the firm. This variable was constructed from the year the firm was officially set up. A *LIFE2* (squared life) quadratic term was introduced in order to test the existence or not of a linear relation between the joined probabilities of being an exporter to a level of competitiveness and the life of the firm.

Type of product sold: firms were distinguished according to the nature of their *PRODUCT* business, between cereal derivatives, animals, fruit and vegetables, wine products. Firms selling fruit and vegetables (*PRODUCT=3*) were retained as the reference group.

Firms' former business: Firms were expected to assess their competitiveness and export level on the basis of turnover from previous years. Business level was measured according to turnover of 1997 (*TU97*).

The nature of the competitive environment

Beliefs and anticipations as to the development of the market were explicitly taken into account. Managers were questioned as follows: do you expect to see new competitors within the next twelve months? According to the answers that were given, a *COMPET* nominal variable with three modalities helped distinguish between the managers who: did not answer this question (*COMPET=1*), anticipated on the arrival of new competitors (*COMPET=2*), answered that they believed there would not be a new competitor (*COMPET=3*).

3.4. Econometric model

The empirical work consisted in estimating a modified version of a bivariate probit model (with correction of heteroscedasticity) and hypotheses tests. To the extensions already reported in econometric literature (Boyes & *al.*, 1989; Poirier, 1980; Van de Ven & *al.*, 1981), the empirical model presented in this paper generalizes the bivariate probit to the case of ordered polytomic endogenous variables. Veritably, unlike the simple bivariate probit which only contains two binary variables (Green, 1997; Maddala, 1983), the ordered polytomic bivariate probit shown in this work includes a binary variable (decision to export) and an ordered discreet variable[iii] (competitiveness levels). The econometric model is developed in a second appendix.

4. Econometric results

Our econometric tests provided a clear answer to the question as to whether there was a connection between the decisions to export and the managers' evaluation of the firm's competitiveness. As a rule, the explanatory variables tested did not affect in the same way the joined probabilities of being an exporter and enjoying a certain degree of competitiveness. Let us recall here that the parameters that were estimated (**s**,**â**,**á**) have no absolute interpretation and only provide a scale as to the intensity of the desire to export or as to intensity of propensity to strongly evaluate the quality of the products of the firm. In order to lend weight to each determinant of the decision to export and declared level of competitiveness, we calculated the marginal effects of the explanatory variables for each firm included in the sample[iv]. Results to the tests were summarized as follows:

Being an exporter with strong perceived quality competitiveness would appear to be negatively related. A straightforward *chi-two* test revealed that the decisions to export and the evaluations as to the levels of competitiveness were connected (the *chi-two* amounted to 23.70 for two degrees of liberty, the *adjusted contingence coefficient* amounted to 0.37, *Cramer V* amounted to 0.26). Thus, the *Gamma static* measurement revealed a value of -0.3 with a confidence interval at 95% of [-0.125, 0.47], which confirms the existence of a moderately negative and imprecise linear relation.

Symmetric and asymmetric Lambda statistics did not provide any information about the causal relations between the two endogenous variables (*COMPQUAL* and *d*). Thanks to the estimated ordered polytomic bi-varied probit model the evaluation correlation coefficient was estimated at ***r=-0.40*** with a standard deviation of 0.19. One should be prepared to expect the firms having reported low quality competitiveness to be the ones that were the most inclined to export.

Hypothesis 1, therefore, would not be validated in the case of our sample. The variables, which have a negative effect on the decision to export, have a positive effect on the evaluation of competitiveness and vice-versa. However, we shall see that some variables have a similar affect on both perceived quality and the fact of exporting.

The probability of finding a SAFF reporting the manufacture of high quality products which does not export is quite high (cf. appendix 3). Indeed, the probability (estimated by the model) of finding an exporting firm amounts to *P[d=1]=44,71 %* with a standard deviation of 0.37 (empirical frequency is 45.07%). Most SAFFs claim to be at a high level in terms of quality competitiveness. The estimated mean probability of this is *P[COMPQUAL=3]=48,79%* with a standard deviation of 0.25 (empirical frequency is 48.96%).

Table 1: Mean of joined probabilities estimated on the basis of the model from 335 SAFFs

Whether the firm exports or not, quality competitiveness plays a major part. According to our calculations, the level of quality competitiveness is very high (*COMPQUAL=3*) in 57.7% of the exporting SAFFs. However, this high proportion is the same in the case of the SAFFs which do not export. It can be noted in Table 2 that the conditional probabilities (cf. relations 10 in the econometric model in appendix 2) are similar to one another depending on whether the firm exports or not.

Table 2: Average conditional probabilities estimated on the basis of the model from 335 SAFFs

The older the manager of the firm, the more the SAFF is perceived as competitive, yet the less it exports. The probability of exporting is high among young managers. On the basis of our results it can be asserted that the manager's experience, measured in accordance to his age, does not lead to a greater development on the international market. Quasi-age elasticity was assessed at 51%. The effect of one year's aging decreased the probability of exporting while remaining competitive to the rate of -0.007, which corresponds to a mean quasi-elasticity of -0.37. Hypothesis H2a could therefore be valid among SAFF managers in Languedoc-Roussillon.

Educational background has a positive effect on the probability of exporting. Managers whose standard of education is higher than the Baccalaureate, stand a better chance of being exporters. Hypothesis H2b may therefore be invalid. However, the parameters associated with this *EDUC* dimension are imprecise (a nil hypothesis is accepted at the usual significance threshold for a *Chi-two* 2.26

and a *p-value* of 0.32 for two degrees of liberty). The parameters associated to *EDUC* are more precise when it comes to explaining the probabilities related to quality levels (*Wald's test* yields a *Chi-two* 17.42 for two degrees of liberty). The managers with the highest standard of education are the most likely to consider their firm as highly competitive. The probability of a high level of competitiveness *P[COMPQUAL=3]* decreases by 24% between the manager who has been to university and the manager holder of a BEP (*certificate of technical education*), or a CAP (*vocational training qualification*).

