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Determinants of university participation in EU-funded R&D cooperative projects

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Abstract

This paper examines the factors that influence university participation in R&D cooperative projects supported by the EU, using an original data set of the total population of universities in the EU countries in 1992. An econometric model is developed to test for the relevance of university size, scientific research productivity, and other fixed factors on two dependent variables. The first is the probability of joining an EU-funded R&D cooperative project; the second is the number of times a university participated in these cooperative projects. The results indicate that the probability of taking part in an EU-funded R&D project depends primarily on the scientific research productivity of the university. The factors that explain the number of times a university participated in a project include scientific research productivity, size, and differences among countries and scientific fields. © 1998 Elsevier Science B.V.

Keywords: University research; EU funding; R&D cooperation

1. Introduction

Since the First Framework Programme in 1984, the number of organisations receiving EU funding for R&D cooperative projects has increased considerably. In the Third Framework Programme, the type of organisation that participated in EU-funded R&D cooperative projects with the highest frequency consisted of Higher Education Institutions (HEIs), almost exclusively universities.

The increasing participation of HEIs in each successive Framework Programme carries important consequences both for the funding structure of universities, and for the process of network formation and internationalisation of research. As an example of the former, consider the situation in the UK. A comparison of funding for each university from European Community sources versus research grants and contracts from the British Research Councils in 1992–1993 shows, on average, that the European Community funds are 21% of Research Councils funds. However, for about 10% of the institutions EU funding represents more than 50% of Research Council funds. As part of the trend towards the internationalisation of scientific networks, [1] Frame-

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[1] For the development of international scientific collaboration see, among others, Leydesdorff (1992) and Luukkonen et al. (1992).

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work Programmes represent a useful vehicle to develop or reinforce linkages for a more extensive European research network. Thus, participation in EU-funded R&D cooperative projects may have an important impact on the future research potential of the participants. [2]

A large body of literature has been devoted to the evaluation of the impact of EU-funded R&D cooperative projects. [3] Generally, these studies focus their analysis on the industrial implications of EU-funded projects, considering only marginally the participation of universities. [4] The purpose of this paper is to study the factors that influence university participation in EU-funded R&D cooperative projects. In particular, it will be highlighted how, among other factors, the characteristics and behaviour of the universities, the behaviour of the funding agency, and the unintended consequences of the selection mechanisms for allocating funds, are relevant for the understanding of university participation. The unit of analysis can vary from the most disaggregate level of the research group to the entire institution. For the present study, a cross-country analysis at the university level is developed. To avoid biases, the availability of information on the reference population—i.e., participant and nonparticipant—is extremely important. In this study, it is possible to consider the totality of recognised universities in the EU countries as the total population without imposing any selection bias.

A data set including the total population of universities in the EU countries in 1992 is used. [5] In addition to information on each institution, the number of times each university took part in an EU-funded R&D cooperative project in the First, Second and Third Framework Programmes has been gathered. On the basis of this original data set, an empirical model is used to test the relevance of different factors, both on the probability of joining an EU-funded R&D cooperative project, and on the number of times a university participated in these projects.

The paper is organised as follows. Section 2 presents the unit of analysis, gives a description of the data, and introduces some of the factors that influence university participation in EU-funded R&D cooperative projects. The econometric model and an interpretation of the results are offered in Section 3. Finally, Section 4 provides concluding remarks and suggestions for further research.

2. University participation in EU-funded R&D cooperative projects

In Europe, there is no standardisation on the definition of Post Secondary Institutions (PSIs) and Universities. In the different countries, these terms carry varying connotations. However, in all the EU countries, the institutions that have been granted university status went through a national selection process that can be considered more stringent then the one for granting PSI status. Therefore, this category can be considered more homogeneous. Moreover, most PSIs are teaching-oriented institutions only marginally involved in research. Those that are involved in research are generally more oriented towards regional or national type of networking, and only when their scientific research quality is extremely high, they try to access the EU funding system. [6] For this reason, whereas all universities can be considered candidates for EU research funds, a minority of PSIs would qualify as such. Therefore, the number of recognised universities in the EU countries is considered as the reference population.

The ideal unit of analysis to understand university participation in EU-funded R&D cooperative projects would be the research group or research centre that applied for EU funds. This information is currently not available at the cross-country level. Al-

[2] For the continuation of cooperation after the end of the project see AXION (1995).

