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Martina Cioni
Davide Conforti

The effectiveness of regional policies for innovation: an empirical investigation

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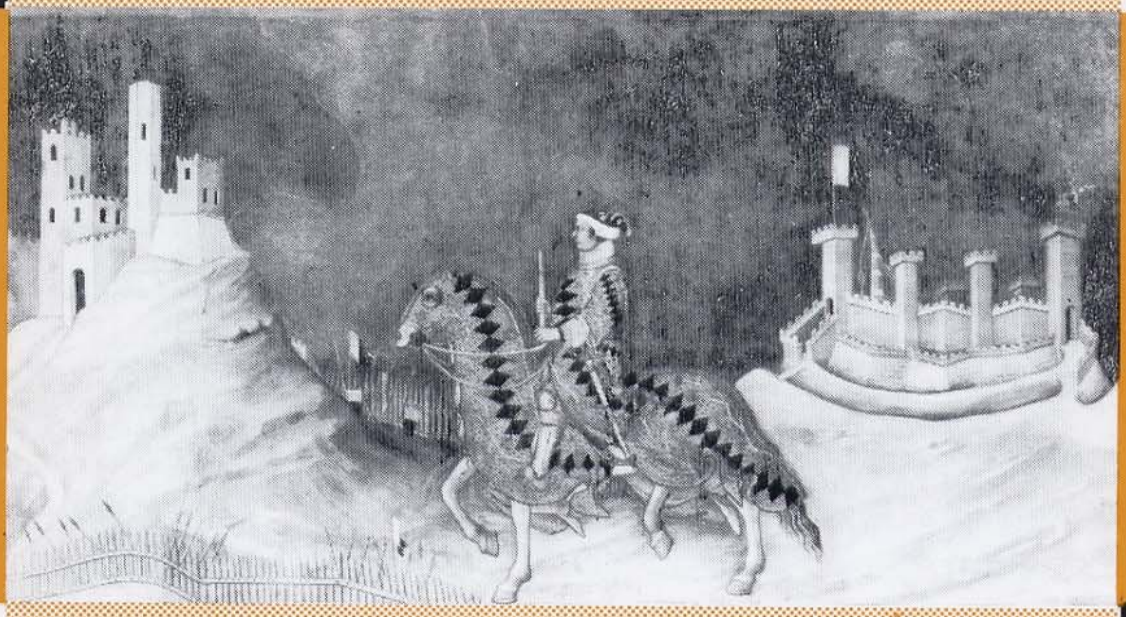

Abstract - This paper provides the outcomes following an evaluation analysis of a public intervention aimed to support innovation within small and medium firms (azione 3.2 under Council Regulation EEC 2081/93, Docup Ob. 2 1997-1999). We gathered the data through an *ad hoc* survey of firms which applied for granting, whether successfully or not. We carried on an impact evaluation of the intervention on the basis of specific indicators pertaining both to performance and to innovation capability. According to our outcomes, the intervention had a (quite limited) effect on the economic performance of beneficiary firms, though without having any particular impact both on occupation and on long-term innovation capability.

JEL classification: D2, H2, L25, O31

Keywords: Public Subsidies, Regional aid, Industrial Policy, Innovation capability

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Martina Cioni, Università degli Studi di Siena, cionimart@unisi.it
Davide Conforti, Ministero dell'Economia e delle Finanze, davide.conforti@finanze.it

1. Introduction

Over last years we witnessed a growing consensus about the key role played by technological innovation as a driving force of economic growth. As for the European context, over Nineties it has been established, within the European Commission, what has been defined a "systemic vision" of the innovation process, which underlines the importance of cognitive exchange micro-processes between individuals, organizations, and institutions (Edquist 1999; EC 2003). Thanks to a close relationship with their area, regions looked more and more likely to be natural candidates for managing pro-innovation interventions; moreover, the European Commission granted innovation policies a prominent role as for its regional policies.

Such an European focus onto public policies for innovation was shaped in different paths of intervention aimed to encourage a spread of innovation within entrepeneurship. Therefore, crucial are those tools able to evaluate the effectiveness of intervention if compared to our goal, that is to provide exact information about results of the above mentioned policies.

While scholars have been discussing since decades the role of investment incentives as a tool for cutting differences between areas and regions (Bronzini, de Blasio 2006), they neither achieved a consensus about their effectiveness, nor their research reached the same conclusions (Faini, Schiantarelli 1987; Lee 1996; Gabe, Kraybill 2002; Harris, Trainor 2005).

