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EVALUATING THE EFFICACY
OF EUROPEAN REGIONAL FUNDS FOR R&D

by Davide Fantino♣ and Giusy Cannone♠

Abstract

This paper provides some empirical evidence of the impact of two policy measures designed to support innovation in small and medium firms in an Italian region, both financed using the European Structural Funds but managed at regional level. The first measure was a concessional loan to promote the introduction of innovative plant, machinery and equipment, while the second was a free grant to stimulate research activity by firms. The programmes were effective in stimulating targeted investments (respectively tangible and intangible), but the benefits were short-lived, although to different degrees. The impact was stronger for the smallest firms and, in the case of the second measure, for firms with a low credit rating.

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1. Introduction[*]

Public intervention is usually crucial to foster innovation and economic development. There exists a gap between the optimal social level of R&D investment and the private level, causing a systematic under-provision that could hamper a country's economic growth. This gap is due to the difficult appropriability of returns to investment by innovators: Arrow (1962) maintains that the primary output of R&D activities is knowledge, a non-rival good, whose spread cannot be avoided by the innovators; therefore, the returns from the acquisition of new knowledge cannot be completely appropriated by the firm undertaking the R&D investment with the result that firms under-invest. Moreover, the cost of financing R&D from sources outside the firm (Hall, 2002) may be higher because asymmetric information problems arise between borrowers and lenders. An additional gap between the private rate of return and the cost of financial capital may therefore exist with imperfect financial markets, entailing borrowing constraints for risky projects such as R&D.

The main strategic tools used by governments in almost all the OECD countries to stimulate innovation are public subsidies (in the form of concessional loans[1] or free grants or a mixture of the two) and tax incentives. Their purpose is to create an "additionality" effect: a subsidy reduces the cost of the R&D investment and so the firm receiving the subsidy performs additional projects whose overall expected profits would have been negative without the public intervention.

Although the evaluation of public policies is a widely recognized issue in all the OECD countries, there are few studies of Italian innovation policies, particularly at regional level: most regional laws do not oblige regional councils to prepare technical and financial reports on the measures carried out and there is a widespread lack of information.

This work would like to go some way towards filling this gap by shedding some light on whether regional management of the subsidies provided by the European Union (EU) Structural Funds has been effective. We focus on evaluating the effectiveness of two regional programmes of subsidies for the development and implementation of innovative technologies managed by the local government of a large Italian region. The first measure, which we call Measure A, is a concessional loan designed to encourage the

[1] According to the IMF definition (IMF, 2003), concessional loans are loans extended on terms substantially more generous than market loans; they are usually provided with lower interest rates or longer repayment periods.

introduction of innovative plant, machinery and equipment, while the second, which we call Measure B, is a free grant to encourage general research activity by firms. It is worth examining the way policies of this type were designed because of their particular characteristics: their general aims and guidelines are defined by the EU, but the operative plans are developed at the national and regional level to take into account the local economic systems; the allocation of the available funds follows two sequential bargaining processes, one between EU and national governments and the other between national and local governments.

The data used in the policy evaluation exercise are taken from the official dataset of the regional financial agency managing the funds, merged with the balance sheets of the firms applying taken from the Cerved database. The methodology follows a difference-in-differences approach, where we compare the firms receiving the subsidy with those whose application was rejected; to minimize the bias due to the existing differences between the two groups we apply a matching procedure to the sample to select within the control group the firms that are most similar to the ones treated. The programmes have been effective in stimulating the targeted investments, even if the effects have been short-lived. Measure A had a positive impact on tangible investments during the project, but the effect faded within four years of the end of the project. Measure B had a significant positive impact on intangible investments only in the first year after the beginning of the project. When evaluating the effects of the two policy measures for some specific groups of firms, both measures seem to have been more effective for the smallest firms, while for the second measure this is also true for firms with a low credit rating. In the case of firms with a higher ratio between subsidy and total investments the effects are similar to the main ones for the first measure, while they are never significant for the second measure.

In general, the economic literature reveals little consensus on the ability of public funding to create additionality. Hussinger (2008) finds additionality, while evidence is mixed in Lach (2002), Almus and Czarnitzki (2003), and Duguet (2003); Wallsten (2000) find no effects. A previous study regarding some other EU subsidies can be found in Cariola et al. (2000): they evaluate the efficacy of two national programmes approved by the EU for small and medium firms (Multi-fund Operational Programmes and Community Initiative Programmes) and find a very weak effect due to the low average amount of funds provided and to some missing policy measures scheduled by the EU but not implemented. The results of our work for Measure B are consistent with those reported by Evangelista (2007), who uses data from the Eurostat Community Innovation Survey and finds a positive correlation between public funding and resources designated for innovation, but a very weak one between public funding and the introduction of new products. Bronzini and de Blasio (2006) investigate the effectiveness of Law 488/1992 in promoting tangible investments and find a temporal substitution between private and public investments, similarly to the results reported here for Measure A. The greater effectiveness of the subsidies for smaller firms is a common result in the literature (e.g. Lööf and Heshmati, 2007, for Swedish firms and Busom, 2000, for Spanish subsidies for R&D). Among the studies regarding regional policies, Bronzini and Iachini (2011) and Bronzini and

Piselli (2012) evaluate the effectiveness of the Regional Programme for Industrial Research, Innovation and Technological Transfer of the Emilia Romagna region (Regional Law 7/2002) and find that small firms increased their investment by about the amount of the subsidy, whereas there was no effect for larger firms. Gabriele et al. (2007) analyse the effect of local subsidies by the province of Trento (Provincial Law 4/1981) and find that subsidized firms increased their investments in the short run, with a transitory increase in labour productivity.

