



Autor(es): **Joost Heijs**

Título: The diffusion of the low interest credits for R&D projects offered by the Spanish government within the spanish production structure

Resumen:

La parte introductoria señala brevemente la importancia de los estudios de evaluación de las políticas tecnológicas y ofrece una visión crítica sobre los problemas de selección y el uso de grupos de comparación. La parte empírica entra en un análisis de la tasa de cobertura, dentro del sistema productivo español, de los créditos de bajo interés para proyectos de I+D ofrecido por el Estado español. Una forma de financiación de la I+D empresarial, la gestionada por el Centro para el Desarrollo Tecnológico Industrial (CDTI), ocupa un papel central en el sistema nacional y regional de innovación de España.

La evidencia empírica apunta que menos del 1% de todas las empresas industriales, del 7% de las empresas innovadoras en un sentido amplio (llevando a cabo todo tipo de actividades innovadoras) y del 23% de las empresas innovadoras en el sentido estricto (con actividades de I+D) han sido apoyado en uno o más ocasiones por el gobierno Español en un periodo de 10 años (1984-1994). El instrumento político utilizado se pueden clasificar como un instrumento de promoción no selectivo, que implica que, en un principio, los créditos están a la disposición de todas las empresas que llevan a cabo actividades innovadoras. Pero la comparación de las empresas beneficiadas con otras empresas innovadoras muestra que algunas empresas están excluidas o se auto-excluyen de las ayudas estatales.

**THE DIFFUSION OF THE LOW INTEREST CREDITS FOR R&D PROJECTS
OFFERED BY THE SPANISH GOVERNMENT WITHIN THE SPANISH
PRODUCTION STRUCTURE**

JOOST HEIJS.

Facultad de Ciencias Económicas y empresariales

Instituto de Análisis Industrial y Financiero

Universidad Complutense de Madrid

1.- Introduction

Technology policy attempts to promote structural change in the economy, with the ultimate objective of strengthening economic growth and creating or reinforcing competitive advantages for a country, region or sector through technological change. In recent decades, policies promoting technological development and innovation have become an integral part of public policy, and have accounted for an increasing percentage of public budgets. This attention has been based on the assumption that new, higher technologies are an important factor determining the competitive positions of the three leading global regions: East Asia, North America and Western Europe and has been an important factor in the decisions of European central governments to intensify their technology policies in the 1980s.

Although the majority of developed countries have implemented technology policies the evaluation of the instruments is still a underdeveloped activity and the scientific level of the studies have been criticised (Meyer-Krahmer, 1989; Nauweleers/Reid, 1995; Meyer-Krahmer, 1995). Although it seems to be clear that studies with a proven methodology, carried out professionally, could improve the use and development of existing instruments., such studies are not as common as they should be. The use of such studies depends on the quality of the study and its recommendations and the willingness and openness of the politicians and the publication of the studies, but most of them are never published or maintained in secrecy.

The problem is that evaluation studies often are only used to defend or justify policies and the improvement of existing policies is rather a marginal objective (Nauweleers/Reid, 1995). A second problem, directly related with the former one, is that most of the studies contracted by the public administration are focused on partial subjects. Due to the lack of a theoretical framework concerning economic development and technological change that includes the role of the public government, most of the studies do not include a comprehensive analysis of the coherence between the instruments of the technology policy, and do not analyze them as an integral element of the national and regional systems of innovation (Koschatzky, 1994; Nauweleers/Reid, 1995; Kuhlmann, 1995). Before it will be possible to carry out such integral study there will need to be a long period of incremental

theory building but policy makers can not wait until scientists offer such integral framework and must work with the tools available at this moment .

2.- Evaluation of public finance for R&D by individual firms and the use of comparison groups

Most of the evaluation studies analysed offer a description of the firms assisted by the public institutions. The majority of them only presents the main characteristics of the supported firms (size, sector region or technological fields; see for example Siegert, 1985; Becher, 1990; Fontela et al 1992). Information that is relatively easy to obtain and in most occasions available by the public institutions which administer the policies according to the written forms. Other studies offer broader information about the characteristics of the firms including their competitive position, innovative orientation and resources in R&D or aspects of their internationalisation (See for example Becher, 1989; Buesa/Molero, 1994; Molero/Buesa, 1995; Kulicke, 1997)

The comparison of the supported firms with control groups or reference groups is less common. The typical exception is the comparison with a reference group for some basic features (size, sector or regional distribution), of which are available public statistics. In most cases the researchers compares if the distribution of the supported firms is equal to those of the reference groups and to find out if one kind of firms receives more assistance than other kind of firms (For example Meyer-Krahmer, 1989; Becher, 1989; 1990; Molero/Buesa, 1995).

Most of the developed countries offer information about the basic characteristics of its firms and also of the innovative firms, which has been used frequently to compare the supported firms. The problem is that -despite of the fact the Statistical Agencies have collected a broad range of data and indicators of characteristics of the firms- they only offer the basic ones like size, sector, region and social capital and often uses different criteria of classification.

In general most of the evaluation studies can be characterised by the lack of a comparison group or the presence of a problematic one. These problems, which are sometimes explicitly mentioned and other times not mentioned or even not detected at all, are an important and recognised weakness of technology policy evaluation studies (Meyer-Krahmer, 1991; Feller, 1991; Roessner, 1992; Brown et al, 1996). Feller suggest that the lack of basic information and the viability of the data were inconclusive that it is only possible to offer qualitative conclusion. I think that the situation is not that extreme but it has

to be clear that the interpretation and comparison of the existing studies of the specific characteristics of the control group and the group of reference has to be taken into account and has to be explicitly mentioned.

In my opinion the use of comparison group is necessary to assure a good contrast of the behaviour and characteristics of the supported firms with other comparable firms. The validity of the evaluation is threatened when the conclusions about the supported firms does not reflect an effect of the support scheme but reflects a general situation of the kind of firms which are supported, in our case the innovative firms, which are product of overall changes in the economical and technological system.

For example, the conclusion that firms supported by their technological activities have higher export rates in relation with their sales and are growing faster than the non supported firms could be a mis-interpretation. Such behaviour of the supported firms is not that surprising taking into account that all innovative firms, the potential users of R&D promotion, have such higher export and grow rates. Also the conclusion that the technology policy has brought the R&D expenditures on a higher rate can be wrong if this responds to a normal development which can be tracked by all firms of the production structure and not only by the supported ones.

2.1.- Selection of reference groups

The use of reference groups can be problematic because you can never be sure if some sub groups of supported firms with similar characteristics are excluded from this reference group. Table 2.1 reflects four kind of reference groups that can be used to compare the firms supported by the Spanish government. The first group (A) includes all the firms of the industrial sector the second group refers to all the firms of the industrial sector which can be categorised as innovative firms in a broad sense (B) and the third reference group (C) includes all the industrial firms which carry out, in a occasional, irregular or regular form, formalised R&D activities being the innovative firms in a strict sense. While the firms reflected in table 2.1b reflects the all the innovative firms of the Spanish production structure regularly implementing R&D activities. This table shows in a clear and simple way that the choice of a reference group implies problems of interpretation and is not free of methodological discussion. Conclusions based on one group or another can be totally different.