The main issue in evaluating whether an intervention was successful or not is to discriminate changes – with regard to interest dimensions – following by the intervention itself, from changes following by exogenous factors. Broadly speaking, we should compare the condition of "beneficiaries" after the intervention with the condition of the same subjects in case of non intervention. But these terms of comparison are different in nature: the first one (subjects after intervention) can be "observed" (factual value), while the second one is merely "hypothetical", since it is referred to what could be observed amongst the same subjects, at the same time as in the previous case, if firms were not granted intervention (counterfactual value). It appears that we cannot assess the difference, since while the first term of differentiation is directly observable (at least in principle), the second one is never, because it is the policy implementation itself to prevent such an observation. The clue issue for impact evaluation, as well as for intervention efficiency, is to reach a reasonable approximation of the counterfactual value (Brown, Curlee, Elliott 1995; Bondonio 1998; Rettore, Trivellato e Martini 2003).

By this considering, according to recent studies about public intervention in Italy (Bronzini, de Blasio 2006; Cannari, D'Aurizio, de Blasio 2006; Gabriele, Zamarian, Zaninotto 2006), this paper focuses onto an evaluation of an European policy for innovation such as it is provided for by Council Regulation EEC 2081/93 Docup Ob. 2 1997-1999 and which is managed on a regional

level. Our analysis aims to assess the effectiveness of a specific intervention supporting innovation in Tuscany, whose general aim was to enhance both innovation and occupation through a financial support for SME to be channelled in projects conceived for concretization of industrial research results.

By this reflection, on one hand we applied methodologies developed at international level, while, on the other, we resorted to data originated from *ad hoc* surveys providing otherwise lacking information[1]. Our findings (a limited clear-cut effect arising from the intervention) are much alike those following by recent works evaluating some public policies in support of firms (Bronzini, de Blasio 2006; Gabriele, Zamarian, Zaninotto 2006).

In the second paragraph we outline the features of the examined intervention; in par. 3 we introduce our investigation, by describing universe, sample and survey methodology; in par. 4 we introduce variables employed in our analysis; in par. 5 we have both the methodological context and the evaluation model employed; in par. 6 we present and discuss our final findings; in par. 7, finally, we suggest some conclusion.

2. Features of the intervention

As already mentioned, the intervention we are going to examine is "azione 3.2" («Technological Services») of the Council Regulation EEC 2081/93, Docup Ob. 2 1997-1999. Such an action was aimed to provide SME[2] with a direct support conceived to carry out projects for shaping up industrial research results through feasibility studies, plans, projects or design for products, production processes or innovative services, whether modified or improved, including the creation of a first prototype not intended for commercial purposes. Such an intervention was more generally aimed to enhance both innovation and occupation level in Tuscany, also by favouring the environmental impact of submitted projects. Global funding was 5,896,000 euros, involving 81 firms. Funds were granted following to a tender evaluating the quality of projects according to criteria such as degree of innovation, financial validity, innovation of products or processes, as well as other criteria more related to "social" effects (growing occupation and better environmental impact of production processes)[3].

[1] As noticed by many scholars [Heckman, Lalonde e Smith 1999; Rettore, Trivellato e Martini 2003], one of the main difficulties faced by *program evaluation* is to have suitable data, to be collected for evaluation purposes.
[2] Eligible firms were to comply to the following requirements: *i*) SME *status* under UE guidelines (Recommendation 96/280/EC, April, 4th, 1996); *ii*) unit localization in Objective 2 areas; *iii*) activities under Istat sectors D (Manifacturing), F (Construction), 72 (Computer and related activities), 73 (Research and Development).
[3] Funds were granted following three different calls, with reference to years 1997, 1998 e 1999. In most cases funds were "balanced" in 2000 and never later than 2001. Time elapsed from erogation is undoubtedly reasonable to evaluate the intervention effects on financial period 2003.

The intervention rationale is that SMEs, situated in Objective 2 areas, face barriers (such as lack of information and knowledge, difficult access to credit market, lack of specific information, etc.) in carrying out investment projects for technological innovation. It is also assumed that "disadvantaged" firms are anyhow able, if placed in favourable conditions, to set up valuable and competitive innovation projects, just as other firms are (Sisti 2000). Selection proceedings carried out for fund granting seek to single out those forms which, yet "disadvantaged", are able to carry out projects upon granting of support. Once determined those firms eligible for support, by setting both "disadvantage" features and requirements for admission to granting, eligible firms brought about a self-selection process, since only applied for granting those willing to enjoy of the intervention. Contribution was then granted after a careful check of requirements and a merit rating. Beneficiary firms carried then out projects conceived to the end of improving their own performance (whether financial, innovative, or occupational).