The rest of the paper is organized as follows: Section 2 briefly introduces the framework of the main EU policies drawn up in recent years to foster economic development, focusing on the policy analysed in this work; Section 3 describes the empirical strategy and the dataset; the results for the main sample, including robustness checks, are reported in Section 4, while Section 5 presents the analysis of the results obtained for four subsamples of firms; Section 6 concludes.

2. Description of the policy

The local authorities have played an increasing role in the development of economic policies in recent years. The local management of the structural funds provided by the EU has provided regional governments with an important tool to stimulate innovative behaviour among firms and reduce the socio-economic gaps between different areas. The main instruments used by the EU to support these policy issues are the European Structural Funds.

The European Structural Funds are designed primarily to support regions with structural weaknesses. The main financial resources for the European Structural Funds policy come from the European Regional Development Fund, aimed at regulating regional unbalances, and the European Social Fund, which supports employment and social cohesion. The Structural Funds for the period 2000-2006 address three objectives: the structural adjustment of regions with lower economic and industrial development, in particular the areas whose GDP was less than 75 per cent of the EU average (Objective 1); the economic and social reconversion of areas with structural problems (Objective 2); and the general renewal of the education and employment systems (Objective 3). The first two objectives address the industrial system.

The framework for the management of the Structural Funds is laid down by the Council of the EU in Regulation 1260/1999. According to these guidelines the national governments approve the Strategic National Framework and the National Operative Programmes; negotiations take place between the EU and the national governments to determine the amount of funds assigned to each country. Subsequently, the regional governments define the Regional Operative Programmes in according to their national guidelines. A second negotiation takes place between the national government and the regions to establish the amount of funds available for each area. The regional government established its policy instruments and aims in a single regional programming document (DOCUP 2000-2006), approved by the European Commission.

The EU provided €29 billion to the Italian government within the framework of the Structural Funds; around 70 per cent was allocated to Objective 1 and the remainder was divided equally between Objective 2 and Objective 3. The region we are considering is not classified as Objective 1, but had most of its municipalities classified as Objective 2 or as being phased-out, which means that they were authorized to receive subsidies in the period considered to consolidate the results obtained when they were Objective 2 areas in the previous period (1994-1999).

The regional programming document sets out the policy tools for Objective 2 local areas in four main fields of intervention: internationalization, support to the economic system, local development, and social cohesion. Under support to the economic system area, six types of subsidy are envisaged: incentives to innovative investments, to the creation of new firms, to the development of new infrastructures, to information and communication technologies, to tourism, and to stimulate research activity. We focus on the two policy measures to foster innovation activity: subsidies for innovative investments and subsidies for research activity.

The subsidies for innovative investments promote the introduction of innovative plant, machinery and equipment. They include the implementation of some national incentive plans (Laws 488/1992, 1329/1965, 598/1994 and 388/2000), an integration to grants already provided by the European Investment Bank, and a funding scheme managed directly by the region. We focus on the latter, that we call Measure A. The subsidies for research activity include two lines of intervention, both managed directly by the region: a general subsidy for firms' R&D activity (in the form of a non-refundable grant) and a specific contribution for environmental investments (in the form of a concessional loan). Only 28 loans have been awarded for the second intervention, not enough to allow a significant analysis; we therefore restrict our analysis to the other line of intervention, that we call Measure B.

The main characteristics of the two Measures are reported in Table 1. The funding scheme of Measure A is a partially public concessional loan for small and medium firms[2] operating in industry and services; applications were accepted between 10 December 2001 and 30 September 2007. The proposed project has to be completed within 18 months after selection, or 36 months for real-estate projects for tourism. The earliest funded project for this Measure was started on 10 December 2001 and the last one was completed on 15 November 2008; the earliest rejected project was supposed to begin on 10 December 2001, while the last one would have been completed on 10 June 2010. The funding scheme of the Measure is as follows: the public share of the funding is 50 per cent (with a maximum amount of half a million euros) and the borrowed amount has to be paid back in 48 months with no interest; a private bank provides the remaining funding at

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[2] According to the "Community Guidelines on State Aid for Small and Medium-Sized Enterprises" (Information from the European Commission C/213, published in 1996), small and medium firms are those with less than 250 employees, and with annual revenues lower than €50 million or an annual balance-sheet value lower than €43 million.

an interest rate equal to the 3-month Euribor, augmented by the market value of the 1-month spread in the repo market. The total amount of funding is paid to the firm after the end of the selection procedure. Projects are subsidized while funds are available in chronological order of approval; the other projects selected are put on a waiting list and funded when the firms already subsidized have paid back their loans.