The probability of an average level of competitiveness *P[COMPQUAL=2]* increases by 14%. However, it can be noted, statistically speaking, that self-educated managers (*EDUC=3*) would not appear to differ that much from the reference group *(EDUC=1)*. Moreover, the parameter associated to the *EDUC*=3 modality (managers who are holders of a BEP (*certificate of technical education*), or a CAP (*vocational training qualification*) is only significant at a threshold of 10% when it is a case of accounting for the decisions to export.

Lastly, the P_{13} (cf. relation in the econometric model in appendix 2) probability that a SAFF should be a (*d=1)* exporter and that its quality competitiveness should be high (*COMPQUAL=3*) decreases slightly (-0.01). By comparison with the other explanatory variables introduced into the model, standard of education admittedly plays a significant part on the probability of exporting but it is not, however, essential. Results in connection with the age of the SAFF were similar to this previous finding.

Young firms are more likely to be exporters, but assessment as to the level of quality competitiveness is not affected by the life of the firm. The probability of exporting products *P[d=1]* increases according to the age of the firm (*LIFE*). Age quasi-elasticity amounts to 1%. However, from a certain age towards half of forty years, then probability becomes low and decreases thereafter until it becomes nil. The nullity test of parameters *LIFE=LIFE2=0* shows that the nil hypothesis is rejected at 5% (*Chi-two=7.04; p-value=0.02* for 2 degrees of liberty), but when it comes to explaining the probabilities related to the different levels of competitiveness, the parameters associated to the age of the firm do not appear to be statistically different from 0 (*Wald's test* yields a very low 0.07 *chi-two* for two degrees of liberty, equivalent to a *p-value* of 0.96). The effect of one year on the joined probability of exporting and being at a high level of competitiveness amounts on average to 0.1% in our sample (0.01 quasi-elasticity).

Entrepreneurial SAFF managers have a low level of quality competitiveness and stand a higher chance of exporting. By comparison with the other managers whose attitude is either managerial or patrimonial, the probability of exporting increases by 17% in the case of the entrepreneurial manager. The probability of a high level of competitiveness increases by 9%. The joined probability of exporting

while enjoying a high quality level (*P[COMPQUAL=3, d=1]*) increased on average by 4% in our sample. The probability of not exporting at all while enjoying a high quality level (*P[COMPQUAL=3, d=0]*) decreases by 13%. Hypothesis 3 is not therefore validated in our sampling of SAFFs in Languedoc-Roussillon (France).

SAFF managers who foresee the advent of new competitors on the market are inclined to be greater exporters and have a high perception of the level of quality competitiveness. Concerning the decisions to export, *Wald's test* joined to this explanatory dimension yielded a *Chi-two* of 20.42 with 2 degrees of liberty. Similarly, the test yields a high value for the distance of the *Chi-two* 9.20, equivalent to a *p-value* of 0.02.

When a manager does not know if he/she is to expect more competitors on the market in the near future, the probability of being an exporter decreases by 25% and the chances of this manager assessing his/her firm as highly competitive, are decreased by 31%. Hypothesis 4 is therefore validated in the case of SAFFs in Languedoc-Roussillon (France).

The level of the firm's former business operations is inclined to encourage the development of exports. The higher the turnover of a firm and the more it is inclined to export its products. A 1% increase of the previous turnover increases the probability of exporting by 2%. Furthermore, turnover would appear not to affect the evaluated levels of competitiveness. It is our belief that a 1% increase of the previous turnover increases the probability of exporting and evaluating a high level of competitiveness equal to 0.007. Hypothesis 5 is therefore validated in the case of SAFFs in Languedoc-Roussillon (France).

Independent firms are great exporters and report a low level of quality competitiveness. The CAPITAL explanatory dimension would appear to be highly significant concerning the joined probability of exporting and reporting a particular level of competitiveness. *Wald's* invalidity test of this dimension when it is a matter of explaining export levels, yields a *Chi-two* of 21.25 with 2 degrees of liberty. Similarly, applying *Wald's* test to explain the probabilities in connection with the levels of competitiveness yields a *Chi-two* of 38.89. According to our estimations, the joined probability of a firm exporting and enjoying a very high level of quality competitiveness (*P[COMPQUAL=3, d=0]*), decreases by -0.37. Hypothesis 6 is not therefore validated in the case of our sample of SAFFs in Languedoc-Roussillon (France).

Concerning the other explanatory factors tested, a number of other findings were noted. Thus, the geographical location of the firm would appear not to be a pertinent explanatory dimension. Within the significance thresholds currently retained, this variable was never significant, no matter which specification was retained. On the other hand, low quality greengrocer SAFFs are the most

inclined to be exporters. The summary tables presented in appendix 4 show that the greengrocer (fruit and vegetable) sector SAFFs are the most likely to be exporters. *Wald's test* yields a *Chi-two* of 58.08 with 3 degrees of liberty, which produces a *p-value<0.0001*. At the same time, however, these same greengrocer firms report low quality competitiveness. *Wald's test* yields a *Chi-two* of 14.91 with 3 degrees of liberty. The joined probability of not exporting while enjoying a high level of competitiveness (*P[COMPQUAL=3, d=0]*), increases by 0.34 in the case of a firm selling cereal by-products.