Table 2.1a reflects that the CDTI has supported in a period of 11 years less than one percent of the Spanish industrial firms almost 6% of the innovative firms in a broader sense and 23% of the innovative firms in a stricter sense. Although the general tendency is the same for each reference group the largest firms were supported more intensively than the SME's.

The second part of the table, reflecting a reference group of the whole Spanish productive structure, indicates a contradictory tendency. Using this reference group it should be possible to conclude that the CDTI has benefited relatively more the SME's than the larger firms. Using a different type of classification on size, this table shows that 52% of the CDTI firms have less than 50 employees while only 39% of the firms identified by the INE as innovative firms in the strict sense have that size. Taking like a reference the number of projects supported by the CDTI this positive discrimination fades away

So what has to be clear is that the use of public statistics like a reference group is not free of methodological problems and can only be justified if it is done with a critical view for the interpretations of the results. The election of the group of references depends on the type of instrument and the objective of the evaluation study. In his article of 1987 Meyer-Krahmer analyses the characteristics of the firm who were reached by three forms of financial support on individual firms: direct project support, indirect specific promotion and general non selective promotion.

The first form is the direct project support meant to develop special technological fields which are considered very important. The selection of projects and firms are based on the content of the project, the expected results and the time planning. The objective of this kind of promotion is to accelerate the technological development of several high tech fields like nuclear power, bio-technology or microelectronics which are often concentrated in large firms with large high-risk projects. This kind of policies is normally justified due to the lack of venture-capital and investments of the private sector. Investments in the new emerging technology fields implies high risks leading to underinvestment of the private sector but at the same time generates externalities which could justify public investments. The second form of public finance of R&D of individual enterprises is the indirect specific promotion. Indirect because each firm can initiate a project within the support scheme and selective because the support is limited to several technological fields of applications (CAD/CAM, Biotechnology, CIM etc.). These types of instruments are used in the case that general non selective promotion do not accelerate the transfer enough and the development of new high-

tech or key technologies, due to the high risks or costs and the complexity of the projects (Meyer-Krahmer, 1989)

Table 2.1 The differences between the possible groups of reference in the Spanish case

Table 2.1a Innovative firms of the industrial sectors

Size in number of employees	Industrial firms (A)	Innovative firms in a broad sense (B)		Innovative firms in a strict sense (C)		CDTI-firms 1984 – 1994 (D)				
		N	A/B (%)	N	A/C (%)	N	D (%)	A/D (%)	B/D (%)	C/D (%)
Less than 5	83.400	3.712	4,5	328	0,4	177	18	0,1	1,4	10
From 5 a 19	61.700	8.422	13,7	1.511	2,45					
From 20 a 49	12.600	2.863	22,6	945	7,46	268	27	2,1	9,36	28,4
From 50 a 199	4.300	1.688	39,2	962	22,3	267	27	6,2	15,8	27,8
More than 200	1.100	799	69,6	614	53,5	281	28	24,5	35,2	45,7
Total	163.200	17.483	10,7	4.360	2,67	993	100	0,6	5,7	22,8

Table 2.1b Innovative firms of all the productive sectors

Size in number of employees	CDTI-firms and projects during the period 1984 – 1994		Innovative firms in a strict sense
	2268 projects	1354 firms	1804 firms
Less than 50	42%	52%	39%
from 51a 250	32%	30%	34%

from 251 a 500	12%	9%	13%
More than 501	14%	8%	14%
Total	100%	100%	100%

Source: Own elaborated with the Survey on innovation technology in firms 1994 (INE, 1996, P. 50)

(N-Number of firms; Di-Distribution)

When comparing the supported firms of these two types of instruments with a reference group the fact that only the firms with large R&D capabilities can apply for such projects should be taken in mind. So it seems not to be logical to take as a reference group all the enterprises of the productive structure but it seems to be more reasonable to use the innovative firms in a stricter sense as a comparison group.

General non selective promotion is a third kind of instrument by the financing of firms R&D activities. This promotion scheme is based on private initiatives leaving the direction of the technological change to the private sector. These instruments are open for all the firms which like to incorporate new and existing technologies, and do not select certain activities by criteria like technology fields, risks, quality etc. but tries to promote the general innovative attitude of the firm and to raise the R&D expenditures of the production system. The activities promoted by such support schemes are in general based on incremental changes (Kuntze/Hornschild, 1995; Becher, 1989) and are not only focused on high tech but also supporting medium and low tech activities (Meyer-Krahmer, 1989).

It is possible to distinguish two types of instruments of direct non selective promotion. The first kind of instruments gives financial support in an automatic way, provides that a firm fulfils some prerequisites. Examples of such instruments are the German grants given towards the costs of R&D personnel or tax measurements. The problem of these instruments is that the government can not control the costs of such policies. The budget is not closed and in the case that they are very successful can be very problematic. For this kind of promotion instrument it seems to be reasonable to use the total number of productive enterprises like a reference group or the innovative firms in a broader sense because in theory all the innovative firms will be favoured by those instruments. Using the whole group of productive enterprises as a reference group probably will generate a good estimates of the number of innovative firms in the productive structure. Using the innovative

firms in a broad sense as reference group you will find out the pick-up rate by the potential users. The study of the firms that could have benefited from the scheme and did not apply could offer information of what went wrong and why these firms were not reached.

A second form of direct non selective support is the support of formalised R&D projects with a mechanism of selection and with a closed budget. Selection will not be based on quality of the project, technological fields and so on but the projects have to fulfil some basic prerequisites and the government will finance projects until the budget is spent all. This instrument of general non selective promotion implies that the firms innovative activities have to be converted into formalised projects with clear objectives, and timetables which means that other innovative activities will not be supported. The election of the reference group depends on the objective of the study. What seems to be clear is the whole number of productive firms will not be a representative reference group. Both the firms defined as innovative in a stricter sense and those defined as innovative in a broader sense can be a useful group of reference.

The firms in a strict sense represent the firms that should be able to apply for support without any real change in its R&D activities. Taking as a comparison group the innovative firms in a broader sense implies that the comparison takes into account all the firms that could be potential users of the support scheme, intensifying or reorganising their existing innovative activities. The support scheme of low interest credits of the CDTI, which will be analysed in the empirical part of this paper, is such an instrument.

Meyer-Krahmer made an extensive study concerning the firms reached by each kind of instruments and he indicates that the three types are supplemental and it is not possible to substitute the direct support by indirect measurements. Not only are the objectives of the instruments clearly different but also the clients actually reached, their innovative behaviour, and the relative importance of new technologies and the in house effects. Direct project support and indirect specific promotion of R&D are normally limited to some sectors and regions where high-tech firms are over presented and are used by a small number of firms. (For a broader discussion about this subject see Meyer-Krahmer, 1987). The choice of the instruments depend on the policy objectives. If the government wants to move the level of the technological development grants for specific R&D projects are needed, and if the government wants to broaden the use of new technologies a indirect specific measurements would be more effective. While If they just want to promote the innovative attitude, a general non selective promotion of R&D will be the most appropriate instrument.

An other way of studying the supported firms with a "group of reference" is the use of general information about normal (innovative) patterns of firms comparing them with the particular patterns of the supported firms. This is not a comparison of two groups but rather a contrast between the general features reflected in the literature and empirical studies with the particular orientation of the supported firms.