Measure B is a free grant for small and medium firms operating in industry and services, except consortiums; the fund accepted applications between 29 January 2004 and 30 September 2006. The overall amount of expenditure of the projects must be not lower than €25 thousand; projects have to be completed within 30 months of selection. The earliest funded project for this Measure was begun on 30 January 2004 and the last one was completed on 30 September 2008; the earliest project that was rejected was due to begin on 29 January 2004, while the last one would have been completed on 30 September 2008. The fund can pay up to 35 per cent of costs for pre-competitive research, patents or services and consulting for research activities and up to 50 per cent of feasibility studies. Moreover, the overall percentage contribution can be increased by up to 15 per cent if the project satisfies other criteria: 5 per cent if the investment is realized in an Article 83.7c area;[3] 10 per cent if there is a technology transfer between firms, countries or public and private sector; 15 per cent if the same project has been submitted to the EU R&D Framework Programme. However, the grant provided for each project cannot exceed 50 per cent of the total cost, with an upper bound of €150 thousand.

Under Measure A, the effective funding received by beneficiaries corresponds to the difference between the cost of financial capital at market price and the lower cost of financial capital at the price offered by the public agency. Considering a hypothetical average market interest rate of 3.5 per cent and public funding of €500 thousand, the amount of saving corresponds to around €18 thousand a year. The maximum subsidy received by beneficiaries for a 3-year project (the maximum allowed) is therefore about one-third of the maximum funding received directly by free grant for Measure B, that is €150 thousand.

The agency in charge of managing these funds is a financial company controlled by the regional government. For both policy measures we analyse, a technical committee evaluates the formal aspects and the content of the applications. The evaluation is not comparative, but one-by-one, with priority of evaluation determined by the order of submission of the applications: if the formal requirements of the application are satisfied and the discretional evaluation of the project's merit is above a pre-defined numerical threshold, the subsidy is awarded. The discretional evaluation is based on the following general factors: 1. economic impact of the project on the firm, its workforce and its internationalization; 2. environmental sustainability; 3. incidence of female employment; 4. investment timing. Moreover, there is one Measure-specific criterion: 5. innovativeness for Measure A and compatibility with the EU Framework Programmes for R&D projects

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[3] Article 87 of the Treaty Establishing a Constitution for Europe regulates the procedure for state aid. In particular, Article 87.3a states that regional areas whose GDP is less than 75 per cent of the EU level are authorized to receive a larger amount of state aid; Article 83.7c lists the regional areas authorized to receive state aid, but for a lower amount.

for Measure B. Up to 5 points are assigned for each general factor and 1 additional point for the Measure-specific criterion; the pre-defined numerical threshold for the award is 6 for small firms and 9 for medium ones, while the theoretical maximum score is 21 points.

The total number of requests received for Measure A was 1837, of which 73 per cent (1339) were funded, for a total amount of public funds provided of around €150 million. For Measure B, 1443 applications were submitted and 45 per cent (643) were funded, for a total amount of funds provided of around €42 million.

3. Empirical strategy and data

3.1 Empirical strategy

The evaluation of a policy programme serves to assess whether firms receiving the subsidy behave differently because of public intervention. This is a well-known counterfactual situation, because we cannot simultaneously observe the behaviour of a firm under the hypotheses of receiving a subsidy and not receiving it. Usually, this problem is econometrically solved by comparing the behaviour of the subsidized firms ("treated") with that of other firms ("controls") with similar characteristics not receiving the subsidy (Blundell and Costa Dias, 2000). A control group needs to be constructed and suitable techniques have to be used to conclude safely that it is a good proxy for the treated firms in the absence of the subsidy programme.

We use the set of the rejected firms as a pool of potential controls. Those firms should be similar to the treated ones because, by submitting their projects, they were self-selected as internally they considered themselves and their projects to be worthy of consideration for the subsidy; the bias due to the fact that the rejection of the project is a negative signal of efficiency should be minimized by the matching procedure for the observable characteristics and by the fixed effects included in the difference-in-differences methodology for the unobservables.

We use a nearest-neighbour matching technique to improve the similarity between the two groups: for each treated firm we choose a vector of characteristics and we select a firm among the controls whose characteristics minimize a distance objective function from the characteristics of the treated firm. The vector is chosen in the pre-treatment year to increase the likelihood of exogeneity with respect to the policy; it includes tangible and intangible investments, the size, economic, financial and profitability variables reported in Table 3. We use the ATECO 2007 code sector classification to identify six technology sectors: two of them are construction and services; the remaining four follow the OECD's partition of manufacturing by technology level (OECD, 2007; Hatzichronoglou, 1997). We partition the matching by technology sector.

The objective function we use is the numerical distance between the propensity score functions of the firms (Dehejia and Wahba, 2002; Frolich, 2004). The propensity score is calculated by using a probit model on the full sample of treated and controls to estimate the likelihood of a firm receiving the subsidy, given the vector of characteristics in the pre-treatment year, which therefore enter as covariates in the estimate. This type of matching procedure weights the effect of the policy on the outcome according to the distribution of the treated; we therefore estimate the average treatment effect on the treated (ATT). The matching procedure is done with replacement: a firm selected as a matching a treated firm is not removed from the pool of the potential matching of the other firms; the same control firm can therefore be selected more than once.

Given the different length of the project for different firms and the length of the interval in which firms were able to begin the project, the temporal overlapping between the timing of the projects was only partial and there were firms at different stages of project completion in a given year. We therefore decided to group firms according to the number of years after the beginning of the project and after its end: we observed each treated firm during the project after each year (up to three); we also observed it after completion for one and two years (and, for Measure A, for three and four years).[4] For each treated firm, we chose from our sample the available control firm whose characteristics in the pre-treatment year minimized the distance in the propensity scores and we associated the chosen control firm with the treated one.

