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EUROPEAN TECHNOLOGY POLICY AND SPANISH INDUSTRIAL FIRMS

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Abstract

The aim of this article is to explore the factors determining the participation of Spanish industrial firms in European Technology Policy which is put into practice through the Framework Programmes. For this purpose, first, a descriptive statistical analysis of the main features of these firms is made and, later on, an econometric study, both based on information provided by the Spanish version of the European Survey of Technological Innovation.

JEL: 0300, 0380, L600
Key words: technology policy, European Union, industrial firms.
1. Introduction

Spain and Portugal’s entry into the erstwhile European Economic Community in 1986, coincided with the beginning of a series of legislative reforms which helped to give greater importance to the technological policy carried out by this Institution. In fact, hitherto, the drive towards R&D activities had been practically reduced to the nuclear field, an area for which an autonomous organisation, EURATOM, had been set up. This was, in fact, the Single Act passed in 1987, when the Framework Programmes were formally established which at the present time cover almost all the aims and support measures of the European Union (UE) to R&D activities and technological innovation. These Programmes have taken over, since that time, between 3% and 4% of the expenditure of EU Budgets, a share which, albeit falling well short of its priority actions, the Common Agricultural Policy (CAP) and Economic and Social Cohesion, is significant. In this sense, it is worth asking about the economic justification of the ever-increasing takeover of competencies in R&D area by the UE.

So, there seem to be four most important motives (see, European Commission, 1997). First of all, the conviction that R&D activities offer great potential for economies of scale and scope offering in turn gains in efficiency and, moreover, it is necessary to overcome a “threshold” or “critical mass” to make

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1 It should be noted that Structural Funds also contain measures of aid for research in the Community Support Framework (CSFs) and more specifically, in the FEDER (article 10 of Regulation 2083/93 of the Council) as well as in the Community Initiatives.
them profitable. Thus, the drive for research programs of a community nature may facilitate the development of research projects which would otherwise be unfeasible, particularly in areas such as those related to energy, the environment and space, which normally require a large amount of investments and in which at this time are being developed jointly with the USA and Japan.

Secondly, the very dynamic of the European integration process and the growing trend to globalisation of economic transactions would provide an extra stimulus to the co-ordination of economic policies, among which those, such as technology, imply public aid to firms.

Thirdly, the linking together of support action for R&D activities was considered ever more desirable in order to avoid possible problems of project duplication. In this regard, it must be noted that one of the conditions for carrying out projects co-financed by the EU is, specifically, the participation of bodies located in at least two different countries. Finally, and speaking in more detail of what has just been mentioned, one finds the advantages obtained from tackling the imbalance between the EU and the United States and Japan in a co-ordinated fashion under the aegis of the Community, instead of dealing with it, as was the case in the 60s and 70s, with an individual nation strategy which had poor results and had aftereffects such as protectionism and isolation of their respective technological systems. Indeed, before the drive provided by the Framework

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2 Though the more general subject of motives justifying technological aid is not dealt with here -but only the reasons which appear to have motivated intervention from a Community standpoint-, the reader
Programmes to community technology policy European firms co-operated more with the American ones than among themselves.

In short, if we consider what is to be found in documents drawn up by the Commission, it appears that the main motive for strengthening Community Technology Policy has been to improve the degree of efficiency in allocating public resources devoted to the promotion of technological development in the European Union and reducing its backwardness when compared to Japan and the United States.

More recently, however, in face of the evidence of strong differences existing between the technological capacity of member states, on the one hand, and in the light of increasing evidence as to the importance of agglomeration economies in technology-generating processes\(^3\), on the other, something of a debate has started about the convenience of the Framework Programmes taking into consideration criteria of social cohesion\(^4\).

In any case, the criteria followed in formulating the Framework Programmes and, particularly, those which in practice guide the granting of aid, which finally

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\(^3\) See, as illustration Saxenian (1994) where the case of Silicon Valley is analysed, and Audretsch (1998), where an argument is presented, based on empirical references, about the high and ever-increasing importance of the agglomeration economies in innovation processes and, consequently, the trend towards emphasising the technological and economic development gaps between countries and regions.

\(^4\) For more details on this subject Peterson and Sharp (1998) can be consulted. In Pavitt (1998) one can find an interesting assessment of EU R&D Policy.
determines the shareout of funding among different EU countries, are not clearly defined.