2.2.- Selection of a control group

The presence of a control group in evaluation studies is very rare. Due to the high costs and the problems of defining and selecting a representative group of control most studies lack such analysis. Although there are several ways to build a control group it is possible to distinguish between two basic forms. The first way is to create a representative group of potential users which makes it possible to analyse the take up rate within the group and study the differences between the supported and not supported firms (See for example Buesa/Navarra, 1997). The second way is a matched group comparison. This implies the selection of some basic criteria and for each supported firm there will be one added, comparable firm which did not make use of the support scheme (See for example Kulicke, 1997)

Buesa and Navarra (1997) have created in the first step of their research a data base of 766 innovative firms of the Basque Country and Navarra to study the innovative attitude of those firms and the impact and the role of the technology centres. As a second step they sent to all the firms a survey with the objective to study the differences between firms that made use of the technology centres and those that did not co-operate with those centres.

Kulicke (1997) analysed the public support by low interest credits offered to 1180 firms by the national German government. As a first step she constructed a control group selecting a group of 1800 firms with a structure that was equal in size, R&D expenditures and sector in comparison to the supported firms. In a second step she matched each supported firm with an equal firm that did not receive support, matching them on their size and R&D expenditures (Due to the dispersed sectoral distribution it was not possible to match them also on that variable).

As aforementioned there are more forms to create a group of control. An interesting example offers a study of Lay (1993), who evaluated the public support of the diffusion of

CIM technology created a control group of those firms which could have participated in the support scheme but that have not been supported. Another example is the study of Brown et al (1991) analysing the supported firms within certain groups of firms clearly characterised (Association of inventors, Patentholders, firms which are located in innovation and incubator centres, near participants etc.).

3.- Comparison between firms supported by the Spanish public low interest credits by firm's R&D activities and other innovative firms

3.1.- Introduction

In this section of the paper, I will present an analysis of the diffusion and take-up rate, within the Spanish production structure, of the low interest credits for R&D projects offered by the Centre for the development of Industrial Technology (CDTI). The public finance of the firm's R&D activity in Spain carried out by the CDTI is meant as a general non selective instrument of the promotion of technological development which should make able that all firms that are carrying out innovative activities could use of it.

As argued in section 2, the evaluation of the characteristics of firms which received public funding has to be completed with a contrast of those firms which were not supported, to find out the indirect influence that could have been generated due to the public support scheme on technological development. In this part of the paper I compare the firms subsidized by the Spanish government with low interest credits and the innovative firms in a broad way, defined as those firms which carry out any kind of innovative activity and with innovative firms in a strict sense, those firms who do carry out formalised R&D activities with clear objectives, well planned and with a time schedule.

The decision to compare the CDTI-firms with other innovative firms is based on the empirical findings of earlier studies (Meyer-Krahmer 1989; Becher, 1989; Molero/Buesa, 1995, 1996; Kulicke et al, 1997) which made clear that even in the case of general non-selective instruments almost only the innovative firms will apply for support. Only a very small number of the supported firms did R&D in an irregular way and almost none of them

started for the first time with R&D activities due to the public aid. The CDTI firms confirm this hypothesis because only 4% of the supported firms indicate that they normally did not have formal R&D activities and only four firms (0,8%) indicates that they carry out any R&D activities at all. So the representiveness and its diffusion and use amongst the population of potential users (pick-up rate) and amongst different classes of potential users has to be calculated with the innovative firms as a comparison group.

Therefore I will make use of three sources of empirical data. The first one is a survey about the innovative activities of 218 firms of two Spanish regions which offers a control group. The other two sources or reference groups are the public statistics dealing with 1804 firms which carry out formalised R&D activities (INE, 1994) and over 17.483 industrial firms which carry out any kind of R&D activities (INE, 1997). The problem of both reports is that they only offer some basic characteristics of the firms (size, sector, social capital). The report of 1997 presents a classification in size which is not the same as used in the survey of our evaluation study.

3.2.- Size of the supported firms

The first characteristic of the firms analysed here is the size of the supported firms. The comparison of the CDTI firms with other innovative firms in the broad sense (table 3.2) shows us how the smaller the firm the lesser the possibility that it would belong to the CDTI firms. In general 28% of the innovative firms in the Basque region and Navarra. are supported by the CDTI but for the smaller ones this rate is only 10%.

The differences in the pick-up rate for firms of different sizes are confirmed independently by the type of project supported by the CDTI. Maintained like a constant factor the firms expenditures in R&D in relation to their sales (ERDs) it was discovered that the firms which are spending less than 1% of their sales in R&D have generally a low pick-up rate (22%) which does not differ to firms of different sizes while the firms with a higher ERDs level shows clear differences in the pick-up rates of SMEs and the large firms.

Table 3.2 Take up rate of the CDTI in the Basque Country and Navarra by size

Size by number of employees	National projects*	Technology development projects		Concerted projects	
		218 firms ^{NS1}	269 firms ^{**}	218 firms ^{NS2}	269 firms ^{**}
1-9	10%	14%	23%	9%	10%
10-19	11%				
20-49	34%				
50-99	27%	21%	35%	10%	12%
100-249	29%				
250-499	33%	24%	48%	12%	22%
More than 500	47%	35%	46%	24%	30%
Total	28%	19%	34%	11%	15%

Source: The survey ESTE/Eusko Ikaskuntza and the survey IAIF/CDTI.

* χ^2 of Pearson with a level of significance of 90%.

** χ^2 of Pearson with a level of significance of 95%

^{NS1} χ^2 de Pearson not significant, level of significance 89%

^{NS2} χ^2 de Pearson not significant, level of significance 61%

The comparison of the CDTI firms to the innovative firms in a strict sense the conclusions about the negative discrimination of small firms has to be revised. As mentioned in section 2.1a the data of the INE (1997) indicates that 39% of the Spanish innovative firms, in a strict sense have less than 50 employees while the group of CDTI firms this percentage is 52%. At the same time only 17% of the CDTI firms are large ones (More than 250 employees) while for the whole Spanish population this percentage is about 27%. So it seems that the CDTI has favoured more the small innovative firms with formalised R&D activities than the large ones. This conclusion is confirmed by the analysis of the firms which applied for support and whose projects were not submitted by the CDTI shows that the projects of small firms have a bigger change to be financed. This makes clear that it is not the CDTI who overlooks the SMEs but probably the problem is related with the exclusion or self-exclusion of these small firms.

There are three fundamental reasons that the smaller firms are not participating in the support scheme of the CDTI

The first reason is the limitation of human resources and time that they can dedicate for gathering information about all kinds of financial aids from the public administration and to prepare the written forms. In fact almost all the large firms who applied for help did send three or more projects while the small ones sent only one.

The second reason related directly with the first one is derived from the centralised organisation of the support schemes of the CDTI. The lack of regional agencies implies that, in the case that the managers of the firms should visit Madrid, the financial and human costs will raise. Those additional costs, especially in the case of the smaller firms with smaller projects, reduce the net benefit of the CDTI credits and could delay the project.