The approach used to evaluate the impact of the public programme is the difference-in-differences technique. We compare the behaviour of the treated and the control firms between the pre-treatment period (2000) and a post-treatment year, where the treatment is the start of the subsidized project; we consider separately the effect during and after the project. The overall effect of the programme for a given year after either the beginning or the end of the project is calculated as the average of the differences in the outcome variable between each pair of treated and control firms, where the treated firm is observed in the required year after the treatment and the control is observed in the same calendar year as the associated treated:

$$\delta_{ij} = \frac{1}{N} * \sum \left(\Delta y_{ij}^T - \Delta y_{ij}^C \right)$$

(1)

where y is the outcome variable, the superscripts T and C are respectively for the treated and the control firms; the subscript *i* discriminates whether the treated in each pair of firms is observed during the project or after it, while the subscript *j* discriminates the number of years after the beginning or the end of the project; this pair of subscripts therefore determines exactly the state of the project of the treated firm in each pair.

The effect can be estimated in the following regression:

$$y_{ij} = [\alpha^T d^T + \alpha^C (1 - d^T)] + \left[\sum \beta_{ij} d_{ij} \right] + \left[d^T \sum \delta_{ij} d_{ij} \right] + \varepsilon$$

(2)

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[4] We considered a longer time window for Measure A because these projects began to be submitted about two years before those for Measure B (see Table 1).

where the Greek letters are the estimated coefficients, d^T is the dummy variable having value 1 when the firm belongs to the treated group and d_{ij} is the dummy variable having value 1 when the state of the project of the treated firm in each pair is exactly the one determined by i and j as defined before. In the equation there are therefore three terms: in the first square brackets there are fixed effects discriminating treated and control firms; in the second square brackets there are the effects discriminating the different years of the post-treatment period from the pre-treatment year; in the third square brackets are the effects discriminating the behaviour of the treated and the control firm for each year of the post-treatment period; it is this last group of coefficients that is interest to us and it corresponds to the coefficients defined in equation (1).

The hypothesis implied by this kind of approach is that the fixed effects discriminating treated and controls are sufficient to capture the differences in the unobservables, while the matching procedure takes care of the differences in the observables.

3.2 Data

For the evaluation exercise we combine two datasets. The first one, provided by the regional agency managing the programs, includes information on the firms applying for the subsidy: name, date of application, programmed investments, assigned grants, revoked subsidies and renunciations. We merge these data with the balance sheets of the firms from the Cerved archives, which include information about virtually all Italian companies.

We used a balanced panel, including all firms with complete observations in the pre-treatment period (1999-2000) and the following years (2001-2008). To remove outliers, we polished the data, eliminating firms experiencing mergers, acquisitions and other similar operations; for each treatment year considered (2001-2008) and separately for funded and not funded firms, we also eliminated the first and last percentile of the variation in net total investments and revenues with respect to the pre-treatment year (2000).

Table 2 shows the distribution of firms by sector according to the OECD technology level classification, with the addition of two categories for the construction and services sectors. The first two columns refer to the firms applying respectively to Measure A and Measure B; the third column shows the sector distribution for firms in the region we are considering. The difference between the two Measures is clearly due to the particular characteristics of each. One half of the firms applying for Measure B come from high and medium-high technology sectors, while this share is one-fifth in the case of firms applying for Measure A and about 12 per cent when considering all the firms in the region.

The main outcome variables of our analysis are the net tangible and intangible investments measured after the treatment, scaled respectively by the tangible and intangible fixed assets observed in the pre-pre-treatment year (1999); net investments should be a good proxy to capture additional investments by the firm

after considering the substitution of depreciated fixed assets. The main drawback is that this variable may be influenced by the firm's fiscal policies.

In the analysis we also use several other aspects of firms' activity: size, economic structure, financial structure and profitability. The size of the firm is monitored through four variables: tangible fixed assets, intangible fixed assets, total assets, including both fixed and current assets, and sales revenue. Intangible fixed assets reveal whether the beneficiaries exploited R&D and patenting activities to make their firm grow. Tangible fixed assets give information about the physical components of the firm's accumulation process. Total assets and sales provide a more general picture and monitor the firm's overall level of activity.

Some aspects of the economic structure are taken into account by a labour productivity index, given by the ratio between value added and employees, and by net working capital, scaled either by sales or by total assets. These indices should monitor the firm's efficiency with respect to the amount of labour and financial resources used for its current management.

The financial structure is considered in order to monitor changes in the amount and characteristics of financial resources available to the firm. The debt structure is examined using the leverage index, that is the ratio between debts and the sum of debts and equity; we also analyse a modified version of leverage including only long-term financial debts in the numerator. Both these indices give signals about the firm's ability and necessity to access external financial resources in general and for the long term. Moreover, the average debt cost, given by the ratio between interest expenditure and total debt, should complement these indices with the perception of the risk associated with the debt and therefore indirectly with the reputation and perceived quality of the firm's assets. The cash-flow is used to monitor the firm's ability to create internal financial resources, normalized by either sales or total assets.