[3] See, among others, Georghiou et al. (1993) and Larédo (1995).

[4] See Pike and Charles (1995) for an example of a study focused on the impact of EU-funded R&D cooperation on the behaviour of UK universities.

[5] Austria, Finland, Luxembourg and Sweden are not included in the database.

[6] Among the 427 HEIs participating in Community Framework Programmes, 97 are PSIs. However, each of these PSIs has participated in a few projects, accounting for only 4.3% of the total number of times HEIs participated in EU-funded R&D cooperative projects (Geuna, 1996).

though less informative, the analysis of university participation in EU-funded R&D cooperative projects at the aggregate level can offer useful insights. Clearly, this unit of analysis has a size bias. Large universities tend to have more research groups and consequently tend to participate more in EU-funded R&D cooperative projects. Nonetheless, given the size of the university, other factors such as scientific research productivity, geographical localisation, and scientific orientation are useful in explaining the participation in EU-funded R&D cooperative projects. Moreover, the analysis at the institutional level has independent justifications. First, although the literature on R&D cooperation emphasises the centrality of the research group, particularly in this special case of international cooperation, the identity of the institution—i.e., Cambridge University versus De Montfort University—plays an important role. In particular, because the funding agency—i.e., the European Commission—is not perfectly informed, the institutional reputation or 'the name' of the institution becomes a substitute for missing information on specific researchers or research groups. Second, to develop an international cooperation with a well-known university creates positive image externalities for the firms involved. The literature recognises, in the increase in image and prestige due to the link, one of the main incentives for cooperation. [7] Thus, the identity of the university itself plays and important role. Third, taking the university as unit of analysis enables one to have information on the total population—i.e., both the universities that have joined EU-funded R&D cooperative projects and the ones that have not taken part in them—and consequently the analysis at the level of the university, will not have any selection bias. Fourth, from a methodological point of view, the macro analysis at the institutional level enables us to draw the background picture of this particular area of R&D cooperation. In future research, the micro analysis at the research group level will be carried out on the basis of the results of the current work.

Table 1 shows the count and share of universities broken down by EU countries in 1992. An institution is classified in the category university following the official national classification. Two other main sources of information have been used: (1) the International Association of Universities (1991, 1993), and (2) the World of Learning (1995). When discrepancies between the sources were found, an institution has been classified in the category university if that institution was entitled to grant a doctoral (PhD.) degree. In a few cases, mainly in Spain and Portugal, the most recent and not yet developed universities were not taken into account. In most of the countries, Art, Physical Education, and Education schools are not included in the university category. In the few cases in which they have university status, they were excluded. The three institutions Universitair Centrum Antwerpen, Universitaire Faculteiten Sint-Ignatius te Antwerpen and Universitaire Instelling Antwerpen have been subsumed under the hat of the University of Antwerp. Finally, to calculate the number of UK universities, the information of the Universities' Statistical Record was used. The resulting value of 71 is due to the fact that the University of London is subdivided into 22 colleges; both the university of Cambridge and the University of Oxford are included as single institutions (the different colleges forming them have not been considered); the three institutions Manchester Business School, Manchester University and UMIST have been subsumed into the University of Manchester. [8]

Table 1
Count and share of universities in 1992, by country

	No. of universities	%
Belgium	15	4.0
Denmark	7	1.8
France	73	19.3
Germany	75	19.8
Greece	15	4.0
Italy	47	12.4
Ireland	7	1.8
Netherlands	13	3.4
Portugal	17	4.5
Spain	39	10.3
United Kingdom	71	18.7
Total	379	100

[7] See, among others, Malerba et al. (1991).

[8] Both in the case of the University of Antwerp and the University of Manchester, the different institutions have been subsumed due to the impossibility of identifying a more detailed institutional association of the scholars in the publication count.

The data regarding the participation of universities in EU-funded R&D cooperative projects have been provided by DG XII—i.e., Directorate-General Science, Research and Development—of the European Commission. They refer to shared-cost actions funded by DG XII under the First, Second and Third Framework Programmes. [9] However, the data for the First Framework Programme are not complete because the database of DG XII has been created only after the end of the programme, then only part of the data concerning the First Framework Programme has been stored in it. Moreover, the information for the Third Framework Programme is only up to 15/3/1994.