3. Survey analysis

3.1 Universe features

Our population is represented by those firms which applied for granting provided by the above mentioned intervention: on 154 firms, only 81 were granted funding (here forward "beneficiaries"), as showed by Table 1. Since they carry out quite different activities, for our purposes we divided them into four groups. Such a variety depends on the intervention features, since the call was open to firms working in manifold fields, both in industry and in services. From this point of view, distribution of firms into sectors matches with the guidelines provided by the calls (see n. 2). More in particular, firms belonging to the Computer and related activities (Sector 72) and to the Research and Development (Sector 73) are 23.4% out of the whole sample, while industrial firms gather mainly into two large sectors: *i*) "traditional" sectors[4] (25.3% of the whole sample), with a strong presence of leather firms as well as, even if less represented, textile and marble firms; *ii*) mechanical sector (in a broad sense including both firms carrying out intermediate manufacturing tasks, and those producing electric and electronic equipment as well as transport equipment[5]), representing 40.9% of the whole sample. The residual share (10.4%) are firms engaged in environmental activities (such as purification plants, waste disposal and processing,

[4] "Traditional" sectors, such as defined by Istat classification [2002], the Italian version of the European NACE classification, are as follows: textile industries (Sector 17); leather and leather products industries (Sector 19); wood and wood products industries (Sector 20); pulp, paper and paper products industries (Sector 21); manufacture of other non-metallic mineral products (Sector Istat 26); furniture industries (Sector 36.1).

[5] Under Istat classification [2002], the mechanical division includes the following sectors: manufacture of fabricated metal products, except machinery and equipment (28); Machinery and equipment n.e.c. (DK); electrical and optical equipment (DL); transport equipment (DM).

recycling, etc.), and their presence is justified by the priority accorded to environmental engagement.

Table 1. Distribution of universe firms on sector basis, 1997

Sector	Beneficiaries		Non-beneficiaries		Total	
	n.	%	n.	%	n.	%
Traditional	18	22.2	21	28.8	39	25.3
Mechanical	34	42.0	29	39.7	63	40.9
Chemical-environmental	8	9.9	8	11.0	16	10.4
Services to firms (Sectors 72-73)	21	25.9	15	20.5	36	23.4
Total	81	100.0	73	100.0	154	100.0

A similar approach can also be applied to size distribution within the universe, mainly characterized by small and very small firms. Almost half of them (45.5%) employ less than 11 employees, while only 5.8% (9 firms) employ more than 50 people[6].

Table 2. Distribution of universe firms on size basis, 1997

Employees class	Beneficiaries		Non beneficiaries		Total	
	n..	%	n.	%	n.	%
0-10	33	40.7	37	50.7	70	45.5
11-50	44	54.4	31	42.5	75	48.7
over 50	4	4.9	5	6.8	9	5.8
Total	81	100.0	73	100.0	154	100.0

Such small firms[7] are not so likely to stock financial and, most important, human resources needed to conceive and carry out an innovation. Moreover, their size curtails variety of innovation, thus favouring innovation with "incremental" nature to "radical" or "systemic" innovation.

3.2 Sampling methodology and sample features

To select the sample, we applied both a stratification on the basis of distribution according to sector, size and "treatment exposiure". The expected sample size was 90 firms, with a wide coverage of the universe (58.4%): 47 "beneficiary" firms and 43 "non beneficiary" firms. On September and October, 2004, interviews based on a structured questionnaire and directly submitted to firms were carried on[8]. As a consequence of the usual problems of unwillingness of some firms

[6] It should be noticed that firms included in the universe employee much less than 250 workers, threshold required by the call under UE criteria. Such a situation may be explained by the atomization" of production system in Tuscany, but we must pinpoint that, in this case, too, the selection process was basically "neutral" with respect to initial features of firms.

[7] So as not to leave anything out, it would be worthy observing that the universe of reference is much smaller than the total amount of applications submitted (250), since many firms submitted more than one application to the three different calls (see n. 3). Moreover, in many cases those firms which were not successful for a granting have been "recovered" within the following one, thus allowing a further reduction of non beneficiary firms.