5. Discussion and conclusion

The first result of this study is in contradiction with both Bonaccorsi's (*ib.*) assumptions and the descriptive approach of Couderc and Remaud (*ib.*) for all SAFFs in Languedoc-Roussillon (France). There could be several explanations to the rejection of hypothesis 1, i.e., a negative connection between the high perceived quality competitiveness and the fact that a firm exports. Firstly, the manner according to which quality competitiveness is perceived by the SAFF managers, is, as it has already been stated, very largely a subjective judgment. This means that exporting managers could very well overestimate the quality competitiveness of their firms. In other words, a direct interpretation of the rejection of this hypothesis could well be that the competitiveness of exporting SAFFs on the international market is based only on the marketing of a specific quality of product (particularly local products). The following graph (Graph 1) gives further support to this proposition.

The index for quality competitiveness results from the question: concerning quality, in relation to your immediate competitors, would you say that your key product was: not competitive, barely competitive, fairly competitive, quite competitive, very competitive? This "quality competitiveness" index was constructed by adding the answers [quite and very competitive / all the answers] to the question. A "price competitiveness" index was produced in the same way.

Graph 1: price and quality competitiveness in relation to exported turnover

The graph shows that, concerning price competitiveness, 73% of SAFFs exporting between 1 and 25% of their turnover, feel highly competitive. This rate drops to 53% in firms whose exports exceed 25% of turnover. Concerning quality competitiveness, the opposite phenomenon is observed. In other words, SAFFs whose exports exceed 25% of their turnover believe they have a competitive edge as concerns the quality of their product, whereas SAFFs whose export trade is between 1 and 25% of their turnover believe they have a competitive edge as concerns the price at which their product is sold. The graph also shows that a greater number of SAFFs are included in the "export between and 25% of turnover" category. Export rates may therefore contribute to account for the

negative connection linking the fact of exporting and high perceived quality competitiveness. More generally, it could be concluded that SAFFs whose exports exceed 25% of their turnover tend to specialize in products that are different and related to a given region, whereas, in the case of SAFFs whose exports are between 1 and 25%, price is considered as a more determining factor.

Concerning hypothesis 2 dealing with human capital, the results are less clear. Hypothesis H2a (age is not positively related to the fact of exporting) could be validated whereas H2b (standard of education is not positively related with the fact of exporting) is not validated. In other words, the younger the SAFF manager and the higher his standard of education, the higher the chances of his/her firm exporting. These results, we believe, are connected to the non-validation of hypothesis 3 concerning the estimated attitude of the SAFF manager. Thus, rather than managerial behavior, it is the entrepreneurial behavior that would seem to lead SAFF managers to the export market. More generally, the acceptance of an element of risk in connection with opening to the international market could be easier for the entrepreneurial manager who is better informed, more highly qualified and more dynamic. Because they are better informed, these exporting managers are able to see the competition strengthening on their markets (hypothesis 4 validated). As reported by Manolova et al. (ib.) human capital, therefore, is a key factor for exporting, but the criteria are different from those mentioned in particular by Westhead et al. (2001). The profile of the exporting SAFF manager in Languedoc-Roussillon (France) would be a person of a young age who is more highly trained (according to the standard of education), dynamic and attentive to the competition on the market.

Alternatively, it would be interesting to know if these managers are adequately supervised for them to open to the international market. In previous studies several authors have attempted to link the skills of a firm's staff with internationalization (Ogbuehi & Longfellow, 1994; Bloodgood & *al*., 1996; Reuber & Fischer, 1997; Manolova & *al*., *ib*.). In truth, it is a well known fact that, beyond the financial means, exporting firms and particularly the smaller of these firms are submitted to an increasingly big organizational structure (Deysine & Duboin, 1995). For these firms, launching into the export market should lead to assigning at least one person to the field and one person to the management of export sales. One could develop this phenomenon by assuming that the number of employees in these firms should, relatively speaking, be greater than that of the firms which do not export.

Graph 2: (Average) human resource mobilization for each job and per exported turnover bracket

Generally speaking, launching into the export market leads SAFFs to employing at least one extra executive and one extra staff-member in management. When

the full time staff is considered as a whole, the situation tends to vary a little more according to the export rate of the firm. Overall, however, these results tend to confirm those of the literature mentioned hereafter.

It is unnecessary to formulate any particular commentary on the acceptance of hypothesis 5 (an export activity positively related to the level of the activity). However, it is interesting to note that the result consolidate analogue results reported in the literature.

In the existing literature on SAFFs, few studies have actually focused on hypothesis. One explanation to this is that it is true that the small firm is generally thought of as being independent. However, quite a large number of these firms are eventually obliged (and sometimes forced) to open their capital in order to fund increasingly intangible assets (Marion, 1995; Couderc, ib.). Contrary to expectations (hypothesis invalidated), the results from our study show that it is especially the small SAFFs with a low perceived level of quality competitiveness that are deeply involved in the export market. It would seem this result is related to exporting SAFFs' financial difficulties. In terms of cash flow, the more these firms export and the more their average cash flow is in the red (over a period of 4 years: 1995-1998), -29 K€ for SAFFs exporting between 1 and 25% of their turnover and -111 K€ for the SAFFs whose exports exceed 25% of their turnover. On the other hand, the cash flow of the SAFFs which do not export remains in the black throughout the same period (1995-1998).

As a conclusion, we would like to stress a point which, in our opinion, puts the impact of our comments into perspective. It would seem that, perhaps like any other industrial sector, the agro-food sector is somewhat unique. Issues such as integration and local impregnation of the manager, (Marchesnay, 1998) history, the fact that the goods are perishable, international standards, and even the local image of the product(s), have an impact on the marketing strategy of the product(s). Consequently, due to the apparent specificity of this particular market, it would be a good idea to compare the results presented in this paper with the results obtained from a sample of small firms operating in the same sector.