For each university, the geographical information and the *Number of Contract Partner Links* were made available. The latter represents the number of times a HEI has been involved in a EU-funded R&D cooperative project. No time or programme information were released. Constructed in this way, the database comprises 330 universities, representing 86% of the total population of universities in the EU countries considered.

For the total population of universities, in addition to the geographical information and the number of times the institution has been involved in an EU-funded R&D cooperative project (PART), the following data have been gathered.

NRES: the number of researchers that includes the total of full-time academic staff plus, when present, 50% of part-time academic staff in 1992. It is used as a proxy for the size for the university.

PUBS: the number of papers published within a certain institution in 1993. [10] It is used as a partial proxy for the scientific research output of the university. The data source is the Science Citation Index, CD-ROM version 1993.

RATIO: the ratio between the number of publications and the number of researchers (PUBS/NRES). It is used as a partial proxy for the scientific research productivity of the university.

FIELDS: the scientific fields in which the institution grants a doctoral degree. These are converted into a categorical variable to classify the institutions in relation to their disciplinary composition.

NEWOLD: the institutions' founding year. This has been turned into a categorical variable to classify the institutions in relation to their historical age.

Before proceeding with the statistical analysis of the main variables, a few remarks concerning the publication count are required. [11] Three main approaches are usually applied to the count of publications. They are: (1) a fractional count, where the paper is divided up between the contributing authors; (2) an all-author count, in which the paper is credited to each of the participating authors; and (3) a first author count, in which the paper is attributed to the first author only. All three methods have advantages and drawbacks. For the purposes of this paper, the all-author count approach has been applied. [12] This method has been chosen for the following reasons. First, it is a rather simple and straightforward method especially in the case of a large number of institutions. Second, the fact that the indicator is calculated for similar institutions, with similar publication profiles, reduces some of the impact of differing publication practices. On the other hand, due to the variance in the disciplinary composition of universities, systematic differences may still exist in the propensities to coauthor in various scientific fields. This can introduce a positive bias in favour of those disciplines, such as medicine or physics, where it is more common to have publications with a large

[9] In both the Second and the Third Framework, the research concerned with information and communications technologies was under the supervision of DG XIII; therefore, it is not included in the data set. Some other small programmes directed by DG VI, DG XIII and DG XIV are not included either. Still, about 55%–60% of the funds were administered by DG XII.

[10] For the analysis of all the problems connected with the data collection, see Commission of the European Community (1994), pp. 38–40.

[11] For an analysis of the shortcomings inherent to the use of publication count as an indicator of university research output see, among others, Johnes (1992), Martin and Irvine (1983) and Moed et al. (1985).

[12] A similar approach is also applied by Katz et al. (1995) in the bibliometric analysis of British science.

Table 2
Descriptive statistics for the main variables

Variable	Mean			Standard deviation			Minimum			Maximum		
	TP[a]	P[b]	NP[c]	TP[a]	P[b]	NP[c]	TP[a]	P[b]	NP[c]	TP[a]	P[b]	NP[c]
PART	49	56	0	65	66	0	0	1	0	420	420	0
NRES	887	922	631	946	896	1232	15	36	15	7330	7000	7330
PUBS	415	461	84	519	530	258	5[d]	5[d]	5[d]	3185	3185	1397
RATIO	0.568	0.636	0.078	0.971	1.016	0.142	0.005	0.005	0.005	12.34	12.34	0.598

[a] 371 valid cases.
[b] 326 valid cases.
[c] 45 valid cases.
[d] Estimated value.
Eight cases have been excluded due to missing data.
TP = total population; P = participants; NP = nonparticipants.

number of coauthors.[13] To limit the importance of this problem in the regression analysis, control variables for the disciplinary composition of the university have been included. Finally, coauthorship requires common competencies and common work, making it difficult to assign a fraction of the credit to the contribution of each author.

The publication output calculated in this way thus represents a partial proxy for the scientific research output of the university. Clearly, universities produce other research output such as reports for public agencies, contract research for firms, etc. However, data on these activities are not internationally comparable. Moreover, as scientific excellence is the most important criteria in the evaluation of research proposals for EU funding, the publication count can be considered to reflect this. Therefore, for the purpose of this study, only the publication output of universities is considered.