[8] The questionnaire is made up of 5 sections: *basic information*, that are essential "vital" data of the firm (legal form, sector, amount of local units, propriety, sales, etc,); *innovation and technology*, that are R&D and investments expenditure, as well as further indicators, such as innovation sources, PC amount, patents, etc.; *markets*, that are outlet sectors, size and geographic distribution of customer base, export propensity; *occupation and human capital*, requiring, in addition to general data about employees, workers distribution on contract and education basis. The last section (*intervention*) aims to collect mainly qualitative information about the intervention itself, both in the application draft preliminary stage and for following stages.

we encountered and the impossibility to carry out further interviews, our sampling incurred some adjustment; the main one attains to the sample size of "non beneficiary" firms, which has been reduced to 36 firms. Such a results is mainly due, probably, to the fact that smaller firms amongst "non beneficiary" ones are at the same time those mostly incurred in shutdown and this led them to a sub-representation in the final sample. A further noteworthy deviation can be found within the "traditional" sectors share amongst "beneficiary" firms (equivalent to 13.3% versus 22.2% in the universe), "counterbalanced" by the chemical-environmental sector (15.6% in the sample versus 9.9% in the universe), as showed by Table 3.

Table 3. Sample distribution on sector basis

Sector	*Beneficiaries*		*Non-beneficiaries*		*Total*	
	n.	*%*	*n.*	*%*	*n.*	*%*
Traditional	6	13.3	10	27.8	16	19.8
Mechanical	19	42.2	15	41.7	34	42.0
Chemical-environmental	7	15.6	4	11.1	11	13.6
Services to firms (Sectors 72-73)	13	28.9	7	19.4	20	24.6
Total	45	100.0	36	100.0	81	100.0

Despite the above mentioned obstacles, the sample marginal distribution according to size within beneficiary firms subsample is in line with the corresponding distribution within the universe, as showed by Table 4.

Table 4. Sample distribution on size basis, 1997 (%)

Employees class	*Beneficiaries*		*Non-beneficiaries*		*Total*	
	n.	*%*	*n.*	*%*	*n.*	*%*
0-10	18	40.0	13	36.1	31	38.3
11-50	26	57.8	20	55.6	46	56.8
over 50	1	2.2	3	8.3	4	4.9
Total	45	100.0	36	100.0	81	100.0

4. Data and variables

Available information for each surveyed firm can be classified into three different typologies: 1) as pertaining to basic statistics; 2) as pertaining to performance; 3) as pertaining to innovation capabilities. From variables pertaining to performance and innovation capabilities, we processed so-called outcome variables, which represent the size on which basis we can evaluate the impact of the intervention, or, in other words, its success or failure. We elaborated them in view of intervention goals and of available information. In fact, variables pertaining to performance are conceived to catch impacts on occupation and firms competitiveness (specific goals provided by the calls), while variables pertaining to innovation capability tell us something about structural effects.

Table 5 shows us in details all variables employed. The first group includes variables pertaining to basic statistics: age, legal status (which allows us to make a distinction between joint-stock companies and other corporations), production sector (divided into 4 main sectors: traditional, mechanical, chemical-environmental and services). The second group includes variables pertaining to performance: sales, number of employees, sales per employee, export share on sales. Finally, the third group includes variables pertaining to innovation capability through three different indicators: share on sales of expenditure for R&D, of expenditure for immaterial investments (patents, trademarks, and licenses) and of expenditure for material investments on sales. We included as a variable also data in absolute value.

Table 5. Variables

Typology	*Description*	*Code*	*Data lay-out*
Basic data	"Age" of the firm	Age	numeric
	Legal form (corporation)	Corp	dichotomic (Yes=1; No=0)
	Production sector	Sect	polythomic: traditional (Trad)=0; mechanical (Mec)=1; chemical environmental (Chem)=2; services to firms (Servfirms)=3
Performance	Employees	Empl	numeric
	Sales	Sales	numeric (x 1.000 €)
	Sales per employee	Sales_empl	numeric (x 1.000 €)
	Export share on sales	Exp (%)	percentage
	Expenditure for material investments	Inv_m	numeric (x 1.000 €)
	Share of expenditure for material investments on sales	Inv_m (%)	percentage
Innovation capability	Expenditure for R&D	R&D	numeric (x 1.000 €)
	Share on sales of expenditure for R&D	R&D (%)	percentage
	Expenditure for immaterial investments	Inv_i	numeric (x 1.000 €)
	Share on sales of expenditure for immaterial investments (%)	Inv_i (%)	percentage

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For each variable we have values gathered both over the period before the intervention (pre-intervention) and over the period after the intervention (post-intervention). More specifically, values pre-intervention are referred to 1997 (or to the year of foundation, if happened later), while post-

intervention values (considering that contribution were mainly paid out in 2000 and anyhow never after 2001) are referred to December, 31st, 2003[9].