The third reason, and maybe the most important one is the auto-exclusion of the smaller firms related with the strict concept of R&D managed by the CDTI. This concept limits the support to formalised R&D projects excluding other kinds of R&D activities. Due to the limited capacity of innovation management of those firms they have difficulties to translate their innovation activities in well organised projects with clear objectives. Spain does not count with additional support scheme that supports the other forms of R&D activities. The analysis of the firms in Navarra and Basque Country reflect that especially the smaller firms, that indicate that their R&D activities are normally incremental and not formalised, never

applied for help by the central government.

3.3.-Sectoral distribution

The analysis of the sectoral distribution of the support firms indicate a broad dispersion. Logically 75% of the firms are industrial enterprises but 16% belong to the service sector and about 6% to the primary sector. Due to the limited number of firms I reduced the number of sectors based on the taxonomy of the innovative behaviour of the firms

Table 3.3a Pick-up rate of the CDTI support scheme between the innovative firms of the Basque Country and Navarra by aggregated sectors based on their technological behaviour

Sector	National projects **	Technological development projects**	Concerted projects NS
Producers of traditional consumer goods	9%	3%	3% ^{D*}
Suppliers of traditional intermediate goods	16%	13%	3% ^{D*}
Specialised suppliers of intermediate goods and equipment	28%	26%	14%
Mass production assemblers	44%	33%	15%
R&D based sectors	45%	36%	18%
Business services	29%	26%	6%

Total	26%	21%	9%
--------------	-----	-----	----

Source: The survey ESTE/Eusko Ikaskuntza and the survey IAIF/CDTI.

** χ^2 of Pearson with a level of significance of 95%

NS χ^2 de Pearson no significant

D* Dichotomising the variable sector in six dummies only these two sector have a pick-up rate statistically different from the average firm with a level of significance of 90%.

Table 3.3b Sectoral distribution of the CDTI firms and the Spanish innovative firms in the strict sense

Sector	CDTI firms with national projects	Spanish innovative firms in the strict sense
Producers of traditional consumer goods	20%	20%
Suppliers of traditional intermediate goods	10%	8%
Specialised suppliers of intermediate goods and equipment	23%	25%
Mass production assemblers	17%	20%
R&D based sectors	13%	13%
Business services	10%	8%
Commercial services	3%	1% ²
Other services	3%	5%
Total	100%	100%
Number of firms	1354	1559

Source data base by the CDTI and INE (1994) The χ^2 of Pearson shows that the two distributions are statistically equal. (² this percentage is actually 0,38%)

Looking at the results in table 3.3a two sectors are highlighted due to their low pick-up rate between the innovative firms in a broad sense. Being the sector of the producers of traditional consumer goods (with a pick-up rate of 9%) and the suppliers of traditional intermediate goods (16%) while the pick-up rate of all the firms of these sectoral analysis is 26%. The pick-up rate of the specialised suppliers of intermediate goods and equipment and the sector of services are about average, while the sector based on R&D and the sector of mass-production assemblers have very high pick-up rates of 45%.

For the technological development projects the intersectoral differences are very similar to the global panorama while for the concerted projects the intersectoral differences are much more moderated. More Surprisingly is that the sector of traditional consumer goods with a low pick-up rate has a relatively high number of concerted projects which could be related with the high number of public research centres in these sectors.

Due to the limited number of firms the control of the sectoral analysis by the possible influence of the size of the firms and the level of ERDs is not possible

Considering like a reference group the innovative firms in a strict sense it can be assumed that the CDTI do not discriminate between sectors. The table 3.3.b doesn't show big differences between the sectoral distribution of both groups of firms.

3.4.- Social capital

The objective of the analysis of the pick-up rates by the social capital of the firms is importance to find out if some kind of firms are excluded example, the foreign firms, or are treated favourably for example, firms with public capital.

Due to the limited number of firms with public capital in survey ESTE/Eusko Ikaskuntza it is not possible to analyse if those were favoured in relation to other firms. The only conclusion that seems clear is that the public firms supported by the CDTI have a higher possibility of having concerted projects (66%) in relation to the rest of the CDTI firms of which only 33% have such projects.

The CDTI firms belonging to a holding or a group of firms show a relatively high pick-up rate (45%) within the group of innovative firms in a broad sense from the Basque Country and Navarra, while the individual firms are less presented (21%). This effect can not be explained due to the relatively small size of the individual firms because the additional analysis of the sub groups based on size reflect that also within the group of small firms and within the group of medium sized firms the same relationships were discovered. For the group of large firms a generally high pick-up rate was found independent of the type of social capital. Also each of the additional analysis for sub groups based on the level of ERDs or types of projects confirms the low participation rate of the individual firms.

Table 3.4 Pick-up rate by social capital

Social capital	National projects ***	Technological development projects***	Concerted projects **
individual firms	21%	13%	6%
firms of a group or a holding	45%	36%	19%
firms with foreign capital	33%	17%	17%

Total	28%	18%	10%
-------	------------	------------	------------

Source: The survey ESTE/Eusko Ikaskuntza and the survey IAIF/CDTI.

*** C^2 of Pearson with a level of significance of 99%

** C^2 of Pearson with a level of significance of 95%

In general firms with foreign capital were not negatively discriminated or excluded from the public support schemes. Within the sub group of small firms (Up to 50 employees) a relatively high number of CDTI firms with foreign capital were found.

This could be explained, on one hand, due to the higher innovation capabilities of the firms with foreign capital. Most of the foreign investors are interested in modernising the production structure of their firms, which means a growing attention for new technologies. This improvement of the innovative culture implies that the firms are better prepared to formalise their R&D activities in projects which could obtain public support.

On the other hand the relatively high presence of foreign firms within the group of small firms could be explained due to the fact that they normally belong to a holding or a group of firms. If this should be the case the foreign firms are discriminated in comparison with the national firms that belong to a holding or a group of firms. But the dates of the survey do not allow to control this hypothesis although the comparison of the CDTI firms with innovative firms in a strict sense may not support this hypothesis.

The comparison of the CDTI firms to innovative firms in the strict sense shows some results which are in contradiction to the earlier conclusions. Almost 12% of the CDTI firms are

enterprises with foreign capital while for the group of the innovative firm in a strict sense identified by the INE (1997) this percentage is 25%. So it seems that, using this reference group, there is some evidence of a negative discrimination of the firms with foreign capital.

3.5.- Competitive position of the supported firms

The competitive position as a character of the supported firms will be analysed to find out if the public support schemes are picking up the winners of the production structure or if they also support the less competitive firms.

The survey ESTE/Eusko Ikaskuntza offers three kind of indicators for the competitive position. The first shows the position of the firm in its main market, in general it doesn't correlate with the fact that a firm belongs to the supported ones. But, by studying the sub groups based on the size of the firms we discovered that, on one side, within the group of small firms (up to 50 employees) the pick-up rate of the leaders in the market (46%) is much higher than for the rest of the firms (27%). The small firms with a relatively low position in its main market do not apply or were not supported by the CDTI. On the other hand within the group of large firms (over 250 employees) the leaders of the market have a relatively low presence (pick-up rate of 45%) within the group of CDTI firms in comparison with the non leaders (69%).