Finally, we observe three profitability indices: the return on equity (ROE), calculated as net income after taxes over equity, which monitors variations in the firm's ability to produce income for the shareholders; the return on assets (ROA), calculated as gross operating surplus over total assets, which is an index of the general profitability of the firm's assets; the return on investments (ROI), calculated as the gross operating surplus over the sum of equity and long term debts, which shows the profitability of the permanent component of the firm's financial resources.

After merging the datasets and removing outliers, the final size of our sample of subsidized firms is 212 for Measure A and 139 for Measure B. The descriptive statistics of the variables in the pre-treatment year (2000) are described in Table 3 for both Measure A and Measure B. There are relatively few significant differences between the two Measures. The most important are that the value of intangible fixed assets is

more than the double for Measure B with respect to Measure A. This dissimilarity clearly reflects the self-selection due to the different aims of the two Measures.

The matching procedure described in the previous section is then applied to the sample of treated firms and of the rejected ones to minimize the differences in the observables. We can test the quality of the final matched sample by checking the mean differences between treated and controls for the whole group of variables under observation in the pre-treatment. The results are reported in the first half of Table 4, where no mean difference is significant.

We also verify that the dynamics of size and investments of the treated and control firms are similar in the years immediately before the policy is implemented. If the treated firms have stronger dynamics than the control ones in the preceding years, the empirical detection of a positive impact of the policy could simply be due to different positions in the investment cycle. The results of the comparison are shown in the first half of Table 5: there is no evidence of differences in the average variations of size and investments of the two groups of firms between 1997 and 2000.

4. Empirical evidence

4.1 Investment

The results obtained from the difference-in-differences estimation for both Measures, for tangible and intangible investments scaled by tangible and intangible fixed assets, are reported in Table 6. The errors are clustered by firm. Dummy variables for the different calendar years are also added to the specification of equation (2); their inclusion or exclusion does not affect the value of the coefficients of interest because they are common to both the treated and the control firm in each matched pair and are therefore differenced out in equation (1). Their inclusion should improve the precision of the estimated standard errors of the coefficients.

Even if the sample is balanced, the number of relevant firms for the estimation of each coefficient is not constant for two reasons: some projects lasted less than three years and were therefore observed only for the first and sometimes the second year; when considering the behaviour of the firms after the end of the projects, we were not able to observe the fourth, third, second or even first year after the end if the projects were completed respectively after 2004, 2005, 2006, or 2007, because our time window ended in 2008.

The table reports the estimates of the coefficients δ_{ij} of equations (1) and (2), which are a measure of the effect of the policy. The first three columns show the impact during the project after one, two and three years; the fourth column shows the average effect during the project; the fifth, sixth, seventh and eighth

columns show the impact for each year after the end of the project and the ninth column shows the overall effect over the whole time window.

When considering Measure A, the effect on tangible investments during the project is positive and significant in the first year and on average. After completion, the impact becomes negative and is significant in the second year; the average effect over the whole time window is nil. When considering intangible investments, the effect is not significant.

When considering Measure B, we find a positive effect on intangible investments for the whole time window considered, but the impact is significant in the first year after the beginning of the project. The effect on tangible investments is never significant. When comparing the average effect on the intangible investments to intangible fixed assets ratio with the pre-treatment statistics shown, we find that the additionality effect of the policy is about twice the pre-treatment value.

4.2 Robustness checks

The robustness of the results presented in the previous section has been confirmed by several checks with small modifications in the methodology and in the boundary of the sample.

In the first test we constructed an alternative balanced panel including all the firms with full data in the two pre-treatment years, in the start-year of the project and in the following two years. We now observe firms for a shorter period of time and we are therefore able to increase the number of those with the data requirements for inclusion in the balanced sample, improving the overall quality of the estimates. We repeat the analysis of the previous section for the three years after the beginning of the project, without distinguishing the firms observed during the project from those observed afterwards; in this way we reduce the composition effects due to the loss of firms with shorter projects or near the end of the time window for the estimation of each coefficient. The cost of this methodological change is that we are not able to discriminate different behaviours of the firms still working on their project and of those which have already completed it. The other aspects of the methodology are unchanged. The tests of the quality of the matching procedure for this alternative sample are shown in the second half of Tables 4 and 5 and we do not find significant mean differences in the variables monitored in the pre-treatment year.

The results for the impact of the subsidies are reported in Table 7. They largely confirm those reported in the previous section: for Measure A, we find positive effects in the first year, also significant for tangible investments, which become not significantly negative in the following years, when the share of completed projects increases; the overall effect of the policy over three years is still positive. For Measure B, we find positive effects for both types of investment in all the years; the coefficient is significant for intangible investments in the first year; the effects shown are slightly stronger than in Table 6.

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In the second check we show the impact of the policy measures considering alternative investment ratios as objective variables. For both tangible and intangible investments we considered the scaling by the amount of sales and total assets. The results are shown in Table 8 and are in general qualitatively similar to those shown in Table 6. We find positive results during the project for both Measures and both types of investment when normalizing by total assets; the coefficients are significant for the tangible investments to total assets ratio for Measure A and for the intangible investments to total assets ratio for Measure B after the first year of the project; after completion we have mixed non-significant results, which reduce the average effect when compared with that obtained at the end of the project. When we scale investments by sales the results are similar, but never significant.