Table 6 shows both the mean and the standard deviation in reference to the above mentioned variables, related to "beneficiary" and "non-beneficiary" firms in two different periods: 1997 (before policy implementation) and 2003[10].

Table 6. Average values pre- and post-intervention of variables pertaining to performance and innovation capability with reference to both beneficiary and non-beneficiary firms

Typology	*Variables*	*Average value**			
		Beneficiaries		*Non-beneficiaries*	
		Pre	*Post*	*Pre*	*Post*
Performance	Employees	17.0	23.2	20.4	27.9
		13.7	*22.7*	*24.9*	*31.0*
	Sales	2661.0	3698.7	4544.8	4918.5
		3867.5	*5109.7*	*7039.2*	*7469.7*
	Sales per employee	120.1	139.6	181.1	143.1
		108.1	*121.2*	*146.7*	*128.0*
	Export share on sales (%)	16.1	21.6	20.0	25.3
		22.4	*25.0*	*25.8*	*26.0*
	Material investments	54.5	121.6	369.0	87.0
		77.6	*202.7*	*1418.0*	*144.6*
	Share of expenditure for material investments on sales (%)	4.8	4.0	5.3	4.0
		7.7	*5.4*	*8.3*	*6.6*
Innovation capability	R&D	70.3	134.8	80.1	92.7
		121.5	*360.5*	*168.6*	*161.6*
	Share on sales of expenditure for R&D (%)	10.7	9.2	8.3	7.8
		20.9	*17.4*	*18.6*	*14.9*
	Immaterial investments	1.8	10.3	10.9	4.8
		4.8	*43.1*	*47.3*	*13.4*
	Share on sales of expenditure for immaterial investments (%)	0.6	2.0	0.3	0.4
		1.6	*9.6*	*0.9*	*1.2*

* Italics are for standard deviation

By analysing the data referred to "beneficiary" firms, we may notice that, over the period of reference, all variables pertaining to performance in absolute value at current prices[11] raised. We may also see an increment for the average number of employees and for the average share on sales of export and immaterial investments, while the average share on sales of expenditure for R&D and for material investments experienced an opposite trend. For "non beneficiary" firms as well

[9] Post-intervention value of variables R&D, Inv_i, Inv_m, Exp, both in general and in percentage, results from the average values over years 2002, 2003, and 2004. We employed the average value in order to seek to reduce randomness in variables, if considering that their annual values are closely linked to investments planning and achievement timing, which are cyclic and not linear.

[10] All data refer to 12/31/1997 and 12/31/2003.

[11] Our analysis provides data in current prices, since, in our opinion, a comparison between sales increases for both beneficiaries and non-beneficiaries firms was likely to overcome problems due to inflation, supposed to work uniformly. In addition, an hypothetic deflation procedure aimed to a constant price analysis (with obvious reference to a general basket of commodities) would have introduced a distortion factor. Anyway, we evaluated the model referred to in paragraphs 5 and 6 also by employing constant prices without assessing any significant variation to results.

indicators pertaining to performance raised, excepted for sales per employee, while all remaining indicator values decreased over considered periods, excepted for R&D expenditure.

By comparing data referred to 1997 and 2003 we can highlight the variable variation over that period, but we are not yet able to determine whether such a change depends on the intervention we analyze, as we may better see in next paragraph about the methodological framework.

Indeed variations – differences between post-intervention and pre-intervention values – in values obtained for variables pertaining to performance and to innovation (in Table 7 represented as Δ) represent outcome variables on which basis we will infer the policy effectiveness.

Table 7. Average values of outcome variables in beneficiary and non-beneficiary firms

Typology	*Outcome variables*	*Average value*	
		Beneficiaries	*Non-beneficiaries*
Performance	Δ_Employees	6.2	7.5
	Δ_Sales	1037.7	373.7
	Δ_ Sales per employee	19.5	-38.0
	Δ_ Export share on sales (%)	5.5	5.3
	Δ_Material investments	67.1	-282
	Δ_ Share of expenditure for material investments on sales (%)	-0.8	-1.3
Innovation capability	Δ_R&D	64.5	12.6
	Δ_ Share on sales of expenditure for R&D (%)	-1.5	-0.5
	Δ_Immaterial investments	8.5	-6.1
	Δ_ Share on sales of expenditure for immaterial investments (%)	1.4	0.1

5. Methodology framework

As already mentioned, the program evaluation goal is to assess effects attributable to a precise public intervention net of "spontaneous dynamics" (i.e. all changes not attributable directly to it).