The second type of indicator is a self-evaluation of five characteristics of the competitive position of the firms; quality and price of their products, technological level and commercial position of the firm and services to clients. The analysis of these variables reflect that the most competitive firms, -those who consider their competitive position very high in relation to their national competitors- have a pick-up rate somewhat higher than the less competitive firms. But this relation is only confirmed on a statistically significant way for the firms with technology development projects, not for those firms with concerted projects. Controlling these relations for each sub group based on the size indicates that this positive discrimination of the most competitive firms are confirmed for the sub groups of SMEs while the sub group of large firms, with a general high pick-up rate, don't reflect such

discrimination.

The third indicator of the competitive position of the firm, the percentage of exports over the whole sales of the company, also indicates that the most competitive firms are somewhat over represented within the group of CDTI firms. But this relation fades away studying the sub groups of control (Size and ERDs).

Resuming the three indicators it seems that the CDTI does not really pick up the winners but also has given broad support to the less competitive firms. Although some of the indicators showed some positive discrimination of the more competitive firms the differences, although statistically significant were not that big. And in the case of the firms position on its main market the conclusions were contradictory depending on the size of the firm.

An analysis of the competitive position of the CDTI firms in comparison to the innovative firms in a strict sense is not possible because the INE does not supply such information.

3.6.- Innovative orientation and R&D efforts

As aforementioned the support scheme for technological development normally reached only firms already carrying out R&D activities. In this part of the paper I try to demonstrate that mainly the firms with higher innovative culture and R&D effort make use of the CDTI's support scheme. The survey ESTE/Eusko Ikaskuntza provides over sixty variables that reflect all kinds of characteristics of the innovation process. Here I like to present the most important conclusion on the hand of some of the indicators of the process.

Table 3.6 Pick-up rate by level of Expenditures in R&D by sales

Expenditures en R&D by sales	pick-up rate by type of projects			Distribution of firms with*:	
	National projects ***	Technological development projects*	Concerted projects ***	Rejected projects	submitted projects
less than 1%	13%	9%	2%	15%	26%
from 1 to 3%	27%	19%	8%	37%	48%
from 3 to 5%	44%	30%	20%	22%	15%
over 5%	52%	35%	30%	26%	11%
Total	28%	20%	11%	100%	100%

Source: The survey ESTE/Eusko Ikaskuntza and the survey IAIF/CDTI the database of the CDTI

*** C^2 of Pearson with a level of significance of 99%

* C^2 of Pearson with a level of significance of 90%

The traditional indicator for the input of the innovative activities are the ERDs. Which can be seen in table 3.6 this variable discriminates clearly between CDTI firms and not supported firms. The higher the level of ERDs the bigger the chance that a firm is supported by the CDTI. This relation is confirmed independently of the variable size or type of project.

To find out if this is a deliberate policy of the CDTI or if its a consequence of the design of the instrument I have compared the firms whose projects were rejected by the CDTI with those with projects which were accepted. Table 3.6 shows that it is not the CDTI which selects firms with a high level of ERDs but the firms with a low level simply do not apply that much for public support. Firms with a low level of ERDs have, assuming that they should apply for support, a higher possibility that their project will be approved than the firms with a higher ERDs level.

A second variable that represents the R&D efforts of the firm is regularity of its R&D activities. 88% of the CDTI firms carry out R&D activities on a regular basis while the non CDTI firms of the survey ESTE/Eusko Ikaskuntza this percentage is about 65%. Calculating the pick-up rates it was discovered out that 34% of the firms who are doing R&D on regular basis are supported by the CDTI while for the rest of the innovative firms of the Basque Country and Navarra this percentage is 14%. These relations have been confirmed independently by the size of the firm, the type of project and the ERDs.

Most of the analysed variables, that reflect the process of innovation, indicate the same relationship. Even within the group of innovative firms, in a broad sense, from the Basque Country and Navarra it is possible to detect that the most innovative firms have been benefited more by the public support scheme than the less innovative firms

So the general conclusion, based on the analysis of the innovative orientation and R&D efforts by the firms makes clear that the more innovative firms, within the group of innovative firms in a broader sense, are supported more by the CDTI than the less innovative firms. An analysis of the innovative orientation and the efforts in R&D by the CDTI firms in comparison with the innovative firms in a strict sense is not possible because the INE do not facilitate such information.

4.- CONCLUSIONS

In the first part of the paper I have discussed briefly the methodological problems of the use of reference groups and control groups. It has been pointed out that the choice of one of the possible comparison groups can lead to different conclusions. This has not only been demonstrated by a simple example presented in the second section but also in the empirical part we have seen that the use of different comparison groups has led to different conclusions. So the selection of the reference groups and the methodological consequences has to be explained clearly. And if it is possible the researchers should use more than one reference group and try to explain eventual contradiction in the results. Due to the uncertainty of the viability of the different reference groups I think the best, but more expensive solution, would be the use of a control group.

The next summary of the rate of supported firms proves that methodological problems are not that easy to solve. Using different reference groups I have illustrated that the CDTI supports only 0.6% of all the industrial firms during a period of 11 years, only 5.7% of all the industrial firms with innovative activities in a very broad sense and almost 23% of the industrial firms which carry out formalised R&D activities.

Using a control group of innovative firms, in a broad sense, in Basque Country and Navarra I found a pick-up rate of the CDTI of 27% taken into account by only the industrial firms. Remarkably is the difference between those 27% and the 5.7%. Although both are defined as innovative firms in a broad sense the 5.7% is based on the European Innovation Survey sent to a large number of industrial firms to find out if they are doing R&D using a very broad definition of R&D activities. While the survey ESTE/Eusko Ikaskuntza started to select a group of innovative firms (766) based on demonstrated results and clearly revealed activities. Using a definition much more broader than formalized R&D activities but clearly more restrictive than the European Innovation Survey.

So it is not that easy to explain the differences between several reference and control groups. But it has to be clear that the CDTI reached only a very small number of firms of the Spanish productive structure and that a large number of innovative firms did not get any support, which can impede the competitive situation.

In the empirical part of this paper I tried to point out the differences between the innovative firms supported by the CDTI and those who were not favoured by this public institution. I used both, control and reference groups, to overcome some of the methodological problems mentioned before. Distinguishing between a comparison to innovative firms in the strict sense and innovative firms in a more broader definition.

The main instrument used in this paper to analyse the influence of the CDTI in the productive sector and to detect some tendencies was the pick-up rate. This instrument was used to reveal which percentage of the whole group of innovative firms was supported by the CDTI, and to track some particular kind of firms that have a very high or very low pick-up rate.

The **size** is a clear discriminatory variable; small innovative firms are not able to make use of the CDTI support scheme due to the lack of time and information but also due to the implicit requirements in obtaining low interest credits. The CDTI support scheme, theoretically accessible to all firms, is focused on clearly designed R&D projects which hinder the entrance of small firms with other types of innovative activities.

The **sectoral analysis** clarifies clearly that the traditional sectors have lower pick-up rates than the modern ones. This is not a typical Spanish circumstance but this occurs in the majority of European countries. Dankbaar et al (1994) proposes for more active public support for those sectors although the problem is if it is possible to obtain long range sustainable advantages in such low-tech sectors. The question is that only in high tech sectors is it possible to build up competitive advantages with a high added value on a long term.

The analysis of the pick-up rate by **social capital** pointed out that foreign firms are not excluded from financial support by the CDTI. But the analysis of the CDTI firms with the innovative firms in a strict sense does not offer a clear conclusion. The results depend on the kind of comparison group and for a better understanding additional information is required.