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Table 1: Mean of joined probabilities estimated on the basis of the model from 335 SAFFs

	Exporting SAFF	Non-exporting SAFF	Competitiveness
Quality competitiveness	$P(COMPQUAL = j, d = 1)$	$P(COMPQUAL = j, d = 0)$	$P(COMPQUAL = j)$
Low *COMPQUAL=1*	0.071***	0.046***	0.11 ***
Average *COMPQUAL=2*	0.202***	0.190***	0.39***
High *COMPQUAL=3*	0.172***	0.315***	0.48***
Export *d*	P[d=1]=0.44***	P[d=0]=0.55***	1

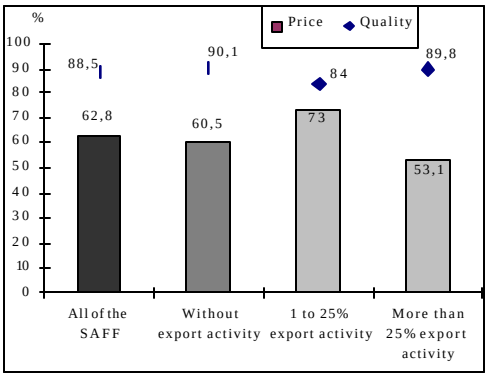
*** significant at 1%

Table 2: Average conditional probabilities estimated on the basis of the model from 335 SAFFs

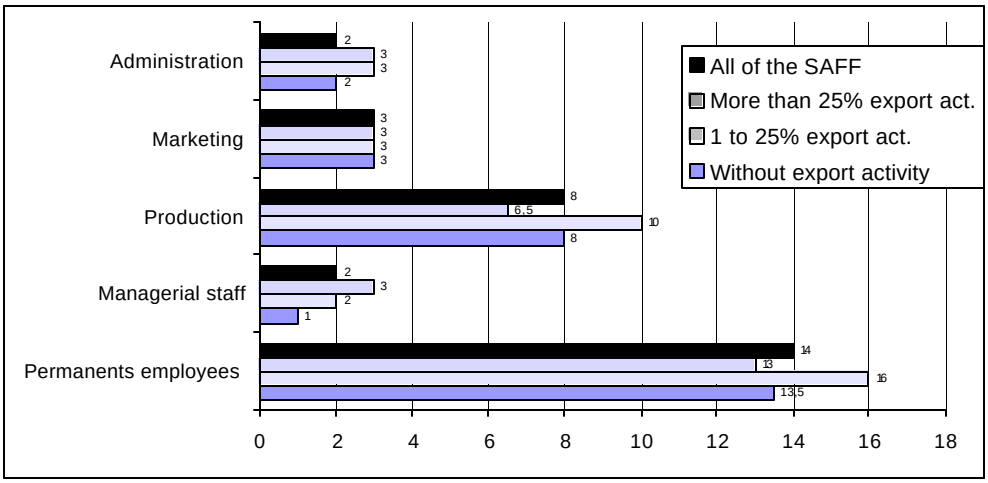
	Exporter SAFF d=1	Non-exporter SAFFd=0
Quality competitiveness	$P(COMPQUAL = j / d = 1)$	$P(COMPQUAL = j / d = 0)$
Low *COMPQUAL=1*	0.096 ***	0.079***
Average *COMPQUAL=2*	0.326***	0.356***
High *COMPQUAL=3*	0.577***	0.564***
Total	1	1

*** significant at 1%

Graph 1: price and quality competitiveness in relation to exported turnover



Graph 2: (Average) human resource mobilization for each job and per exported turnover bracket



Appendix 1: Definition and modalities of explanatory variables (335 SAFFs)

Designation of variables	Values and modalities considered by the explanatory variables	Mean Frequency
Characteristics of firm manager		
Overall human capital. EDUC (ordinate discreet variable)	=1 BAC + 2 year university diploma, =2 BEP, CAP, BAC =3 Self-educated or other trainings	35.5% 49.6% 14.9%
Specific human capital. *AGE* (continuous variable)	*in years*	50.04 (9.43)
Behaviour nature of manager. ENTREUP (binary discreet variable)	*=1 Managerial behaviour.* =0 Patrimonial or managerial behaviour	44.5% 55.5%
Firm characteristics		
Firm ownership structure. CAPITAL (nominal discreet variable)	=1 Independent firms =2 Open capital firms =3 Controlled firms	57.9% 24.2% 17.9%
Life of the firm. LIFE (on-going variable) LIFE2 (on going variable)	Life of the firm in years Life squared	24.52 (20.41)
Type of product sold PRODUCT (nominal	=1 Cereal by-products =2 Animal products	26.9% 28.4%

discreet variable)	=3 Fruit and vegetables =4 Viticulture and other products	23.3% 21.5%
Former profitability of firm. TU97 (on-going variable)	1997 Turnover in Kilo-francs - year of study = 1998	30742.13 (64241.98)
Environmental characteristics		
Nature of the information held by the firm managers . CONCUR (nominal discreet variable)	=1 : Ignore, does not know =2 :Yes, new competitors =3 : NO, no new competitors	12.8% 44.5% 42.7%
Geographical location. *AUDE* (binary discreet variable)	= 1 if the firm is located in the *département* of Aude = 0 other case	18.2% 81.8%

In brackets: standard deviation

Appendix 2: The econometric model

Case with a connection between competitiveness level and the decision to export

In order to explain the decision or not to export agro-food products, one may assume that the manager compares profitability obtained when exporting or not exporting the firm's products. Let us assume that for each manager (spotted by an *i* index) of an *n* sized sample, the profitability difference between each alternative is represented by a latent y_i* variable. Let us also assume that this latent variable is a linear combination of a certain number of explanatory variables:

$$y_i^* = \boldsymbol{\acute{a}}' \boldsymbol{X}_i + m_i \qquad i=1,\ldots n, \tag{1}$$

with $\boldsymbol{\acute{a}}'$ the parameter vector, m_i a nil mean error term with a variance of $\boldsymbol{s}^2_{m_i}$, and $\boldsymbol{X}_i$ the ensemble of these variables which affect the *i* firm's profitability. For each *i* firm, a d_i Bernoulli variable worth 1 if and when the firm exports agro-food products, if not d_i=0, was defined.