In order to achieve a coherent evaluation of the impact itself in conditions where, as in our case, a rating to determine who can be awarded the granting is established and includes all firms applying, and where, as a consequence, the distinction between "beneficiary" and "non-beneficiary" firms is constituted by a differently determined threshold, we may in principle apply the analysis in a neighborhood of the discontinuity point (Mohr 1988). The hypothesis underlying this method is that, in the proximity of such a point firms are much similar as for initial features, and what characterizes them as eligible or not-eligible for granting is a minimal variation along one dimension.

In our case we could not apply the above mentioned method, despite of a ranking in project evaluation, because such a ranking was made up of three different rankings drawn up at three different times (see footnote 3), where same firms appeared both as "beneficiaries" and as "non-

beneficiaries". Such a condition prevented us from determining a single discontinuity point and from applying such a method.

As a consequence we found it appropriate, both thanks to its simpleness and to the accuracy of the underlying theoretic pattern, to recur to the more widespread statistic method: causal inference according to "potential outcomes" approach (Rubin, 1974). The basic idea runs as follows: each statistic unit (in our case, the firm), with reference to a precise moment, is defined by two possible values of the outcome variable under consideration. Since Y is the generic outcome-variable (in our case, see Table 7), we find two possible outcomes for each statistic unit, Y(1) and Y (0), representing the value of the interest variable, respectively in case of intervention ("treatment") and of non-intervention. The impact (or net effect) attributable to the intervention, for a generic unit *i* simply represents the difference between both potential outcomes.

$$\tau_i = Y_i(1) - Y_i(0)$$

The crucial problem concerning such an approach is that we cannot observe simultaneously both outcomes (reason why they are called "potential") for each unit (Holland 1986).

This leads us to focus our attention on impact distribution, and particularly on its synthetic indexes, within the set– or subset – of reference. In our case we may assess the average impact on beneficiaries, that is the quantity:

$$E(\tau \mid T=1) = E(Y(1) - Y(0) \mid T=1)$$

where τ is the impact and T the granting (T=1) or not (T=0) of the treatment.

Shortly, the underlying idea is to employ information pertaining to non-beneficiary group units in order to approximate the quantity we could not observed $E(Y(0) \mid T=1)$.

It would be noteworthy clarifying that, despite our choice to adopt as a "control group" all non beneficiary firms which applied for granting, instead of a random sample chosen amongst the whole population of Tuscany firms, allowed us to reduce in a significant way the selection bias[12], we could appreciate differences in firms initial conditions likely to deceive a "direct" comparison of data in Table 7, and this could lead to a biased estimate of the impact. In order to achieve plausible estimates of the impact in such a condition, we have to resort to new hypothesis, where their sustainability is closely connected to the amount of information available. We shall consider, in particular, the "unconfoundedness" hypothesis

$$\big(Y(0); Y(1)\big) \perp T \mid \mathbf{x}$$

[12] In fact we assume that beneficiary firms are more similar to other firms applying for granting and not successful, than to firms which did not apply at all (likely to be less structured, less informed, less committed to innovation, ecc.).

according to which, given a vector of covariates **x**, potential results are independent from T, which means that the value of potential results does not change according to treatment provision. Moreover, it is worthy pointing out that by covariates we mean all features associated to statistic units unlikely to be affected by intervention (in our case, variables pertaining to basic information of the firms and all pre-intervention variables).

All this considered, in order to sum up all information included in the set of available covariates, we employed the propensity score, a proper tool which, after its introduction (Rosenbaum e Rubin 1983), was more and more applied to non-experimental studies and, more in particular, to the program evaluation. The propensity score is the conditional probability of exposure to intervention; formally:

$$e(x) = \Pr(T = 1 \mid \mathbf{x} = x)$$

More than a balancing score, as showed in Rosenbaum e Rubin (1983), that is a tool able to homogenize covariate distribution between units exposed to treatment and not exposed units:

$$\Pr(\mathbf{x} = x \mid e(x) = k; T = 1) = \Pr(\mathbf{x} = x \mid e(x) = k; T = 0)$$