Table 2 presents the descriptive statistics for the four continuous variables. Three hundred and twenty-six universities (four cases have been excluded due to missing data) have participated from a minimum of 1 time to a maximum of 420 times in an EU-funded R&D cooperative project. They have participated on average in 56 projects. The high Kurtosis (5.536) and the positive Skewness (2.130), together with the high standard deviations (66) and large difference between Min and Max, indicate concentration in the values. Moreover, as the first three quartiles have values of 10, 32 and 78, respectively, one can describe the population of universities participating in EU-funded R&D cooperative projects as composed by a large number of institutions with little participation in projects and a small group of institutions involved in a large number of EU-funded R&D cooperative agreements. Similar observations can be made when the other three variables are analysed. Finally, when the descriptive statistics of the total population are compared with those of participants and nonparticipants, small positive differences are present in the participants' distribution, while important negative differences characterise the nonparticipants' distribution. Thus, the participation or nonparticipation in cooperative R&D projects financed by the European Commission does not appear to be independent of the size and scientific research productivity of the institution.

To control for effects other than size, scientific research productivity and country fixed effects, information on the disciplinary composition of the university, and on the age—i.e., period of establishment—of the universities, have been gathered.

The widespread institutional variety of the European university system has always constrained the value of international comparisons. For example, the Rheinish-Westphalian Technical University in

[13] Special mention must be made of the peculiar role played by hospitals. Their weight in the present count is not just overestimated because of the effect of coauthorship; it is also often unclear whether they are linked to the university or not. Hence, in some cases, the publication is counted as university and in other cases as hospital. This varies among the European countries due to the widespread institutional variety.

Aachen, Germany, has few things in common with the Eindhoven Technical University in Eindhoven, [14] the Netherlands. The former has faculties such as philosophy and education, while the latter is an engineering school. Nonetheless, starting from the fact that the requirements for the doctoral degree are approximately standardised among the EU countries, the various diversified institutions can be classified according to the scientific fields in which they grant the PhD. degree. In particular, considering the OECD classification for scientific fields—i.e., Agriculture, Medicine, Natural Sciences, Engineering, Social Sciences and Humanities—28 categories have been created. Six for the universities defined as *Mono-discipline*, which grant the doctoral degree in only one scientific field. Each of the six classes contains observations. Fifteen for the universities are *Bi-discipline*, which grant the doctoral degree in two scientific fields. Only nine of them include some institutions; seven for the universities are *Multi-discipline*. In this latter group, all the institutions that award doctoral degree in three or more scientific fields are included. To better classify these universities, the presence of Engineering, Medicine and Natural Sciences has been used as a discriminatory variable. The multi-discipline group has been thus subdivided in seven categories. All of them contain observations.

For each institution, the founding year has been identified. In relation to this, the universities have been classified into one of the following classes: (1) new post-war university (144 institutions), all the institutions established after 1945; (2) modern university (32 institutions), that includes the institutions created in the interim between 1900 and 1945; (3) nineteenth century university (77 institutions), as the name indicates, those founded between 1800 and 1900; and (4) old university (126 institutions) that includes all the universities that have been founded before 1800.

The number of times an institution participated in EU-funded R&D cooperative projects is a share of the number of applications it made. Among other factors, the characteristics of the university such as scientific research productivity, reputation, and disciplinary composition, influence the share of accepted applications. In turn, the total number of applications by a university is the sum of the applications of the single centres; thus, it depends on the number of the centres—i.e., the size of the institution—and on the characteristics of the centres and of the university. In the following section, an econometric model that analyses the importance of a few institutional characteristics on university participation is developed. In particular, the analysis will focus on the relevance of size and scientific research productivity.

3. An econometric test of the determinants of university participation

The aim of the regression analysis is to test the relevance of size, scientific research productivity, and other fixed factors on university participation in EU-funded R&D cooperative projects. The analysis of the estimates shall enable us to highlight how the behaviour and characteristics of the universities, the behaviour of the European Commission, and the presence of unintended effect of the selection criteria influence the participation of universities in EU-funded R&D cooperative projects.

As the number of times a university participated in an EU-funded R&D cooperative projects (PART) takes values between 0 and 420, the OLS regression is not a suitable estimation procedure. Two approaches can be used. One is a Tobit model with the number of times a university participated in projects as a censored dependent variable. The other is a two-equation model, where the first specification is a Probit model with a binary dependent variable that takes the value 1 when the university has a participation, and 0 when it does not, and the second equation is a Truncated regression model for the non-limit observations—i.e., for the number of participation in projects greater than zero. The two alternative approaches can be tested against each other. [15] The double specification can be tested as the unrestricted model against the restricted Tobit model.