In relationship with the **competitive position** of the support firms, one can say that the CDTI doesn't have a policy of picking up the winners. It seems that within the group of innovative firms, in general, the leaders of the market have the same possibility of belonging to the CDTI firms as the non leaders.

As aforementioned the evaluation studies about the technology policy indicates that the firms reached by almost all types of instruments are firms who already do carry out innovative activities (Becher, 1989, 1990 Meyer-Krahmer, 1989, 1995; Buesa/Molero, 1995; Molero/Buesa, 1996) But even within the group of innovative firms it is possible to detect "more" innovative firms with a clearly greater possibility of belonging to the CDTI firms. The results of the survey ESTE/Eusko Ikaskuntza made clear that the firms with a low **level of ERDs**, low **regularity of innovation activities**, low importance of their own R&D etc. have less chance of belonging to the group of CDTI firms.

The fact that only the more innovative firms do participate in public support schemes is one

of the main problems for the traditional technology policy model. This model based on the supply of financial sources, information and technological knowledge does not reach the firms which are not doing any innovative activity at all. This is not a typical Spanish problem but in all developed countries you will find the same tendency. The technology policy favours a part of the most dynamic and fast growing firms accelerating their innovative activities.

The modern technology policy should not only force the R&D activities of the already innovative firms, but also raise the number of innovative firms. The problem is how to push the small individual firms, often owned by a sole family or a few partners, to modernise their production structure and to integrate the innovation as a central aspect of their strategic behaviour.

BIBLIOGRAFÍA

Archibugi D.; Cesaratto, S.; Sirili, G., 1991; Sources of Innovative Activities and Industrial Organisation. *Research Policy*, 20 (1991).

Becher, G., 1989; FuE-Personalkostenzuschüsse: Strukturentwicklung, Beschäftigungswirkungen und Konsequenzen für die Innovationspolitik. Fraunhofer-ISI/DIW.

Becher, G.; Kuhlman, S.; Kuntze, U., 1990; Forschungs und Technologiepolitik für Kleine und Mittlere Unternehmen in Ausgewählten Industrieländern. Fraunhofer-ISI.

Becher, G.; Kuhlmann, S. (Editors), 1995; Evaluation of Technology Programmes in Germany. Kluwer Academic Publishers.

Becher, G.; Kuntze, U.; Pfirrmann, G.; Walter, H.; Weibert, W.; Zwischenbilanz der Einzelbetrieblichen Technologieförderung für Kleine und Mittlere Unternehmen in Baden-Württemberg, Endbericht, Teil1. Fraunhofer-ISI.

Becher, G.; Weibert, W., 1990; Zwischenbilanz der Einzelbetrieblichen Technologieförderung für Kleine und Mittlere Unternehmen in Baden-Württemberg Endbericht, Teil 2. Fraunhofer-ISI.

Bozeman, B.; Melkers, J. (Editors), 1993; Evaluating R&D Impacts: Methods and Practice. Kluwer Academic Publishers.

Brown, M.; Randall, C.; Steven R. E., 1995: Evaluating Technology Innovation Programs: the Use of Comparison Groups to Identify Impacts. *Research Policies* 24.

Buesa, M.; Molero, J., 1995: Innovación y Diseño Industrial, Evaluación de la Política de Promoción del Diseño en España *Documento de Trabajo*, Instituto de Análisis Industrial y Financiero.

Buesa, M.; Navarro.; Zubiaurre, A., 1997: La Innovación Tecnológica en las Empresas de

las Comunidades Autónomas Del País Vasco y Navarra. *Azkoaga. Cuadernos de Ciencias Sociales y Económicas / Eusko Ikaskuntza.*

Busom I.; Impacto de las Ayudas Publicas a las Actividades de I+D: Un Análisis Empírico, *Herri-Ekonomiaz, Economía Publica No: 11.*

CDTI, 1995; Anual Report 1995. CDTI.

Dankbaar B. (Cftg), 1994; Research and Technology Management in Enterprises, Issues For Community Policy; Conceptual Framework and Technical Guidelines Sast-Project No. 8. Commission of the European Communities.

Dankbaar B. (OSR), 1993; Research and Technology Management in Enterprises: Issues For Community Policy Overall Strategic Review, Monitor-Sast Project No. 8. Commission of the European Communities.

Ewers, H.J.; Wettmann, R.W., 1980; Innovation Orientated Regional Policy. *Regional Studies, Vol. 14, Pp. 161-179.*

Feller, I., 1991; Do State Programs on Technolgy Work ? *Forum For Applied Research on and Public Policy, Fall 1991, (6), N° 3.*

Feller, I.; Glasmeier, a.; Mark, M., 1996; Issues and Perspectives on Evaluating Manufacturing Modernization Programs. *Research Policy* 25.

Fontela, E.; Pulido, a.; Paloma Sanchez, M.; Vicens, G., 1992; Evaluación de la Actuación Del CDTI en Apoyo a la I+D. CDTI.

Gielow, G.; Kuntze, U.; Meyer-Krahmer, F. (Projektleiter), 1981; Wirkungsanalyse der Zuschüsse and KMU's des Produzierendes Gewerbes zu den Aufwendungen für das in FuE Tätige Personal. Fraunhofer-ISI.

Hassink, R., 1996; Technology Transfer Agencies and Regional Economic Development. *European Planning Studies, Vol. 4 No. 2.*

Hornschild, K., 1989; Forschungs und Personal Zuwachsförderung. *Wochenbericht des Diw, Nr. 48.*

Hornschild, K. Meyer-Krahmer, F., 1990; FuE- Personalkosten-zuschußprogramm, Erfahrungen mit einer Fördermaßnahme für KMU, *Wochenbericht Diw, Nr. 10.*

Hornschild, K; /Kuntze, U, 1995; Evaluation of the Promotion of R&D Activities in Small

and Medium Sized Enterprises. en: Kuhlmann (1995).

INE, 1993, Estadística sobre las Actividades en Investigación Científica y Desarrollo Tecnológico (I+D).

INE, 1997, Encuesta sobre Innovación Tecnológica en Empresas 1994.

Koschatzky, K . 1996; New Concepts of Measuring Technological Change. Fraunhofer-ISI.

Koschatzky, K.; Gundrum, U.; Muller, E., 1995. Methodology in Design, Construction, and Operation of Regional Technology Frameworks. Fraunhofer-ISI.

Kuhlmann, S., 1992; Evaluation von Technikpolitik en: Grimmer Et Al (1992).

Kuhlmann, S.; Holland, D., 1995: Evaluation von Technologiepolitik in Deutschland. Physica-Verlag.

Kuhlmann, S; Becher, B. (Ed), 1995 Evaluation of Technology Policy in Germany. Kluwers Academic Publishers.

Kulicke, M; Bross, U.; Gundrum, U., 1997; Innovationsdarlehen als Instrument zur Förderung Kleiner und Mittlerer Unternehmen. Fraunhofer-ISI.

Kuntze, U., 1983; Evaluation of the Scheme For Funding R&D Personnel in Small and Mediumsized Firms in the FRG. en: Rothwell (1983).

Kuntze, U.; Hornschild,K., 1995; Evaluation of the Promotion of R&D Activities in Small and Medium Sized Enterprises, in Becher/Kuhlmann, 1995.