it is also useful to synthesize individual features **x**, with size **k**, in a single dimension, since the previously introduced "unconfoundedness" hypothesis, may be re-written as follows:

$$\big(Y(0); Y(1)\big) \perp T \mid e(\mathbf{x})$$

Therefore, the unknown quantity $E(Y(0) \mid T = 1)$ which may be re-written as

$$E_{e(x)|T=1}\big[E(Y(0) \mid T = 1, e(x))\big]$$

can be calculated, thanks to the "unconfoundedness" hypothesis, by resort to available information about not exposed firms

$$E_{e(x)|T=1}\big[E(Y(0) \mid T = 0, e(x))\big]$$

Such a remark suggest us to apply the stratification method[13] (blocking) employed in (Rosenbaum e Rubin 1984), that is to determine sample stratifications with respect to the propensity score value, on the basis of assumptions, to be assimilated to an experimental study[14]. It allows us

[13] The *propensity score* may also be employed together with *matching* techniques [Dehejia and Wahba 1999], with regression techniques [Heckman et al. 1998] or as a weighting tool [Hirano et al. 2003].

[14] We often make reference to pseudo-experimental studies, where "experimental" points to cases where allocation to groups (i.e. treated or control) is performed on the basis of a randomization mechanism.

to compare firms with similar features in terms of attitude to treatment, therefore similar also as for own features. From an operative point of view, this means identifying some subsample homogeneous in terms of the propensity score (blocks), so that amongst them features distribution is much alike between beneficiary and non-beneficiary units. Afterwards we have to quantify the impact by aggregating, with respect to beneficiaries distribution amongst blocks, average differences calculated within each block.

6. Results

As far as the propensity score rating is concerned[15], we resorted to a logit model. It would be worthy to notice that many works[16] highlights that the results which may be obtained, when changing the model specification of the propensity score, are robust if applied together with matching and stratification techniques. As for variables to be included in our model, since the "unconfoundedness" hypothesis is even more tenable once increased the number of own features[17], we employed all available covariates, that are, as already suggested, variables pertaining to basic information and pre-intervention variables.

Table 8. Rating of propensity score coefficients[18]

Variables	Parameters	Std. Dev.	P-value
Constant	0.507	1.605	0.752
Age	-0.028	0.029	0.340
Corp	0.956	1.217	0.432
Mec	-0.129	1.010	0.906
Trad	1.150	1.354	0.396
Servfirms	-0.090	1.057	0.932
Salespre	0.000	0.000	0.755
RDpre	-2.263	2.324	0.330
Sales_emplpre	-0.005	0.005	0.363
Exppre	0.009	1.278	0.995
inv_mpre	-2.651	6.973	0.704
inv_ipre	21.601	32.307	0.504
Emplpre	0.002	0.056	0.972
Salespre*inv_mpre	-0.010	0.007	0.121
Emplpre*inv_mpre	2.106	1.501	0.161
Beneficiaries	45	Likelihood ratio	14.31
Non-beneficiaries	36	Pr>chi-square	0.4271

With "pre" we mean the variable value on 12/31/97, before the funding supply.

[15] Generally speaking, excepted for experimental cases, the propensity score is relatively unknown. Therefore, we need to resort to an estimation.
[16] See, i.e. Dehejia and Wahba [1999].
[17] For further consideration, see Rubin and Thomas [1996].
[18] The two interactions Salespre*inv_matpre e Emplpre*inv_matpre were introduced in the model specifications to assure the balancing function of the propensity score.

Table 9. Mean, standard deviation and propensity score percentages

	Mean	Std. Dev.	Min	25%	50%	75%	Max
Beneficiaries	0.667	0.177	0.203	0.460	0.651	0.805	0.961
Non-beneficiaries	0.487	0.217	0.001	0.243	0.539	0.629	0.814

Doubtless, since the forecasting capability of the model and the significance of single coefficients are relevant when the propensity score is applied together with regression or weighting techniques, these factors become irrelevant if stratification or matching techniques are implemented. Anyway, on one hand Table 8 (value of coefficients in the model) shows that almost all parameters are not significant. While on the other the propensity score distribution (synthesized in Table 9), though showing, as predictable, higher values referred to beneficiary firms, underlines a satisfying degree of overlapping between both subsamples, thus allowing the stratification procedure.

Finally, Table 10 represents, for each outcome variable (column 2), an estimation of the impact on beneficiary firms due to the intervention (column 5), obtained as a difference between its components (columns 3-4) and the observed significance[19] (column 6).