In the third test we consider different hypotheses of clustering for the errors of the estimated equation. In the first alternative we bootstrap by firm (1000 replications) the whole matching and difference-in-differences procedure to get a better estimate of the standard errors of the coefficients; the second alternative examines what happens if we assume clustering by economic sector (ATECO) instead of by firm; the third one assumes no clustering of the observations, i.e. the case of full independence among the errors. The results for all the cases are reported in Table 9; changing the hypothesis of clustering of the equation errors does not substantially modify the conclusions of the analysis.

In the fourth check we consider whether the addition of other control variables would change our conclusions. With the aim of isolating the direct effects of the policy from those coming from the evolution of other aspects of the firm, we add to the specification of equation (2) the following variables, observed in the same year as the outcome variable, covering the main aspects of the firm's activity: the amount of revenue from sales, the net working capital to sales ratio, the cash-flow to sales ratio, the leverage index, the ratio between long-term financial debts and the sum of equity and debts, the average cost of the debt and the return on assets profitability index. The results are reported in Table 10 and are qualitatively similar to the main case: during the project we find positive effects, significant for the first year for tangible investments for Measure A and for intangible investments for Measure B; after the end of the project, for Measure A the effect is almost always negative for both types of investment and is significant in the second year.

4.3 Other outcome variables

In addition to the effect on investment, in this section we consider whether the policy influences other aspects of the firm's activity. The results regarding size, economic structure, financial structure and profitability for Measure A are reported in Table 11a.

The variables accounting for the firm's size show a positive impact during the project and immediately after. The coefficients are significant for sales in the three years following the end of the project. The effect

on intangible fixed assets is weaker and sometimes becomes negative. The average impact of the policy is always positive, but never significant. When considering the economic structure of the firm, net working capital is not consistently significant in any estimation, showing that there is no relevant effect on the management of the firm's current activity. The same is true when considering the value added per employee, showing that the additional investments are not more productive than the old ones.

The financial structure of the firm is partially affected by the policy. The cash-flow indices are usually positive, but not significant, during the project and they become not significantly negative from the second year after the end of the project: even if the subsidy provides additional liquidity, the subsidized projects do not seem to be more efficient in generating additional current financial resources than the total assets already accumulated. While the leverage is not significantly influenced by the policy, the effect on long-term financial debts is positive up to three years after the end of the project and significant in the second year and on average during the project; the firm uses the subsidy, whose amount is included in financial long-term debt, to substitute short-term debt. The average cost of financial capital shows a significant decrease of 0.8 percentage points on average during the project and of 0.5 over the whole time window, probably associated with the concessional nature of the loan.

Finally, the profitability indices do not seem to be significantly and consistently affected by the public programme during the development of the project or after its completion, either in terms of return on equity, return on assets or return on investment. Given the positive dynamics of total assets and sales, this is a signal that the additional assets accumulated with the subsidized project have the same profitability as those accumulated previously.

The impact on the other outcome variables for Measure B is shown in Table 11b. The impact on firm size is never significant; it is slightly positive, for the two types of fixed asset, while the effect on sales and total assets is mixed. The impact on net working capital is not significantly negative, while that on value added per employee is not significantly positive. Moreover, the financial structure is not heavily affected: the impact on cash-flow is weak and almost always negative, showing that the project is not creating additional financial resources in the time window considered and there are indications that it is still draining them. The debt structure is substantially unchanged and there are no relevant effects on the average cost of debt; this difference in the effectiveness with respect to the other Measure may be due to the fact that this subsidy is a free grant, while the other Measure is a concessional loan. The results concerning profitability are generally weak and not significant.

5. Effect on some subsamples

We now evaluate the impact of the Measures on four sub-samples in order to verify whether particular conditions could influence the efficacy of the programme. The matching procedure is repeated for each of

them. For all the sub-samples, the usual mean comparisons for the pre-treatment year after the matching procedure, useful to test its quality, are reported in Table 12, while the results of the difference-in-differences estimation are shown in Table 13a for Measure A and in Table 13b for Measure B.

The first sub-sample includes the firms whose credit rating in the Cerved dataset is particularly low; we include in the analysis the firms from the three lowest classes of rating, which are those defined as risky in the Cerved balance-sheet analysis. These firms are more likely to be financially constrained and may benefit from the additional financial capital provided by the subsidy. We find that for Measure B the impact of the policy on intangible investments is stronger than in the main case, while for Measure A the policy has somewhat weaker effects on this class of firms.

In the second and third sub-samples we split the overall sample according to dimension. In one case we include the smallest firms, defined as those with an amount of sales under the median of the distribution in the pre-treatment year; in the other we include all the remaining firms. Small firms had an advantage in the selection process because the threshold of acceptance was lower for them. This is because they have a peculiar role in the economic structure of the region and more in general of Italy; moreover, they usually have additional difficulties in accessing financial markets and therefore may get more benefit from the subsidy (Carmignani and D'Ignazio, 2011; Hussinger, 2008). We find that for both Measures the impact of the policy on the investment ratios of the smallest firms is stronger than for the other firms during the projects, while after their end the coefficients are never significant and for Measure A the effect fades once again. The effect for the largest firms, which is still substantial for Measure A, becomes not significant for Measure B.

The fourth sub-sample includes the subsidized firms for which the ratio between the amount of subsidy received and the total net investments is above the median of the distribution of the total sample of subsidized firms, to understand whether a high intensity of subsidy may improve the efficacy of the programme. Indeed, if the subsidy covers a small share of the investments, its influence on the firm's behaviour may be not observable because it is hidden by the overall variance of the investments. The effects on the net investments to fixed assets ratio are similar to those reported for the main sample, even if they are never significant for Measure B; the estimated impact is on average slightly greater.