Lambright, W.H.; Rahm, D., 1991; Science Technology and State. *Forum For Applied Research on and Public Policy, Fall 1991, (6), N° 3.*

Meyer Krahmer, F.; Kuntze, U., 1992; Bestandsaufnahme der Forschungs- und Technologiepolitik. en: Grimmer Et Al 1992.

Meyer-Krahmer, F., 1987; Evaluating Innovation Policies; the German Experience . *Technovation, 5 (1987) 317-330.*

Meyer-Krahmer, F. 1991; Technology Policy Evaluation in Germany. Contribution to the SPRU International Conference on Science and Technology Policy Evaluation, London.

Meyer-Krahmer, F.; Gielow, G.; Kuntze, E., 1984; Innovationsförderung bei Kleinen und Mittleren. Unternehmen: Wirkungsanalyse von Zuschüssen für Personal in Forschung und Entwicklung. Campus Verlag.

Meyer-Krahmer, F.; Gielow, G.; Kuntze, U., 1984; Wirkungsanalyse der Zuschüsse für Personal in Forschung und Entwicklung Endbericht and der Bundesminister für Wirtschaft, Bonn. ISI-Fraunhofer

Meyer-Kramer, F., 1989; Der Einfluss Staatlicher Technologiepolitik Auf Industrielle Innovationen. Nomos

Molero, J.; Buesa, M.; Fernández, C.M.; Jiménez, J.C., 1995; Política Tecnológica E Innovación en España: Una Evaluación de la Actuación Del CDTI. *Documento de Trabajo*, Instituto de Análisis Industrial y Financiero.

Molero, J.; Buesa, M.; Fernández, C.M.; Jiménez, J., 1995; Política Tecnológica e

Innovación en la Empresa Española. Una Evaluación de la Actuación Del CDTI (Informe Final), Documento de Trabajo, Instituto de Análisis Industrial y Financiero.

Muller, E.; Gundrum, U.; Koschatzky, K., 1994; Horizontal Review of Regional Innovation Capabilities-Final Report-. Fraunhofer-ISI

Nauweleers, C.; Reid, a., 1995; A Comparative Review of Methods of Evaluating Regional Innovation Potential. European Commission

Oecd, 1990; Evaluation of Programmes Promoting Technological Innovation. *Public Management Studies (11)* Oecd

Oecd, 1992; Technology and Economy: the Key Relationships. Oecd

Oecd, 1992; Science and Technological Policy, Review and Outlook. Oecd

Oecd, 1993; The Impact of National Technology Programmes, Dsti/Spt (3)

Oecd, 1995; Main Science and Technology Indicators

Pavitt, K., 1984; Sectoral Patterns of Technical Change: Towards a Taxonomy and a theory. *Research Policy* 13

Roessner, J.D., 1989; Evaluating Government Innovation Programs: Lessons From the USA. *Research Policy*, 18

Roessner, J.D. (Ed), 1988; Government Innovation Policy. Macmillan

Rothwell, R., 1985; Reindustrialization and Technology. Towards a National Policy Framework. *Science and Public Policy* 12(3); Pag 113-130-

Rothwell, R.; Zegveld, W., 1981; Industrial Innovation and Public Policy. Francis Pinters

Shapira, P.J.; Youtie, J.; Roessner, J.D., 1993; Review of Literature Related to the Evaluation of Industrial Modernization Programs paper Presented For the Workshop on Evaluation of Industrial Modernisation Programs: Developing Best Practice.

Shapira, P.J.; youtie, J.; Roessner, J.D., 1993; Current Practices in the Evaluation of Industrial Modernization Programs Paper Presented For the Workshop on Evaluation of Industrial Modernisation Programs: Developing Best Practice.

Siegert, G; Meyer-Krahmer, F.; Walter, G., 1985; Wirkungsanalyse der Fachprogrammbezogenen Projektförderung bei Kleinen und Mittleren Unternehmen. Fraunhofer- ISI

1. This paper is a preliminary version of a chapter of my PhD thesis and a product of my research activities at the Institute of Financial and Industrial Analysis (IAIF). I would like to express my thanks to all my colleagues there for their support and valuable comments, and especially to José Molero and Mikel Buesa, not only for the empirical data that they provided but also for their personal involvement and advice. The empirical information used in this paper is mainly based on two studies. The first one, "*Análisis and evaluation of the actuación of the Centre for the development of Industrial Technology (CDTI) (1984-1994)*" carried out by the IAIF and directed by José Molero and Mikel Buesa (1995). The second study is "*Technology innovation and the enterprises of the "comunidades autonomas" of the Basque Country and Navarra*" carried out by Mikel Buesa, Mikel Navarro y Arantxa Zubiaurre. Together the aforementioned studies provided the empirical data used in this paper. I would also like to thank the ISI-Fraunhofer institute in Karlsruhe Germany where I stayed 18 months as a visiting researcher, in and in particular Knut Koschatsky, who coached my work during that time. There I obtained much valuable information for the theoretical part of this paper. I am indebted to all the people aforementioned for their valuable comments and support. As usual the author is responsible for this working paper and any errors that remain.

2. Questions, suggestion and critics are welcome on my E-mail number joost@ccee.ucm.es

3. There has been visible growth in financial and other support for technology, especially in the highly industrialised economies, although public budgets for R&D now seem to be stabilising. See OECD, *The Impact of National Technology Programmes*, OECD DSTI/SPT 1993 (3), January 1993 and OECD, *Main Science and Technology Indicators*, OECD, Paris, 1995.

4. In Spain most instruments of the technology policy were developed in the last decade and their evaluation is almost non-existent. Some studies evaluate the Spanish technology system and the general characteristics of the instruments used, but only a few studies analyse particular instruments.

5. Germany, United States are some of the few countries which analyse frequently their policies but even in those countries large numbers of instruments were never or seldom analysed. Kuhlmann and Meyer-Krahmer found out that in Germany 80% of the evaluation studies are concentrated in a

few technological fields which reflect only 40% of the total number of technology policy measurements (1995, P. 11)

6. It has to be clear that here we only analysed some studies of Spain and Germany. I do not conclude that these are representative of all the studies done but it gives a broader idea about what is happening in this field.

7. The concept of a reference group is used for the comparison of the supported firms with public information not especially elaborated for the evaluation and the concept of a control group refers to a group of firms determined by the evaluator and included in the survey.

8. Especially the European Innovation Survey started up in 1992 has improved the availability of such data although some countries have offered this kind of information before that period.

9. The German evaluation studies to the grants towards the costs of R&D personnel used the total number of industrial firms like a reference group (Meyer-Krahmer, 1989; Becher, 1989, 1990) analysing a general non selective promotion instrument which reached about 20% of all German firms.

10. Remember that each firm that fulfils the prerequisites get automatically the financial assistance

11. Both Kulicke and Lay, working in the ISI Fraunhofer institute, have made use of the broad source of information on firm level that this institute has generated for more than 25 years. They selected their control groups using data from their institute. For most countries such information is not available or researchers have no access to the data due to the legal protection or because the information is private property of the research centres like in the case of ISI-Fraunhofer.

12. Brown et al evaluated a support scheme that was focused on the aid of inventors and small companies to help them to develop their Energy-Related inventions.