In the light of this situation, it has been considered worthwhile to explore the characteristics of the participation of Spanish firms in the Framework Programmes with the object of extending our knowledge of its determining factors. To this end, we will begin by examining the share of Spain in the different Framework Programmes (section 2). Later, a more detailed analysis will be made of the participation of Spanish industrial firms, from information provided by the Spanish version of the European Innovation Survey. The latter will be based, firstly, on a statistical analysis (section 3) and, afterwards, on an econometric study (section 4). In the final section a summary will be given of the main findings and some conclusions will be drawn for economic policy.

2. The participation of Spain in EU Framework Programmes

To obtain a general idea of the characteristics of Spanish participation in the Framework Programmes two basic information sources are available. First, there is the Comisión Interministerial de Ciencia y Tecnología (CICYT), which provides data on contracts forwarded by Spanish participants in the different programs—whether firms, universities or research centres—, and on projects approved by Supervising Committees. And, second, there is the Annual Report of the European Court of Auditors, which provides data on payments made by each member state in
each of the different policies put into practice by the EU, among them, since 1995, R&D-related policy. However, to give an adequate interpretation to the information from the European Court of Auditors it must be borne in mind that the latter gives its judgement on the total sum of each contract funded by the Framework Programme to the country in which the project leader is located. Consequently, this procedure may offer a biased picture of the participation of the Fifteen, since the bodies in some of the most technically developed EU countries, particularly the United Kingdom, tend to head projects to a greater extent than the other member states\textsuperscript{5}.

\[\text{[Table 1, around here]}\]

In table 1 a synthetic and graph presentation is given of the path taken by the most significant ratios to assess Spanish participation. From its inspection several interesting findings emerge. Thus, according to CICYT data, one must begin by stressing their upward trend: from 5.5\% in the II Framework Programme to 6.3\% achieved in the last which has been implemented. A notable increase, particularly when we see that the IV Framework Programme had, unlike the others, the presence of the latest members to join the EU (Sweden, Finland and Austria).

\textsuperscript{5} EU-subsidised research projects are composed, of, at least, two bodies located in different Community countries (article 4 of the Council Decision 22 December, 1998 published in the Official Journal of the European Communities 1/2/1999), who sign a contract with the Community (article 12) in which one of the participants, the one who took the initiative in making the application, is the leader. So, according to the Report on Activities of the National R&D Plan (see, CICYT, 1998, page 135) bodies from the United Kingdom headed 25\% of projects chosen by the EU in the IV Framework Programme.
Moreover, it must be pointed out that the relative presence of Spain in the Framework Programmes has become more and more in accord with the weight of the country, both in terms of GDP and of their contribution to the Community Budget, even if this presence is still slightly lower. This trend towards the growing involvement of Spain in EU R&D funding corresponds partly to the logical learning process of our firms and research teams in meeting requirements for aid (see Vencé, 1998, Chapter 5), though it is surely also a consequence of the recent inclusion among selection criteria for projects some of which are distributive to a certain extent⁶.

Finally, it is worth highlighting that Spanish percentage participation in the Framework Programmes -which, as we have seen, is very similar to its GDP, in comparison with the EU- is far higher than the figure for its R&D expenditure in comparison with Union countries as a whole. This feature is obviously symptomatic of another on which all diagnoses carried out on the technological capacity of the Spanish economy agree: that its R&D expenditure level is far lower than it should be given its level of economic development⁷.

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⁶ Thus, among selection criteria for the V Framework Programme (laid down in article 10 of the Council Decision, Official Journal of European Commission 1/2/1999), one finds, as well as some related to efficiency and scientific quality (a), Community value added (b) the innovative nature of the project (d) prospects for divulging and exploiting the findings (e) effective and efficient management (g), others which are more distributive in character such as: the contribution to the Community’s economic and social aims (c) or transnational co-operation (f). In fact, article 163  (article 130F) with the heading devoted to Research and Technological Development in the Treaty of Amsterdam states: “The Community has as its aim (...) the encouragement of all research actions which might be considered as necessary by virtue of the other chapters of the present Treaty”.