$$d_i \begin{cases} =1 & \text{si } y_i^* = \boldsymbol{\acute{a}}' \boldsymbol{X}_i + m_i > 0 \\ =0 & \text{si otherwise} \end{cases} \tag{2}$$

Furthermore, let us lay down the $COMPQUAL_j$ variable to be explained which describes the competitiveness levels ($j=1,\ldots, J$). In our case, we have three levels of competitiveness ($J=3$). We can assume the existence of a w_i* continuous latent variable, explained by the $\boldsymbol{Z_i}$ characteristics observed and $\boldsymbol{e}_i$ random shocks:

$$w_i^* = \hat{\boldsymbol{a}}' \mathbf{Z_i} + \boldsymbol{e}_i \qquad i=1,\ldots,n \tag{3}$$

$\boldsymbol{e}_i$ is a nil mean stochastic term with a standard deviation of $\boldsymbol{s}_{ei}$, $\hat{\boldsymbol{a}}$ a vector of parameters containing the intercept. When the w_i* variable is within the intervals as set out by unknown s_j thresholds, a particular *j* level of competitiveness is observed:

$$COMPQUAL_i = j \quad si \quad s_{j-1} < w_i^* \leq s_j \qquad j=1,..,3 \tag{4}$$

According to (4), a firm with a level of competitiveness $j=1,2,3$ is observed when the latent w_i* variable is within a particular $]s_{j-1},s_j]$ interval and at the same time the manager would do well to export $y_i^*>0$. We assume that the error terms $(\boldsymbol{e}_i, m_i)$ follow a nil mean bivariate normal distribution with a variance covariance matrix $\mathbf{W}$:

$$\grave{U} = \begin{vmatrix} s_e & r s_e s_m \\ r s_e s_m & s_m \end{vmatrix} \tag{5}$$

With this matrix we also postulate homoscedasticity. Thus, the probability of observing a firm with a certain level of competitiveness exporting and yet, does not export, is respectively as follows:

$$\begin{aligned} p_{1j} &= P[d_i = 1, COMPQUAL_i = j] \\ &= \Pr[s_{j-1} < w_i^* \le s_j \ \ et \ y_i^* > 0] \\ &= P(e_i \le s_j - \hat{a}' Z_i, m_i > -\acute{a}' X_i) - P(e_i \le s_{j-1} - \hat{a}' Z_i, m_i > -\acute{a}' X_i) \\ &= F\left(\frac{s_j - \hat{a}' Z_i}{s_e}, \frac{\acute{a}' X_i}{s_m}, r\right) - F\left(\frac{s_{j-1} - \hat{a}' Z_i}{s_e}, \frac{\acute{a}' X_i}{s_m}, r\right) \end{aligned} \tag{6}$$

$$\begin{aligned} p_{0j} &= P[d_i = 0, COMPQUAL_i = j] \\ &= \Pr[s_{j-1} < w_i^* \le s_j \ \ et \ y_i^* \le 0] \\ &= P(e_i \le s_j - \hat{a}' Z_i, m_i \le -\acute{a}' X_i) - P(e_i \le s_{j-1} - \hat{a}' Z_i, m_i \le -\acute{a}' X_i) \\ &= F\left(\frac{s_j - \hat{a}' Z_i}{s_e}, -\frac{\acute{a}' X_i}{s_m}, r\right) - F\left(\frac{s_{j-1} - \hat{a}' Z_i}{s_e}, -\frac{\acute{a}' X_i}{s_m}, r\right) \end{aligned} \tag{7}$$

with $F(.,.,r)$ function of standard bi-varied distribution (normal) evaluated to the points $s_j - \hat{a}' Z_i / s_e$, $\acute{a}' X_i / s_m$. In total, we have $2 \acute{} J$ joined probabilities.

According to this model (ordered polytomic bivariate probit), the probability of exporting products is more complicated than the one generated from a simple binary probit. Indeed, the probability of exporting according to the models is given as follows:

- *Probability of exporting generated by the ordered polytomic bivariate probit*

$$\begin{aligned} P_1 &= P[d_i = 1 | Z_i, X_i] = \sum_{j=1}^{j=J} P[d_i = 1, COMPQUAL_i = j] \\ &= \sum_{j=1}^{j=J} \left[F\left(\frac{s_j - \hat{a}' Z_i}{s_e}, \frac{\acute{a}' X_i}{s_m}, r\right) - F\left(\frac{s_{j-1} - \hat{a}' Z_i}{s_e}, \frac{\acute{a}' X_i}{s_m}, r\right) \right] \end{aligned} \tag{8}$$

- *For a simple binary probit:* $p_i = P[d_i = 1 | X_i] = F_m\left(\frac{\acute{a} X_i}{s_m}\right)$

With $F_m(.)$ the distribution function of the standard μ uni-varied law (normal). In the same way, the probability of a particular *j* level of competitiveness is more complicated than the one generated by a simple ordered probit (see. MaKelvey & Zavoina, 1975).

- Probability of a particular level of competitiveness generated by the ordered polytomic bivariate probit

$$P_j = P[\,COMPQUAL_i = j \mid \boldsymbol{Z}_i, \boldsymbol{X}_i]$$

$$= \sum_{m=0}^{m=1} P[d_i = m\ ,\ COMPQUAL_i = j\,]$$

$$= \sum_{m=0}^{m=1} F\left(\frac{s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i}{\boldsymbol{s}_e}, (-1)^m \frac{\hat{\boldsymbol{a}}'\boldsymbol{X}_i}{\boldsymbol{s}_m}, \boldsymbol{r}\right) - F\left(\frac{s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i}{\boldsymbol{s}_e}, (-1)^m \frac{\hat{\boldsymbol{a}}'\boldsymbol{X}_i}{\boldsymbol{s}_m}, \boldsymbol{r}\right) \qquad (9)$$

- Probability of a particular level of competitiveness generated by the simple ordinate probit

$$\boxed{p_{ij} = P[COMPQUAL_i = j \mid \boldsymbol{Z}_i] = F_e\left[\frac{s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i}{\boldsymbol{s}_e}\right] - F_e\left[\frac{s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i}{\boldsymbol{s}_e}\right]}$$

with $F_e(.)$ the distribution function of the standard uni varied law of ε (normal law).