13. The empirical data, on firm level, used in this paper are based on a study on Mikel Buesa, Mikel Navarra and Arantxa Zubiaurre of 219 innovative firms in the Spanish "Comunidades Autonomas" Basque Country and Navarra. Buesa et al have selected 766 firms that carried out all kind of innovative activities and the survey (Survey-ESTE-Eusko Ikaskuntza) sent to these firms has been answered "correctly" by 219 of them of which 55 were supported by the CDTI. This database

was completed with information of 50 CDTI -firms obtained by a survey (Survey-IAIF-CDTI), as a result of an evaluation study by José Molero and Mikel Buesa concerning the CDTI firms.

In this way I have obtained the information of 269 innovative firms of these two autonomous communities and covering 70% of the CDTI firms. Aware of the methodological problems derived by the over representation of the CDTI firms I will use basically the Survey-ESTE-Eusko askuntza with 218 firms, the limited data base, and only in a few cases will I use the whole group 269 firms. The comparison of the information of the CDTI firms generated by both surveys did not show differences in size, sector or level of R&D expenditures which could limit the methodological and statistical problems.

14. This last one is used only as an additional source of information, first of all due to the fact that it contains only industrial firms and the CDTI also supported other sectors but also because the results are very similar to those found using the Survey-ESTE-Eusko Ikaskuntza.

15. The reader of this part of the paper has to take into account two important methodological remarks. First all the relations and empirical results mentioned in this section are statistically significant except if it is denied explicitly. The second remark is that all the relations and results of the analysis of the pick up rates, presented in the following sections were controlled on the possible influences by three variables (size, expenditures on R&D as a percentage of the sales (ERDs) and type of project. Repeating the analysis by each of the following sub-groups (Size: up to 50 employees, from 51 to 250, from 250 till 500 and more than 500 employees; ERDs: up to 1%, more than 1% and less than 3% and more than 3%; type of firm concerted projects versus technology development projects, see also annex)

16. These percentages are very similar to those we saw in table 2.1 which shows the take up rate for the industrial firms of the whole of Spain. So we could suspect that the conclusions based on the survey ESTE/Eusko Ikaskuntza reflects more or less the Spanish situation.

17. Although the CDTI distinguish between 4 types of projects in this paper I dichotomised them in two groups. The first group are the so called "concerted projects" which are of precompetitive nature and are developed jointly by companies and Universities or other Public Research Centres (PRC) and are financed by means of interest free credit charged to the annual endowments from the national R&D fund. The second group are the projects of technological development, technology transfer or technological innovation. Those projects which are developed wholly by companies, are of an applied nature and are more market-oriented. They are financed by means of low-interest credits from the CDTI own resources (For more details see also the annual reports of the CDTI, 1997).

18. Taking into account instead of the number of firms the number of projects those positive discrimination of SME's fades away
19. Except the promotion scheme of the industrial design but this instrument has very limited budgets
20. Such taxonomie was presented for the first time by Pavitt (1984) who studied the innovative attitudes of English firms. In 1991 Archibugi et al (1991) presented such taxonomy based on the innovative activities of the Italian firms. I will use the five types of industrial sectors proposed by Archibugi et al (See table 3.3.a) appending the sector of services. This implies that some sectors supported by the CDTI are not included in these analysis due to the limited number of firms (which are construction, agriculture, fishery, mining and energy).
21. In the survey the firm had to indicate their position on the market. First position or leader, position 2 till 5, position 6 till 15 or beneath the 15th position
22. Most of these variables confirms the tendency that more innovative firms have higher changes to form part of the CDTI firms and lot of them show relations statistically significant. And the most important conclusion of the more than 60 variables analysed is that none of them show a contrary tendency
23. These relationship were confirmed in the two sub groups of size which contains the SME's. The sub-group of firms with more than 250 employees, with a high general pickup rate, firms with higher ERDs do not have a higher pickup rate than the firms with a low level of ERDs.
24. Except for the sub group with a ERDs lower than 1% who in general has a low pick up rate and for the sub group of very large firms (more than 250 employees) which have in general a high pick-up rate. In these two sub groups there was no difference in the possibility of firms belonging to the CDTI firms due to more or less regularity of their R&D activities.
25. Other variables analysed are the technological autonomy of the firm, the importance of several kinds of R&D, the importance of own R&D activities, the importance of technical objectives, quality of the products and technological level of the firm in comparison with national and with international

competitors, Patents, percentage of innovative products in sales and in exports For a more detailed analysis of these aspects see Joost Heijts 1998 (Forthcoming).

26. The survey ESTE/Eusko Ikaskuntza is based on a database of 766 innovative firms selected due to the fact that they: have registered patents, models, applied for public support by several administrations, firms of the database of EUSTAT that did formalised R&D activities in 1993, firms who had given technical assistance in foreign countries, firms with investment in foreign countries related with patents, design, trademarks or models etc.)

RESUMEN

La parte introductoria señala brevemente la importancia de los estudios de evaluación de las políticas tecnológicas y ofrece una visión crítica sobre los problemas de selección y el uso de grupos de comparación. La parte empírica entra en un análisis de la tasa de cobertura, dentro del sistema productivo español, de los créditos de bajo interés para proyectos de I+D ofrecido por el Estado español. Una forma de financiación de la I+D empresarial, la gestionada por el Centro para el Desarrollo Tecnológico Industrial (CDTI), ocupa un papel central en el sistema nacional y regional de innovación de España.

La evidencia empírica apunta que menos del 1% de todas las empresas industriales, del 7% de las empresas innovadoras en un sentido amplio (llevando a cabo todo tipo de actividades innovadoras) y del 23% de las empresas innovadoras en el sentido estricto (con actividades de I+D) han sido apoyadas en uno o más ocasiones por el gobierno Español en un periodo de 10 años (1984-1994). El instrumento político utilizado se pueden clasificar como un instrumento de promoción no selectivo, que implica que, en un principio, los créditos están a la disposición de todas las empresas que llevan a cabo actividades innovadoras. Pero la comparación de las empresas beneficiadas con otras empresas innovadoras muestra que algunas empresas están excluidas o se auto-excluyen de las ayudas estatales.

Palabras claves: Política tecnológica, innovación, financiación pública de I+D

ABSTRACT

The first part of this paper presents a short introduction concerning the importance of evaluation studies concerning technology policies and a brief discussion about the problems of the selection and use of comparison groups. The empirical part of this paper analyses the diffusion and take-up rate, by Spanish firms, of the low interest credits for R&D projects offered by the Spanish government. This form of public finance of the company's R&D activity in Spain is carried out by the Centre for the Development of Industrial Technology (CDTI) an institution which plays a fundamental role in the Spanish national and regional system of innovation.

The empirical information suggests that less than 1% of all industrial firms, 7% of innovative firms in the broad sense (undertaken any kind of innovative activities) and 23% of the innovative firms in a strict sense (doing R&D) were supported once or in several occasions by the Spanish government over the period 1984-1994. The credits are meant as a general non selective instrument for the promotion of technological development which should be available to all firms that are carrying out innovative activities. But the comparison of the supported firms with other innovative firms makes clear that some firms are excluded or are excluding themselves from this public support scheme.

Keywords: Technology policy, innovation, public finance of R&D