⁷ In this respect, it must be recalled that technological effort (R&D expenditure/GDP) in Spain is only 46% of the EU whereas Spain’s per capita income (measured in PPP) rises to 80% of the Community’s.
As was previously mentioned, those taking part in Framework Programmes may develop a leading role or, on the contrary, simply participate in projects proposed by others, while receiving the subsidies stipulated in the contract. In this respect, after examining chosen projects directed by Spanish institutions -from data available in the Annual Report of the European Court of Auditors- it can be seen that community funding for projects headed by Spanish firms, research centres or universities in the period for which information is available, (1995-1997), amounted to 5.8% of the total. Thus, it must be pointed out that this percentage is markedly lower than that obtained when analysing funds received during the IV Programme Framework, which suggests that Spanish institutions play a less important role as leaders when compared with their European counterparts⁸.

[Table 2, around here]

Concerning the relative participation of each of the different Spanish institutions -firms, research centres and universities- in the Framework Programmes one must stress their present similarity with the average pattern of UE countries (see table 2). This is the result of a catching up process, achieved throughout the time of the various editions of these Programmes.

⁸ In fact, this is reflected in the CICYT in the Report on activities of the National R&D Plan, where this information is provided by number of projects, though not as done by the Court of Auditors by the volume of expenditure. Only 6.7% of Project leaders of the IV Framework Programme are located in Spain, when, as a whole, Spanish institutions accounted for 7.1% of all groups participating in it. Nevertheless, in this aspect as well, there has been positive evolution, since in the III Framework Programme the percentage of projects headed by the Spanish was only 4.7%.
After providing a global assessment of Spain’s participation in the Framework Programmes, a detailed analysis will be given of the features of Spanish firms which have benefited from their financial support.

3. Features of Spanish Industrial firms, which participate in the Framework Programmes: a statistical exploration

The first exploration of the features which characterise the Spanish firms which have benefited from EU funded R&D programmes will be made by means of a statistical analysis of the data contained in the Spanish version of the European Innovation Survey drawn up by the Instituto Nacional de Estadística (INE, 1998)\(^9\).

For reasons of statistical secrecy it has not been possible to obtain data for individual firms, though we have it for branches of activity where there is a high rate of statistical breakdown: 4 CNAE digits. To give an initial picture of the participation of our firms in the Framework Programmes these branches have been incorporated into the 14 industrial sections of the NACE-CLIO classification. R.25. The data refer to 1994 and 1996, the only data so far obtained by the Innovation Survey\(^10\).

[Table 3, around here]

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\(^9\) This survey provides information on innovation activities of industrial firms, in accordance with the guidelines of the Oslo Manual of the OECD.
So, as can be seen in table 3 the proportion of industrial firms that have benefited from the financial support of the Framework Programmes is small, 0.17 on average for the years considered. A proportion lower than the -in itself low one- of firms which have taken part in National R&D programs (0.40%) and in Regional ones (0.32%).

Nevertheless, when the number of firms which have received help from the Framework Programmes is put into perspective with all those which carry out R&D (2.91% of the total), the former constitute a significant proportion: 5.77%. A look at table 3 emphasises other interesting facts, among which two are outstanding. On the one hand, the existence of a concentration of public aid to R&D in branches where this type of activity is more intensively carried out, and, furthermore, that the concentration of aid related to Community Technology Policy is more noticeable than that to be found in the domestic policy area.

In order to gain more insight into other traits related to the degree of participation of industrial branches in Framework Programmes, we went on to carry out a test of equality of means from the data- with the maximum level of breakdown: 4 CNAE digits - once the latter had been classified in two groups: those obtaining some form of research aid from the EU and those who, on the contrary, conduct this type of investment with their own funds or from somewhere

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10 Though the launching of this Survey was attempted for the year 1992, the data collected were not sufficiently representative and consistent, so the INE itself has advised against its use. Therefore, the only
other than the EU. The data for investigating the characteristics differentiating these two groups of branches also come from the INE Innovation Survey which has as a whole, for 1994 and 1996, 567 observations\textsuperscript{11}. With the same information a correlation analysis has been made on the basis of the calculation of Pearson and Spearmans’ coefficients.

[Table 4, around here]

The findings of the statistical analysis clearly show -see table 4- that the branches receiving community aid have a series of interesting characteristics. First of all, regarding the structure of their firms, according to their classification into three groups: state firms, domestic private firms and subsidiaries of multinationals, the test of equality of means has not produced any significant differences. The correlation test findings suggest, nevertheless, a positive association between the presence of public firms and participation in the Framework Programmes.

Other variables- already included in table 3 -where the possible relationship with the degree of participation of industrial firms in Framework Programmes has been studied in more detail, are those related to innovation data, which are so far usable, are those used here: those referring to 1994 and 1996.