Table 10. Estimate of the impact of the intervention on each outcome variable

Typology	Outcome Variable	$E(Y(1)\mid T=1)$	$E(Y(0)\mid T=1)^*$	$E(\tau \mid T=1)$	p-value[20]
Performance	Δ_Employees	6.15	6.77	-0.63	0.575
	Δ_Sales	1037.63	418.72	618.91	0.091
	Δ_ Sales per employee	19.41	-21.74	41.15	0.001
	Δ_ Export share on sales (%)	5.46	5.76	-0.30	0.459
	Δ_Material investments	67.05	-78.41	145.46	0.039
	Δ_ Share of expenditure for material investments on sales (%)	-0.73	-0.63	-0.10	0.529
Innovation capability	Δ_R&D	64.47	11.80	52.67	0.118
	Δ_ Share on sales of expenditure for R&D (%)	-1.51	0.69	-2.20	0.882
	Δ_Immaterial investments	8.49	2.00	6.49	0.206
	Δ_ Share on sales of expenditure for immaterial investments (%)	1.37	0.27	1.10	0.228

* Estimated value

It can be observed that, as for most of the variables taken into account, we do not meet significant effects; a remarkable effect may be met as for sales, sales per employee and material investments (in absolute value). More in details, the effect of intervention was to increase, over six years time, the sales of 618,910 euro (+148%), sales per employee of 41,150 euro and material investments of 145,460 euros. As for the last two outcome variables we may notice that the

[19] $\Pr ob(T > t^{obs})$.

[20] Normal approximation is used.

intervention appears to have changed a decrease trend (material investments –78,410, sales per employee –21,740 for non-beneficiaries) into an increase trend.

Though our findings about the intervention impact are undoubtedly positive, we should notice that an increase (though statistically not relevant) in absolute value in investments for R&D does not correspond to an increase in terms of propensity in development of innovation capability.

From this point of view, well bearing in mind a quite poor sample size which suggests us to express just cautious opinions and evaluations overriding the sample itself, it may be worth noticing that the main question is not to evaluate the effects of intervention, but whether such effects are likely or not to cause permanent changes. Our analysis suggest that such changes are merely transitory.

7. Conclusions

By observing performance indicators, we may notice a positive (though quite limited) effect of the intervention on sales, both in value and per employees, while we do not observe appreciable effects as for occupation (remarkably, a specific goal of the intervention) and for export propensity. The effect on sales may be assessed by verifying from a quality point of view (through some information not employed by the impact analysis) how beneficiary firms employed the funds provided. We may then see that 75% of firms funded product innovation and that in general such an innovation was commercially successful (according to individual suggestions arisen by interviews), thus allowing firms to differentiate their markets of reference and/or to increase their customer base.

On the other hand, the intervention in exam did not have a structural impact on beneficiary firms' innovation capabilities, to be measured in terms of propensity to R&D expenditure and to material and immaterial investments. In particular, innovation propensity, approximated by the value of such variables in relation to sales, does not vary much within both groups. Looking at absolute variations, the only one having an appreciable positive impact is the one regarding material investments. Anyway, investment propensity of beneficiary firms did not incur in relevant changes, since investments increased in proportion to a sales raising recorded during the same period. Maybe such a lack of structural effects was also reinforced by some specific factors, such as: *i*) weak selective capability of the selection process which, also due to its "transversal" character, did not favour neither more *spillover*-likely sectors, nor those firms which were more structured in term of size, thus excessively dividing up the resources involved; *ii*) possible distortions upstream the selection process, partly caused by a spread of information through informal sources (trade associations, ecc.), partly by a firms' propensity to systematically search for public funds.

Therefore funds granted caused (limited) increases of beneficiaries' economic performance, while being unable neither to engender relevant consequences for occupation, nor to affect long-term innovation capabilities. At the same time, it would be worthy underlining that certain indirect effects of the intervention are not "seizable" by an impact analysis, but they would need further deepening. In particular, the effect on beneficiary firms sales is likely to produce wider benefits for the production system if new products and services are embedded in production processes of many client-firms on a local basis. We must anyway be doubly cautious: *i*) innovations which have been introduced are mainly "incremental", since they basically respond to short-time requirements; *ii*) a lack of structural changes in innovation propensity causes intervention effects to be mainly temporarily, unless over next years they show structural effects. It means that as of now, in the perspective of a future and equivalent necessity, beneficiary firms will again need public support in order to achieve their purposes.

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