6. Conclusions

Despite the large number of studies on the evaluation of R&D public subsidies, there is still controversy about their effectiveness. The aim of this paper is to contribute to this debate by providing some evidence of the impact of two policy measures that use the European Structural Funds but are locally managed, which aim to support innovative activity for small and medium firms in a large Italian region.

The results obtained, which are robust to several changes in methodology, show that the programmes are effective in stimulating the targeted investments, even if the effects are short-lived. In the case of Measure A, which is designed to stimulate the introduction of innovative plant, machinery and equipment through a public concessional loan, the subsidy has a positive impact on tangible investment during the project, but the effect fades within four years of its completion. The effectiveness of the subsidy therefore seems weak, providing a temporary boost to the firm's activity.

Results obtained from Measure B, which promotes research projects through a free grant, show a positive impact on intangible investment, coherently with the Measure's focus on research and knowledge capital; even if the effect is significant only in the first year after the beginning of the project, this policy seems to be at least partially effective.

When evaluating the effects of the two policy measures for some specific groups of firms, the effects are similar to the main ones for Measure A, while are never significant for Measure B for firms with a higher ratio of subsidy to total investments. Both measures seem to be more effective for the smallest firms, while for the second measure this is also true for firms with a low credit rating. In designing policy measures of this type, focusing on these specific groups of firms may help to increase their effectiveness.

The different degree of effectiveness of the two subsidies can be explained by looking at the projects targeted. Projects financed by Measure A are at the end of their R&D cycle, when the risk associated with the project is low: basic research has been completed, firms are nearing the end of the development stage and they have an industrial plan for the introduction of the innovation in the production process; firms are therefore already committed to their projects because they have spent a lot of time and resources in the previous stages of creating the innovation and the likelihood of financing a project that will not be completed is very small. The subsidy therefore modifies the firm's schedule in such a way that the timing of investments corresponds to that of the Measure; moreover, the award of the subsidy simplifies the search for financiers on the financial markets and so may reduce the time needed to complete the project.

Measure B is a general R&D subsidy, which can therefore be used by the firm to finance the earliest and riskiest stages of the research activity; since the subsidy is a free grant covering a large share of the costs, its award allows the firm to pass a large part of the financial consequences of failure onto the public sector. The likelihood of creating additionality is therefore quite high and the firm has an incentive to apply for projects with low social value added; in this case the effectiveness of the selection process is particularly important to ensure that the projects financed are of public interest and that they are able not only to create general knowledge, but also to be effectively applied in the production process.

Tables

Table 1: Summary of the characteristics of the Measures

	Measure A	Measure B
Number of applications	1837	1443
Number of firms funded (percentage)	1339 (73%)	643 (45%)
Overall amount of subsidy granted	150 mln €	42 mln €
Earliest start date of a funded project	10/12/2001	30/01/2004
Earliest end-date of a funded project	31/12/2001	30/06/2004
Last start-date of a funded project	15/05/2008	01/03/2007
Last end-date of a funded project	15/11/2008	30/09/2008
Earliest theoretical start-date of a rejected project	10/10/2001	29/01/2004
Earliest theoretical end-date of a rejected project	10/03/2002	15/05/2004
Last theoretical start-date of a rejected project	01/07/2008	01/03/2007
Last theoretical end-date of a rejected project	10/06/2010	30/09/2008
Average length of the funded projects	330 days	604 days
Average length of the rejected projects	309 days	520 days

Table 2: Firms obtaining the subsidy (by technology sectors) and sector distribution of all firms in the region in 2000

Technology sector	Measure A	Measure B	Region
High technology (OECD)	2.75%	11.06%	2.22%
Medium-high technology (OECD)	17.56%	39.38%	9.95%
Medium technology (OECD)	34.06%	16.52%	11.41%
Low technology (OECD)	14.01%	6.05%	11.47%
Construction	9.50%	2.51%	10.83%
Services	22.13%	24.49%	54.12%

Table 3: Descriptive statistics of treated firms in the pre-treatment period (2000)