\textsuperscript{11} It should be noted that for reasons of statistical secrecy, access has not been granted to information for the branches which in any particular year had three firms or more, thus, the number of observations is not even. Also, in order to carry out this test, data for 1994 and 1996 were normalised via their respective averages, to prevent any bias in the conclusions incorporated from the evolution between these two years. In the first group there are 390 sectors, 201 in 1994 and 189 in 1996-and 177 in the second-79 in 1994 and 98 in 1996. Moreover, there are some variables for which the number of observations we have is smaller. These are the ones related to property structure, for which the question was designed on the basis of the last questionnaire regarding 1996, and expenditure on innovation and R&D for which only data
activity. In this respect, the findings of the analysis of averages show that the group of sectors obtaining EU aid corresponds to the one with the highest percentage of firms carrying out R&D activities, and, within them, those who do it most intensively, as measured both in terms of internal R&D expenditure and in innovation expenditure on a total of turnover. The values of the correlation coefficients confirm this relationship.

The extent to which firms are associated with a group and the level of participation in other Programs, national and international, of support for R&D activities are variables showing a positive correlation in the receiving of funding from the Framework Programmes.

Export propensity and particularly productivity\footnote{This was obtained by means of turnover per worker. The supply of variables contained in the survey on Innovation has prevented a more exact productivity measure being used.} are other characteristics of firms which have a positive correlation with participation in Community Technology Policy. Finally, the findings obtained here indicate that the size of firms - roughly calculated by turnover- favours their ability to obtain resources from the Framework Programmes.

In short, with this initial statistical exploration we have managed to obtain some variables which appear susceptible to influencing the likelihood of Spanish industrial firms benefiting from these European R&D Policy. The next step in our concerning 435 and 441 sectors, respectively, are available. In any case, the extension of the sample is sufficient to guarantee robust results.
analysis will be to obtain sounder knowledge of the factors determining the likelihood of participating in the Framework Programmes by means of an econometric analysis.

4. Determinants of the participation of Spanish industrial firms in Framework Programmes: an econometric analysis

Ideally, econometric analysis of the factors that have determined the degree of participation of Spanish industrial firms in EU-implemented Framework Programmes to encourage R&D activities should be made on the basis of data at a firm level. Thus, the variable to explain would have to be defined as a discrete variable which would take the value 1 if the firm received funds and 0 if otherwise. Nonetheless, as was mentioned, for reasons of statistical secrecy, individualised data of firms has not been made available from the Innovation Survey. What we have managed to obtain is just a percentage of firms from each branch- with a breakdown level of 4 CNAE digits- obtaining aid from the Framework Programmes. Consequently, the dependent variable must be, in our case, the expected value of the likelihood of a firm belonging to a sector \(i\) and with characteristics \(x\) taking part in those Programmes.

\[ Y = E(Prob(Y_i=1/X_i)) \]
When considering the factors determining participation in community aid for R&D as incorporated in the Framework Programmes, the findings obtained in the statistical exploration carried out in the previous section have been considered. More specifically, the equation regressors correspond with the variables analysed in the tests of equality of means and the correlation analysis, except those which either did not clearly show an associative relationship with the dependent variable (property structure and export propensity) or those constituting possible approaches to the same variable (as in the case of technological intensity, which is measured both in terms of innovation expenditure and in internal R&D expenditure, both expressed in relation to turnover\(^{13}\)). Therefore, the formulation of the empirical model is as follows:

\[
y_i = \beta_0 + \beta_1 \text{inid}_i + \beta_2 \text{giid}_i + \beta_3 \text{asoc}_i + \beta_4 \text{opii}_i + \beta_5 \text{pnid}_i + \\
+ \beta_6 \text{paau}_i + \beta_7 \text{prod}_i + \beta_8 \text{tam}_i + \epsilon_i
\]

Where,

\(y_i\): percentage of firms in sector i participating in EU Framework Programmes.

\(\text{inid}_i\): percentage of firms in sector i carrying out R&D activities.

\(\text{giid}_i\): internal expenditure on R&D as part of turnover in sector i.

\(\text{asoc}_i\): percentage of firms in sector i belonging to a group with which they maintain an associative relationship.