[14] The two towns are only 120 km from one another.

[15] See Cragg (1971) for the original specification of the two-equation model.

Table 3
Estimation results

Variable	Tobit	Restricted probit	Probit	Restricted truncated	Truncated
LL	−495.46	−137.08	−77.18	−546.72	−349.95
Constant	−1.312 (0.01)**	1.168 (0.00)**	5.333 (0.88)	3.316 (0.00)**	−1.552 (0.00)**
ln NRES	0.847 (0.00)**		0.197 (0.19)		0.888 (0.00)**
ln RATIO	0.560 (0.00)**		0.321 (0.00)**		0.498 (0.00)**
DCOUNTRY					
Belgium	0.769 (0.00)**		−3.961 (0.94)		0.853 (0.00)**
Denmark	0.78E − 1 (0.84)		–		−0.112 (0.70)
France	−0.522 (0.00)**		−3.958 (0.94)		−0.646 (0.00)**
Germany	−0.809 (0.00)**		−4.604 (0.94)		−0.707 (0.00)**
Greece	0.706 (0.01)**		−2.777 (0.96)		0.293 (0.20)
Italy	−0.457 (0.02)**		−3.654 (0.95)		−0.595 (0.00)**
Ireland	0.950 (0.01)**		−4.280 (0.94)		1.139 (0.00)**
The Netherlands	−0.18E-1 (0.95)		–		−0.283 (0.25)
Portugal	0.312 (0.29)		−3.997 (0.94)		0.346 (0.17)
Spain	−0.852 (0.00)**		−4.465 (0.94)		−0.860 (0.00)**
United Kingdom	–		−4.036 (0.94)		–
DSCIFIELD					
Eng and agr	0.804 (0.00)**		−3.653 (0.95)		0.930 (0.00)**
Soc and hum	−0.844 (0.00)**		−5.067 (0.93)		0.100 (0.68)
Nat and med	−0.318 (0.24)		–		−0.313 (0.13)
Mix-scientific	0.46*E* − 1 (0.85)		−3.677 (0.95)		0.90*E* − 1 (0.64)
Mix-technical	0.952 (0.00)**		−3.329 (0.95)		0.924 (0.00)**
Multi-soc and Hum	−0.124 (0.58)		−4.240 (0.94)		0.87*E* − 1 (0.61)
Multi-scientific	−0.192 (0.26)		−3.896 (0.94)		−0.137 (0.29)
Multi-technical	0.305 (0.101)		−3.798 (0.94)		0.331 (0.01)**
Multidisciplinary	–		−3.602 (0.95)		–

Nonlinear probit.
Dependent variable: binary.
Number of observations = 371.
Nonlinear truncated regression.
Dependent variable: number of participation in projects.
Number of observations = 326.
Coefficient significance between brackets.
Marginal effects have the same significance of coefficients.

The advantage of the two-equation model is that it separates the analysis of participation in a project from the analysis of multi-participation. In this way, it is possible to separate the analysis of the probability of joining an EU-funded R&D cooperative project from the study of the level of participation in projects. The former considers factors that affect selection, while the latter provides information about the level of participation.

In the Tobit model (Eq. (1)) the dependent variable PART is regressed on the independent variables number of researchers (NRES), and ratio between number of publications and number of researchers (RATIO). The first independent variable measures the size of the university, while the second is used as a proxy for the scientific research productivity of the institution. A log–linear relation is assumed. Dummy variables (DCOUNTRY) for country fixed effects and control dummy variables (DSCIFIELD) for scientific fields [16] are included. In the Probit model (Eq. (2)), the dependent variable Y is the probability

[16] The 9 dummies for scientific fields orientation are the result of a re-categorisation of the original classification in 22 classes given by the variable FIELDS.

of being involved in a project, which takes the value 1 when the university has a participation, and 0 when it does not. The same set of independent variables is used. [17] In the Truncated regression model (Eq. (3)), only the universities that have participated in at least one EU-funded R&D cooperative project are considered. The dependent variable P is the number of times a university participated in projects and is recorded only when it is greater than zero. The independent variables are the ones used in the previous two equations. As in the Tobit model, a log–linear relation is assumed. Eqs. (1)–(3) are then formulated as:

$$\ln(1+\text{PART}) = \alpha + \beta_1 \ln \text{NRES} + \beta_2 \ln \text{RATIO} + \sum_{i=1\dots n} \beta_i \text{DCOUNTRY}_i + \sum_{j=1\dots m} \beta_j \text{DSCIFIELD}_j + \epsilon_1 \quad (1)$$

where n = number of countries = 10 and m = scientific fields categories = 8.