The advantage of a bi-varied model is that if and when the coefficient of ρ correlation is different from 0, the conditional probabilities enabling an assessment of the chances of observing a level of competitiveness, taking into account the fact that the firm is orienting its operations towards the export market. These can be of several types:

$$\boxed{P_{j \mid d=1} = P[COMPQUAL_i = j \mid d_i = 1\ ] = \frac{\Pr(COMPQUAL_i = j, d_i = 1)}{P(d_i = 1)}} \qquad (10)$$

Given that the firm has decided to export, these probabilities enabled us to estimate the chances of observing a particular level of competitiveness. Because the endogenous variables are ordered and the latent variables are not observable, identification of the model requires that we set $\boldsymbol{s}_e = \boldsymbol{s}_m = 1$. The logarithm of the likelihood function of the ordered polytomic bivariate probit to be maximised is therefore:

$$\boxed{\begin{aligned} LogL(\hat{\boldsymbol{a}},\boldsymbol{a},\boldsymbol{s};\boldsymbol{r}) = \sum_{i=1}^{i=n} \Big(\sum_{j=1}^{j=3} A_{ij} \times Log\big[F(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, \boldsymbol{a}'\boldsymbol{X}_i, \boldsymbol{r}) - F(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, \boldsymbol{a}'\boldsymbol{X}_i, \boldsymbol{r})\big] \\ + \sum_{j=1}^{j=3} B_{ij} \times Log\big[F(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, -\boldsymbol{a}'\boldsymbol{X}_i, \boldsymbol{r}) - F(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, -\boldsymbol{a}'\boldsymbol{X}_i, \boldsymbol{r})\big]\Big) \end{aligned}} \quad (11)$$

with A_{ij} and B_{ij} as indicators defined as follows:

$$A_{ij} \begin{cases} =1 & \text{if } d_i = 1 \text{ (and) } COMPQUAL_i = j \\ =0 & \text{if otherwise} \end{cases} \qquad i=1,\ldots..n, \quad j=1,\ldots,J$$

$$B_{ij} \begin{cases} =1 & \text{if } d_i = 0 \text{ (and) } COMPQUAL_i = j \\ =0 & \text{if otherwise} \end{cases} \qquad i=1,\ldots..n, \quad j=1,\ldots,J$$

s_j the unknown *ordered* thresholds $s_0<s_1<\ldots.<s_3$ estimated with the model's ($\boldsymbol{a}$, $\boldsymbol{b}$) parameters. One can postulate that each of the ***(b, a)*** vectors contains an intercept term. One of the s_j thresholds is therefore not identifiable, a fact which leads us to putting forward the following normalisation: $s_1=0$. Moreover, we must postulate that $s_0 = -\infty, s_3 = +\infty$ so that the sum of the probabilities on all the intervals should equal 1 as follows:

$$\sum_{j=1}^{j=3} \sum_{m=0}^{m=1} P[COMPQUAL_i = j, d_i = m \,|\, \mathbf{Z}_i, \mathbf{X}_i] = 1.$$

Therefore, for three levels of competitiveness $J=3$, only one s_2 threshold is identifiable. In order to provide a satisfactory estimation of these {s_2, ***b, a***}parameters, we used White's correction (1982) so as to obtain estimators that would robust to heteroscedasticity.

By observing the likelihood logarithm (11), one can evaluate the possible bias that may result from a separate estimation of a simple ordered probit and a simple binary probit if $\rho \neq 0$. In the same way, unlike the *ordered polytomic bivariate probit*, the standard bi-varied probit would not, in the case of this study, enable us to make out several levels of competitiveness.

When the levels of quality competitiveness and the decisions to export are independent

If the correlation coefficient is nil $\boldsymbol{r} = 0$, the decisions to export are not related to the export levels. Relations (8, 9) in this case can be simplified as follows:

$$F(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, \boldsymbol{a}'\boldsymbol{X}_i, \boldsymbol{r}) - F(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, \boldsymbol{a}'\boldsymbol{X}_i, \boldsymbol{r}) = F(\boldsymbol{a}'\boldsymbol{X}_i)\big[F(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i) - F(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i)\big]$$

$$F(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, -\acute{\boldsymbol{a}}'\boldsymbol{X}_i, \boldsymbol{r}) - F(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i, -\acute{\boldsymbol{a}}'\boldsymbol{X}_i, \boldsymbol{r}) = [1 - F(\acute{\boldsymbol{a}}'\boldsymbol{X}_i)]\left[F(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i) - F(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i)\right]$$

The likelihood function of the logarithm to be maximized is therefore:

$$\begin{aligned} LogL(\hat{\boldsymbol{a}}, \acute{\boldsymbol{a}}, \boldsymbol{s}; \boldsymbol{r}) = \sum_{i=1}^{i=n} \Big(& d_i\, Log[F_m(\acute{\boldsymbol{a}}'\boldsymbol{X}_i)] + (1 - d_i)\, Log[1 - F_m(\acute{\boldsymbol{a}}'\boldsymbol{X}_i)] \\ & + \sum_{j=1}^{j=3} C_{ij} \times Log\left[F_e(s_j - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i) - F_e(s_{j-1} - \hat{\boldsymbol{a}}'\boldsymbol{Z}_i)\right] \Big) \end{aligned} \tag{13}$$

with C_{ij} an indicator defined simply as follows:

$$C_{ij} \begin{cases} = 1 & \text{if } COMPQUAL_i = j \\ = 0 & \text{otherwise} \end{cases} \qquad i=1,\ldots..n, \qquad j=1,\ldots,J \tag{14}$$