\(^{13}\) In this latter case, we opted to include the R&D expenditure variable as part of turnover, since it was considered not to contain the lack of conceptual precision which is the defect, in our opinion, of innovation expenditure.
**opi**: percentage of firms in sector i participating in international research programs other than EU ones.

**pnid**: percentage of firms in sector i participating in National R&D programs.

**paau**: percentage of firms receiving aid from Regional R&D programmes.

**prod**: average labour productivity in sector i.

**tam**: dummy which tries to register the influence of size. It takes the value 1 for sectors where the average turnover figure (that of the representative firm) is lower than the median and the value 0 for the rest.

**i**: sectors of CNAE-4 digits.

In any case, a large number of the variables introduced as regressors in the equation also have a theoretical justification to be considered among the possible criteria for funding distribution channelled by European technology.

Thus, with regard to share of firms the carrying out of R&D activities (*inid*), and the latter’s intensity, measured from the ratio of R&D expenditure as part of turnover (*giid*), it is logical to think that they will exert a positive influence on firms’ capacity to gain access to European programs for encouraging technological innovation. Even more so when it is borne in mind that in the Treaty of Amsterdam (Section XVII, Article 163- former section XV, article 130F of the Treaty of Maastricht), it is explicitly laid down that one of the priority aims of R&D policy is “to strengthen the scientific and technological base of community industry and...

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14 For the *giid* variable (internal R&D expenditure), only 441 observations are available, and these, consequently, will be those used in the estimate.
stimulate its international competitiveness”. The latter is, moreover, the underlying economic rationale in the inclusion of the variable measuring labour productivity \( \text{prod} \). Likewise, it is to be expected that setting up association agreements with other firms \( \text{asoc} \) will be an extra stimulating factor for achieving funding of community technological policy, to the extent that it may be considered to improve the efficiency of the projects receiving financial aid. Apart from that, there also exists a reference in the provisions regulating the Framework Programmes which points to the consideration of this variable among the criteria determining the choice of projects for subsidy, since -as was said-, among the requirements demanded for applying for financing is that of working jointly with bodies resident in at least two UE member states.

With regard to the three variables reflecting participation in other programs for stimulating technological development, the international-range ones \( \text{opii} \), those integrated into National R&D programs and those of a Regional nature \( \text{paau} \), it is not so clear that a theoretical argument can be offered to justify their association with the dependent variable. Thus, on the one hand, it could be expected that the experience of participating in other aid programs-and the resulting exploitation of economies of scale produced in all technical tasks, either legal or of other types, requiring the preparation of these applications-, would mean greater ability in drawing up and organising such applications to the Framework Programmes. Therefore, one would be led to believe that firms benefiting from subsidies for technological activities from other bodies would have a greater
chance of receiving simultaneously those stemming from EU R&D Policy. But, on the other hand, there are reasons for believing that, via the co-ordination of the different areas of Technological Policy -community, national and regional-, an attempt is made to prevent concentration of aid in a small group of beneficiary firms. Therefore, the latter is one of the aspects of the EU Technological Policy for which an econometric exploration seems of greatest interest.

Finally, among the explanatory variables a dummy \((tam)\) has been included for those sectors where the turnover of its representative firm is lower than that of the sector representing the median, thus establishing two groups with the same number of observations. Introducing this variable is justified by the ample empirical evidence which backs the hypothesis on the need for a certain critical mass or threshold required for R&D projects for them to become profitable\(^{15}\) and, of course, also, like the other regressors, in the light of findings obtained in the previous correlation analysis.

Once the empirical model has been specified, it is important to choose the most suitable econometric method to estimate it. The model most suited to this if we had data for each firm would be a normal \textit{probit} or \textit{logit}, but, as mentioned, -for reasons of statistical secrecy, we have not been able to gain access to this type of data. Otherwise, despite the high number of zeros for the dependent variable - 280, that is: in nearly 63% of branches, no firm has taken part in EU Framework

\(^{15}\) A summary of the extensive literature which, starting with Schumpeter’s (1942) pioneering ideas, has analysed this question can be found in Cohen (1995).
Programmes-, the use of the tobit model is not advisable, since, on the one hand, it is used for censored data, which is not the case that is being analysed, and on the other, it does not guarantee that the predicted probabilities will be between 0 and 1.