$$Y = \delta + \gamma_1 \ln \text{NRES} + \gamma_2 \ln \text{RATIO} + \sum_{i=1\dots n} \gamma_i \text{DCOUNTRY}_i + \sum_{j=1\dots m} \gamma_j \text{DSCIFIELD}_j + \epsilon_2 \quad (2)$$

where $Y = 1$ if PART > 0 and $Y = 0$ if PART $= 0$; n = number of countries = 9 and m: scientific fields categories = 7.

$$\ln(1+P) = \zeta + \mu_1 \ln \text{NRES} + \mu_2 \ln \text{RATIO} + \sum_{i=1\dots n} \mu_i \text{DCOUNTRY}_i + \sum_{j=1\dots m} \mu_j \text{DSCIFIELD}_j + \epsilon_3 \quad (3)$$

where P is observed only when PART > 0; n = number of countries = 10 and m = scientific fields categories = 8.

Taking Eq. (1) as the restricted model, and Eqs. (2) and (3) together as the unrestricted model, a likelihood ratio test (LLR) has been used to decide the best specification. As the LLR is equal to 136.66, using a χ^2 test with 21 degrees of freedom, the Tobit model was rejected at 99% probability.

The results of the estimation are shown in Table 3. In the Probit equation (the model correctly predicts 90% of the outcomes), the scientific research productivity of the institution has a positive and significant effect on the probability of taking part in an EU-funded R&D cooperative project, while the size of the university is not significant. None of the dummy variables for country and scientific field fixed effects has a significant value. These results indicate that the probability of taking part in a cooperative project financed by the European Commission depends primarily on the scientific research productivity of the university. This is consistent with the results of Arora et al. (1995), which showed that, in the case of publicly funded R&D projects, the scientific reputation of the research group, and in particular its weighted number of past publications, is the main factor influencing the probability of being selected.

Important differences in the influence and significance of the explanatory variables are present in the result for the truncated regression model. Both size and scientific research productivity have positive and significant coefficients. The size effect—i.e., large universities tend to have more research groups and consequently tend to participate more in EU-funded R&D cooperative projects—has an important positive impact on the number of times a university participated in projects, consistent with the analysis in the previous section. Nonetheless, given the size, institutions with higher scientific research productivity are involved in more projects. Thus, while the probability of being granted depends primarily on the scientific research productivity of the university, the participation in EU-funded R&D cooperative projects is affected by the size of the institution, and, given its size, by its scientific research productivity.

Major country fixed effects (the reference country is the United Kingdom) are present in the truncated regression model. They can be subdivided in three sub-groups. First, the dummy variables for France, Germany, Italy and Spain have negative significant values. Given the size and scientific research performance, universities in these countries had a lower participation rate. Among the many possible explanations, the negative sign of these dummies could be related to the administrative and bureaucratic structure of their national university system. In predomi-

[17] The dummy variables for The Netherlands, Denmark and Natural and Medicine universities are not included in Eq. (2) because the related universities always have probability equal to 1.

nantly publicly financed systems, the novelty of a competitive financing process has constrained the propensity to participate in EU-funded R&D cooperative projects. Moreover, in particular, in the case of France and Italy, a large portion of research is realised in public research organisations—e.g., CNRS (F), Max Planck Society (G), CNR (I), CSIC (S)—hence, the research intensity of the university system tends to be lower than in other countries.

Second, the dummy variable for Ireland has positive and significant value. Other factors being equal, this indicates that Irish universities had an advantage in the level of participation. This advantage can be interpreted as the result of the policy objectives of the European Commission. Since the First Framework Programme, technological and economic convergence among the member states of the EU is a major policy aim. Especially from the Third Framework Programme, a clear technological cohesion policy has been developed. Projects involving partners from less-favoured [18] regions tend to be preferred to projects of the same quality, but without members from less-developed regions. Some results show that the cohesion policy has probably also had a positive influence on the participation of Greek universities, while the statistical evidence does not support the same conclusion for Portuguese universities.