The likelihood function logarithm (13) is therefore simply the sum of a binary probit $LogL_1(\boldsymbol{a})$ and an ordered probit $LogL_2(\boldsymbol{b},\boldsymbol{s})$. Thus it is possible to obtain the optimal vector $\boldsymbol{a}°$ by maximizing the likelihood logarithm $LogL_1(\boldsymbol{a})$ independently from $LogL_2(\boldsymbol{b},\boldsymbol{s})$. Consequently, the usual specifications (binary probit, simple ordered probit) are irrelevant unless there is an independence between the term of errors (ε,μ), which is not the case, as we are about to see.

Correcting the heteroscedasticity Yatchew & Griliches (1984) showed that when the disturbances are of heteroscedastic nature, maximum likelihood estimators are not consistent and the covariance variance matrixes are inappropriate to perform the standard tests. The resulted presented in this paper were obtained after performing White's correction (*ib*.). Optimization programs were realized using the SAS software ([v]) (including its IML module).

Appendix 3: Econometric results

Estimation of the econometric model (joined probabilities)

		Levels of competitiveness			Decision to export		
		COMPQUAL=1,2,3			d=1		
		Parameters		Stand. Dev.	Parameters		Std deviation (a)
Intercep	Constant	0.3034171		0.6598452	3.0958062	***	1.1038209
PRODUCTS =	1 cereal by-products	0.8589175	***	0.2799958	-1.997098	***	0.3100335
	2 animal products	0.8068382	***	0.2195046	-1.650925	***	0.2590836
	3 Fruit and vegetables		Reference			Reference	
	4 viticulture and other products	0.4405061		0.2834172	-1.642176	***	0.3815963
CAPITAL =	1 Independent firm	Reference			Reference		
	2 Open capital firm	-1.37965	***	0.2246047	1.0228076	***	0.26983
	3 Controlled firm	-0.606788	**	0.302341	1.2603139	***	0.4244566
AUDE =	1 Firm located in Aude	-0.016347		0.1941137	0.3142894		0.2718629
AGE =	2 Age of firm manager	0.0233791	**	0.0104229	-0.056388	***	0.0183497
EDUC =	3 self-instructed manager	0.0165616		0.2378646	-0.243614		0.4129193
	2 BAC CAP BEP	-0.816465	***	0.2182447	-0.455142		0.3051068
	1 BAC +2		Reference			Reference	
LIFE =	Age of firm	0.0036333		0.0133426	0.0480065	**	0.0201843
LIFE2 =	Age of firm squared	-0.000041		0.000165	-0.000501	*	0.0002571
TU97	Turnover in 1997	3.4674E-7		1.8095E-6	6.6109E-6	**	3.1535E-6
ENTREUP =	1 Entrepreunerial behaviour	-0.317121	*	0.1906815	0.9037105	***	0.2558855
CONCUR =	1 does not know; ignore	-0.78844	***	0.2642928	-1.808524	***	0.4019261
	2 foresees future competitors		Reference			Reference	
	3 no other competitors	-0.339294	*	0.1889524	-0.294401		0.2383986
COEF	Correlation coefficient	-0.403801	**	0.192659			
SEUIL2	2nd threshold	1.5395681		0.118738			
Logarithm of the Likelihood function				-373.4			
A number of observations				335			
*** significant à 1%, ** significant at 5%, * significant at 10%, (a) standard deviation robuste to heteroscedasticity							

Marginal effects and quasi-elasticity of explanatory variables on the joined probabilities of exporting and enjoying a particular quality of competitiveness

Explanatory variables		Probability of SAFF exporting with …					
		Low competitiveness		Average competitiveness		High competitiveness	
		P[COMQUAL=3,d=1]		P[COMQUAL=2,d=1]		P[COMQUAL=1,d=1]	
PRODUCTS =	1 Cereal by-products	-0.0923576	***	-0.1933795	***	-0.0942212	***
	2 Animal products	-0.0614512	***	-0.2039456	***	-0.1555576	***
	3 Fruit and vegetables	Reference		Reference		Reference	
	4 Viticulture and other products	0.0058832		-0.1162446	***	-0.1993087	***
CAPITAL =	1 Independent firm	Reference		Reference		Reference	
	2 Open capital firm	-0.0861770	***	0.2201138	***	0.1013439	***
	3 Controlled firm	0.0226244		0.1774263	***	0.1396644	***
AUDE =	1 Firm located in Aude	0.0294655	***	0.0299988	***	0.0088957	***
AGE =	Age of firm manager	-0.3792079	***	-0.1505352	***	0.0109278	**
EDUC =	3 Self instructed manager	-0.0167436	***	-0.0168217	***	-0.0071497	***
	2 BAC CAP BEP	-0.1382493	***	0.0109210		0.0378661	***
	1 BAC+2	Reference		Reference		Reference	
LIFE	Age of firm manager	0.0121250	***	0.0078460		-0.0078509	*
TU97	Turnover in 1997 (a)	0.0075257	***	0.0130194	***	0.0072643	***
ENTREUP =	1 Entrepreunerial behaviour	0.0420590	***	0.0954533	***	0.0376037	***
CONCUR =	1 Does not know; ignore	-0.1421665	***	-0.1009988	***	-0.0100845	
	2 Foresees future competitors	Reference		Reference		Reference	
	3 No other competitors	-0.0783742	***	-0.0063193	*	0.0242869	***
Explanatory variables		**Probability of SAFF not exporting with …**					
		Low competitiveness		Average competitiveness		High competitiveness	
		P[COMQUAL=3,d=0]		P[COMQUAL=2,d=0]		P[COMQUAL=1,d=0]	
PRODUCTS =	1 Cereal by-products	0.3445924	***	0.0651180	***	-0.0297521	***
	2 Animal products	0.3047119	***	0.1126980	***	0.0035445	
	3 Fruit and vegetables	Reference		Reference		Reference	
	4 Viticulture and other products	0.1244068	***	0.1305249	***	0.0547385	***
CAPITAL =	1 Independent firm	Reference		Reference		Reference	
	2 Open capital firm	-0.3796369	***	0.0621275	***	0.0822287	***
	3 Controlled firm	-0.2136733	***	-0.1053659	***	-0.0206760	***
AUDE =	1 Firm located in Aude	-0.0385508	***	-0.0259850	***	-0.0038242	***
AGE =	Age of firm manager	0.0059796		0.3633356	***	0.1495000	***
EDUC =	3 Self instructed manager	0.0228294	***	0.0154184	***	0.0024673	**
	2 BAC CAP BEP	-0.1094495	***	0.1389222	***	0.0599894	***
	1 BAC+2	Reference		Reference		Reference	
LIFE	Age of firm manager	-0.0101975	*	-0.0037427		0.0018201	
TU97	Turnover in 1997 (a)	-0.0133249	***	-0.0118304	***	-0.0026542	***
ENTREUP =	1 Entrepreunerial behaviour	-0.1392187	***	-0.0381930	***	0.0022958	
CONCUR =	1 Does not know; ignore	-0.1680642	***	0.2485552	***	0.1727588	***
	2 Foresees future competitors	Reference		Reference		Reference	
	3 No other competitors	-0.0280408	***	0.0646437	***	0.0238037	***