Consequently, a better alternative would be to apply a logit model on grouped data, in which the variable dependent could be expressed as:

\[ \text{Log} \frac{y_i}{(1 - y_i)} \]

Then robust to heterocedasticity Ordinary Least Squares (OLS) method could be applied. However, although this approach takes into account- and this is desirable- that the dependent variable is a probability, it does not enable advantage to be taken of the information provided by the observations for which the latter takes the value zero\(^{16}\).

As a result, it seems that the most suitable method is estimating by Non-linear Least Squares\(^{17}\) of the logistic probability function:

\[ E(\text{Prob}(Y_i = 1/ X_i)) = F(X^\beta) = \frac{e^{X^\beta}}{1 + e^{X^\beta}} \]

\(^{16}\) It must be noted that in the cases where the dependent variable y is zero, then the expression on the left of the equation would be log (0).

\(^{17}\) For this we will use as initial values the ratios obtained in the logit grouped data model. See, for this, Amemiya (1985).
Therefore, in **table 5** the findings obtained by non linear estimates are given. Moreover, in the table we have included the values corresponding to the average of the estimated elasticities for each observation and variable.

[Table 5, around here]

So, as can be observed in **table 5 (estimate 1)** almost all the variables included in the model are significant. Thus, firstly, it is seen that aid from the Framework Programmes is devoted to the most technologically-intensive sectors (**giid**). This, after all is consistent with the Provision of the Framework Programmes which fixes a percentage of project co-financing, according to the type of EU aid in question\(^\text{18}\) and requires applicants to deal with the remaining investment themselves. In this respect, it appears that, as has been pointed out by Buisseret et al. (1995), public subsidies for research are a source of extra financing which enables firms to take on more ambitious R&D projects. Also, according to the value of the **asoc** variable, it seems that the association of a group of firms- whether established in Spain or abroad- makes subsidies from the EU Framework Programmes easier to obtain. This finding coincides with the

\(^\text{18}\) Specifically, the most frequently used type of subsidy, that of share cost actions (it accounted for 61% and 55% of the III and IV Framework Programmes, respectively), finances between 35% of total expenditure, in the case of demonstration projects, and as much as 50% if it is for research and technological development or SME co-operative research projects. This percentage can be extended to 75% only in the case of SME Exploratory awards. For those research centres or universities, which do not use analytical accounting and for actions designed to facilitate access to research infrastructures, the subsidy can be as much as 100% of extra costs. Other types of subsidy registered in the recently-approved V Framework Programme are: training fellowships, research training networks, concerted actions, accompanying measures and direct action. So, the first four of these also require those receiving the aid to invest. Only the complementary measures, by making reference to measures to improve the implementation of the different areas making up the Framework Programmes and the EU direct actions developed by the Joint Research Centre (JRC) may be totally funded.
arguments usually put forward to explain co-operation in R&D projects, basically, the commitment to incurring a certain amount of expenditure and the sharing of the risk (see, Cassiman and Veugelers, 1999).

Furthermore, the variables which measure participation in other international R&D programs (opii) and national ones (pnid) also obtain positive associated coefficients- in fact, for the latter an elasticity of 0.14 is obtained, the highest of all the continuous variables-, which are consistent with the existence of economies of scale in the tasks of preparing and organising applications for financing of R&D projects which might arise in different administrative applications. Nonetheless, this finding, which is indicative of the concentration of different types of aid to R&D -those of the EU Framework Programmes, those of other international and national programs- in the same firms, would give rise to another type of interpretation. Thus, the findings provide signs to lead us to think that in the wake of this superimposition of aid there may be underlying problems of co-ordination among the different public sector applications, and this might lead to inefficiency in organising subsidies in favour of a small number of firms, and, at the very least, unnecessary duplication of expenditure in applications and follow-up of projects.

So, there are only two variables: participation in programs organised at a regional level (paau) and the proportion of firms who carry out R&D activities (inid), which do not obtain significant coefficients. However, given that-as can be
seen in the correlation matrix reflected in the appendix—these variables have very high correlation levels with the variable which measures participation in national programs (\textit{pnid}): 0.76 and 0.56 respectively, there are reasons to think that this is the reason for their coefficients not giving the expected results when they are jointly estimated.

Therefore, and even though making a solidly-based comment on the subject would require carrying out detailed research firm-by-firm and project-by-project-, which is not feasible here due to lack of available information-, it seemed of interest to make a further exploration. In this sense, two more estimates have been made of the model in which in one of them (estimate 2) the variable corresponding to the cases of aid coming from Regional technological policies (\textit{paau}) has been omitted and, in the other (estimate 3) the one measuring participation in the National R&D Program (\textit{pnid}) So, as is shown clearly in table 5 itself, the findings support the idea of the superimposition of aid at the three levels: community, national and regional.