Third, the dummy variable for Belgium has a positive and significant value. This indicates that, given the size and scientific research productivity, Belgian institutions succeeded in having a higher participation rate. A possible explanation is connected with the fact that the diffusion of information about how, where and when to apply for EU funds has taken a relatively long period of time. Belgian universities, benefiting from proximity, had easier access to information and the possibility of face-to-face contacts with the Commission that increased their rate of success.

The dummy variable for scientific field has been used to control for the bias inherent in the way the number of publications was collected and to control for the different propensity in publishing. In the chosen specification, the technology-oriented institutions have positive and significant values. [19] The high value of their coefficients, on top of the control meaning, may also indicate the existence of an advantage for technology-oriented universities. However, with the available date, no conclusive observations can be made.

Fixed effects to account for the age of the university have also been included. Four dummies for the founding year have been used as proxies for the reputation effect—i.e., the older the university, the higher the reputation. Even if some evidence of a positive coefficient for the universities created in the interim between 1900 and 1945 were found, the test for the restricted against the unrestricted specification rejected the latter.

The results of the estimations of the two-equation model presented above point to the existence of important differences in the significance of the factors when they are used to explain the probability of joining an EU-funded R&D cooperative project, or when they are used to explain the actual number of times a university participated in projects. Given other factors such as differences among countries and scientific fields, the scientific research productivity of the university influences both the probability of taking part in an EU-funded R&D cooperative project, and the number of times a university participated in these projects, while the size is only significant when used to explain the latter.

Among other reasons, the different frequency in participation seems to be affected by the characteristics and behaviour of the universities, the behaviour of the funding agency, and the unintended consequences of the selection mechanisms. A possible interpretation of the results points to the existence of a set of factors that seems to have a significant influence on the frequency of participation. First, as large universities tend to have more research groups

[18] In the last Council Regulation 93/2081/EEC Greece, Ireland and Portugal are still included in the less-favoured regions as entire countries.

[19] More detailed specifications have also been estimated. The coefficients of the institutions focused on medicine was sometimes significant and negative, indicating the presence of an overestimation of the scientific research productivity of these institutions. Also, due to the small number of institutions with these characteristics, the test for the restricted against unrestricted specification did not allow to reject the null hypothesis. Thus, the 9 dummies specification has been chosen.

and, consequently, tend to have more participation in EU-funded R&D cooperative projects, the size distribution of the total population of universities in the EU countries may influence the skewness of the distribution of participation. Second, the existence of important differences in scientific research productivity and the presence of cumulative and self-reinforcement mechanisms could explain why only a small number of universities have a high participation rate. Third, the differences in the national systems of higher education may have created different incentives for participating in EU-funded R&D cooperative projects. Finally, the priorities of the EU research and development policy, especially for what concerns cohesion policy and technology orientation, may influence the frequency of the distribution of participation.

4. Conclusions

A growing share of the income of universities in the EU countries is generated through research grants and contracts from both national agencies and the EU. In the context of increasing internationalisation of the research process, and of the rising importance of the research network, the participation in EU-funded R&D cooperative projects has become an issue of crucial importance.

This paper has examined the determinants of university participation in EU-funded R&D cooperative projects. An econometric model has been developed to test for the relevance of different factors both on the probability of joining an EU-funded R&D cooperative project and on the number of times a university participated in these projects.

Some evidence have been found to support the idea that scientific research productivity influences both the probability of joining an EU-funded R&D cooperative project and the number of times an institution has participated in these projects, while research size has a positive influence only on the latter. Given the size and scientific research productivity of the university, other factors are important in explaining the different frequency in participation. Among others, the following three seem to be consistent with the results of the estimations. First, the lack of practice in competitive fund raising of the university system may have a negative influence on the propensity to take part in EU-funded R&D cooperative projects. Second, the existence of technoeconomic convergence aims for the Framework Programmes tends to give advantage to the participation of institutions localised in less favoured regions. Third, due to the unintended consequences of the selection mechanisms, the early entrants in the system tend to have advantages in repeated participation.

The preliminary results of this study underscore the importance of a better understanding of EU university research funding. Further analysis is thus needed to evaluate the implications for the university funding structure of an increasing reliance on EU funding. In particular, improved indicators of scientific research activity, such as publication by scientific fields, publications weighted by their impact factor, and more detailed information on the universities participating in EU-funded R&D cooperative projects, for example at the level of the department, could be used.Unlinked References

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