* significant at 10%, ** significant at 5%, *** significant at 1%, (a) Quasi-elasticity

Probability and quasi-elasticity of exporting or enjoying a particular level of quality competitiveness

Explanatory variables		P[d=1]		P[COMPQUAL=3]		P[COMPQUAL=2]		P[COMPQUAL=1]	
PRODUCT	1 Cereal by-products	-0.3799583	***	0.2522349	***	-0.1282615	***	-0.1239733	***
=	2 Animal products	-0.4209544	***	0.2432607	***	-0.0912476	***	-0.1520131	***
	3 Fruit and vegetables	Reference		Reference		Reference		Reference	
=	4 Viticulture and other products	-0.3096702	***	0.1302899	***	0.0142803		-0.1445702	***
CAPITAL =	1 Independent firm	Reference		Reference		Reference		Reference	
=	2 Open capital firm	0.2352807	***	-0.4658139	***	0.2822413	***	0.1835726	***
=	3 Controlled firm	0.3397152	***	-0.1910489	***	0.0720604	***	0.1189885	***
AUDE =	1 Firm located in Aude	0.0683601	***	-0.0090853	***	0.0040138	***	0.0050715	***
SARL =	1Private firm	-0.1424444	***	0.2550927	***	-0.0896784	***	-0.1654143	***
AGE =	Age of firm manager (a)	-0.5188152	***	-0.0276057	**	-0.0276057	***	-0.3057512	***
EDUC =	3 self-instructed manager	-0.0407150	***	0.0060858	***	-0.0014033	***	-0.0047256	***
=	2 BAC CAP BEP	-0.0894621	***	-0.2476988	***	0.1498433	***	-0.0222688	***
=	1 BAC+2	Reference		Reference		Reference		Reference	
LIFE =	Age of firm (a)	0.0121201		-0.0141873	***	-0.0222688	***	0.0037319	***
TU97	Turnover in 1997 (a)	0		0.0019144	*	0.0015509	***	0.0015509	***
ENTREUP =	1 Entrepreunerial behaviour	0.1751160	***	-0.000496513		0.0572602	**	0.0398995	***
CONCUR =	1 Does not know; ignore	-0.2532498	***	-0.0971597	***	0.1475564	***	0.1626743	***
=	2 Foresees future competitors	Reference	***	Reference		Reference		Reference	***
=	3 No other competitors	-0.0604066	***	-0.1064150	0.0001	0.0583244	***	0.0480906	***
* significant at 10%, ** significant at 5%, *** significant at 1%, (a) quasi-elasticity									

[i] Languedoc-Roussillon is a region of the South of France.

[ii] For further details concerning the methodological aspects of this study, readers are invited to report to Aurier and Autran (2000).

[iii] A different extension of the bivariate probit model similar to the one given in this paper was produced by Hall et al. (2002). It helped in the correction of selection problems when considering a simple ordered probit on a non-representative sub-sample. The likelihood function of the ordered polytomic bivariate probit presented in this study is more complex and more difficult to assess.

[iv] There is no direct interpretation to the parameters of the models as presented in the tables. The sign of the parameter shows if the explanatory variable has a positive or negative effect on the joined probabilities. In order to quantify the effect of exogenous variables on the different probabilities, marginal effects of the explanatory variables were calculated. These marginal effects were obtained differently depending on whether the explanatory variable was continuous or discrete variables (readers not accustomed to this type of calculation should refer to Green, 1986 for the derivation of the marginal effects of the simple bi-varied probit). Instead of calculating the marginal effects for the mean points of the model's explanatory variables as is the custom in the existing literature, because of the relatively small size of our sample, we decided to calculate the effects for each firm included in the sample (cf. Hensher et al, 1981 for more explanation).

[v] In order to obtain a speedy convergence of the estimators (approximately a dozen iterations), the likelihood function was initialised by a vector of parameters obtained at an earlier stage from an estimation of a simple binary probit and a simple ordinate probit. The correlation factor between the disturbance terms was initialised at 0.