Furthermore, as far as productivity is concerned, as an indicator of firms’ efficiency, it must be noted that it is another of the variables with a positive influence on the likelihood of participating in the Framework Programmes, and one which, is also associated with one of the highest elasticities.
Finally, the negative sign, which is obtained for the size dummy \((tam)\), suggests that sectors with the lowest turnover have less likelihood of obtaining research aid. Our findings thus reinforce existing evidence about the problems suffered by SME (Small and medium-sized enterprises) in participating in projects funded by the Framework Programmes (see, European Commission, 1998). Indeed, from the III Framework Programme onwards (1990-94), specific policies have been implemented geared to this group, such as Technological Stimulation Measures in accordance with Article 163 of the Treaty of Amsterdam (formerly 130 F of the Maastricht Treaty)\(^{19}\). Nevertheless, according to our findings, it appears that larger-sized firms are still the principal beneficiaries of the Community Technological Policy.

5. Summary and conclusions

This article has attempted to make progress in gaining knowledge of the economic nature and implications of European Technological Policy which is carried out through the EU Framework Programmes, by means of an analysis of the characteristics of Spanish industrial firms’ participation made with data from the European Innovation Survey for the two years for which it is available: 1994 and 1996. More specifically, the basic aim has been to explore, firstly with the

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\(^{19}\) The Commission defined for the IV Framework Programme as a SME, those enterprises which met the following three conditions: having fewer than 500 employees, having a turnover of less than 38 million euros (6,322 million pesetas) and not being more than a third owned by a firm not considered to be a SME (unless it was financial investment). So, For the V Framework Programme, the Commission has considered the criteria laid down in the EC Recommendation 96/280 on the definition of a SME, which will be a firm employing fewer than 250 full-time staff, whose turnover is less than 40 million euros or with an annual balance below 27, and, finally, one independent of a large company.
calculation of test on equality of means and correlation ratios and, subsequently, with an econometric study, the factors which determine the likelihood of firms benefiting from financial support for the promotion of technological development, which is integrated in these Programmes. However, with the aim of establishing the context of the Spanish firms within this framework, the article began by making a short evaluation of the relative significance and characteristics of Spanish intervention in the different versions of the EU Framework Programmes.

Below a summary will be given of the main findings of the study and, on that basis, some final comments.

Our study has highlighted, firstly, that throughout the three versions of the Framework Programmes in which Spain has participate it has managed to increase its share, it has reached a quota almost the same as the relative weight of its GDP compared to the fifteen EU members. Moreover, it has been shown how the structure, according to the institutions taking part (firms, universities, and research centres) has with the passage of time harmonised with EU standards.

In any case, the most interesting conclusions are those referring to the variables explaining firms’ likelihood of participating. In this respect, it must be stressed that the findings obtained suggest that EU public aid for technological development is concentrated in a small number of firms, and, also, that the carrying out of R&D activities and the intensity of the research effort, belonging to an
association, size, productivity, and participation in other public programs - international, national and regional- of financial aid for R&D are factors exerting a positive, significant influence on firms’ possibilities of having access to subsidies channelled through the EU Framework Programmes.

In the light of the findings two types of inferences can be drawn as to the orientation of European Technological Policy. The first one would be to point out that the evidence provided here supports the idea that funding distribution by the European Technology Policy is geared to extending research and technological activities of firms who not only have the most suitable conditions (greater size, higher productivity,....) for carrying out R&D activities but, indeed, carry them out more intensively. In this respect, there is room to suspect that this gearing implies support for projects which would have got under way even without public financing. In this sense, one could argue that it would be worthwhile reorientating the Framework Programmes’ resource allocation to give more room for the support of activities where there are greater guarantees that the principle of additionality is being met.

The other type of inference to be drawn from the findings of the study and is worth commenting on is the apparent superimposition in a small group of firms of the subsidies associated with the EU Framework Programmes with financial R&D support implemented in the context of both National and Regional R&D Programmes. In this case, the fear is, obviously, that due to co-ordination problems
it may occur an inefficient accumulation of superfluous aid in a group of firms skilled in obtaining subsidies.

**Bibliographical references**