Variable	Measure	Mean	Std. Dev.	Min	Median	Max
		Size				
Intangible fixed assets	A	61.21	93.33	0	27	517
	B	124.10	371.84	0	33	3918
Tangible fixed assets	A	745.06	1061.83	2	409	6915
	B	825.06	1107.73	6	347	5363
Sales	A	3980.68	4239.55	85	2711	40645
	B	4720.66	4473.58	137	3391	24297
Total assets	A	3292.63	3667.70	70	2062	34730
	B	4113.48	4054.33	92	3058	24296
		Investments				
Intangible investments	A	2.50	32.48	-123	-1	194
	B	14.24	73.98	-124	0	402
Intangible investments over sales	A	0.0014	0.0226	-0.1294	-0.0005	0.1794
	B	0.0063	0.0444	-0.0927	0	0.4233
Intangible investments over total assets	A	0.0053	0.0512	-0.1310	-0.0006	0.6316
	B	0.0074	0.0399	-0.0687	0	0.2761
Intangible investments over intangible fixed assets	A	0.7402	4.2565	-1	-0.0935	48
	B	1.0812	6.2936	-1	0	71
Tangible investments	A	83.54	264.60	-324	11.5	1787
	B	73.85	302.64	-1216	4	2158
Tangible investments over sales	A	0.0452	0.1630	-0.1134	0.0057	1.2718
	B	0.0434	0.1620	-0.1123	0.0013	1.2718
Tangible investments over total assets	A	0.0601	0.2762	-0.1257	0.0079	3.1579
	B	0.0471	0.1894	-0.1693	0.0016	1.9346
Tangible investments over tangible fixed assets	A	0.2482	1.1229	-0.6000	0.0556	13.6866
	B	0.3332	1.3458	-0.7901	0.0182	13.6866
		Economic structure				
Value added on sales	A	0.3324	0.1526	0.0051	0.3150	0.9115
	B	0.3306	0.1378	0.0601	0.3150	0.8579
Net working capital over sales	A	-0.0832	0.3695	-3.2115	-0.0288	0.7639
	B	-0.0898	0.2803	-1.5646	-0.0431	0.8180
Net working capital over total assets	A	-0.0718	0.2849	-1.0677	-0.0441	0.5746
	B	-0.0927	0.2692	-0.8763	-0.0537	0.4024
		Financial structure				
Cash-flow over sales	A	0.0607	0.0597	-0.1920	0.0454	0.3124
	B	0.0609	0.0570	-0.0478	0.0448	0.3013
Cash-flow over total assets	A	0.0724	0.0616	-0.1097	0.0581	0.3059
	B	0.0683	0.0528	-0.0616	0.0588	0.2423
Leverage	A	0.7684	0.1847	0.1739	0.8102	1.0504
	B	0.7824	0.1585	0.3380	0.8361	0.9859
Long-term financial debts over (debts+equity)	A	0.1006	0.1244	0	0.0612	0.7731
	B	0.0853	0.1197	0	0.0517	0.6648
Average cost of debt	A	0.0325	0.0226	0	0.0280	0.1372
	B	0.0334	0.0267	0	0.0273	0.1713
		Profitability				
ROE	A	0.2689	0.7987	-6.6667	0.1604	5.4074
	B	0.2986	0.4001	-0.9885	0.1927	2.9487
ROA	A	0.0770	0.0745	-0.0827	0.0633	0.4349
	B	0.0776	0.0624	-0.0702	0.0668	0.3121
ROI	A	0.1621	0.2510	-1.0556	0.1224	1.9091
	B	0.2122	0.2277	-0.1583	0.1418	1.5532

The Cerved dataset includes 212 treated firms for Measure A and 139 firms for Measure B.
The size variables and the raw level of investments are measured in thousand euros.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).

Table 4: Mean differences in firm characteristics in the pre-treatment period (2000) after matching for the full window sample and reduced window sample

	Full window		Reduced window	
	Measure A	Measure B	Measure A	Measure B
Intangible fixed assets	-10.854	-30.770	-14.434	-32.962
	(0.163)	(0.356)	(0.155)	(0.116)
Tangible fixed assets	-17.363	90.252	79.378	-81.694
	(0.834)	(0.487)	(0.321)	(0.403)
Sales	-46.425	644.094	570.707	-457.849
	(0.898)	(0.278)	(0.404)	(0.298)
Total assets	-30.392	386.568	350.108	-352.946
	(0.917)	(0.418)	(0.213)	(0.279)
Intangible investments	3.882	-6.568	-4.341	-12.522
	(0.277)	(0.413)	(0.148)	(0.119)
Intangible investments over sales	0.002	0.010	0.003	0.007
	(0.330)	(0.184)	(0.388)	(0.371)
Intangible investments over total assets	-0.002	0.001	0.003	-0.001
	(0.517)	(0.768)	(0.420)	(0.902)
Intangible investments over intangible fixed assets	-0.319	0.120	0.211	0.669
	(0.332)	(0.853)	(0.734)	(0.328)
Tangible investments	5.788	30.475	23.361	37.688
	(0.795)	(0.357)	(0.339)	(0.217)
Tangible investments over sales	-0.012	-0.013	-0.014	0.004
	(0.471)	(0.409)	(0.213)	(0.769)
Tangible investments over total assets	-0.015	-0.013	-0.015	0.027
	(0.377)	(0.461)	(0.217)	(0.150)
Tangible investments over tangible fixed assets	-0.132	-0.120	-0.133	0.055
	(0.298)	(0.337)	(0.290)	(0.635)
Value added per employee	0.018	-0.009	0.021	-0.024
	(0.259)	(0.627)	(0.100)	(0.130)
Net working capital over sales	0.015	-0.022	0.019	0.005
	(0.638)	(0.507)	(0.486)	(0.878)
Net working capital over total assets	0.028	-0.022	0.006	-0.019
	(0.264)	(0.508)	(0.786)	(0.501)
Cash-flow over sales	-0.004	0.007	-0.005	-0.004
	(0.154)	(0.457)	(0.177)	(0.529)
Cash-flow over total assets	-0.003	-0.004	-0.006	0.000
	(0.211)	(0.615)	(0.123)	(0.994)
Leverage	0.031	0.005	0.006	0.025
	(0.250)	(0.815)	(0.686)	(0.145)
Long-term financial debts over (equity+debts)	0.035	0.022	0.001	0.013
	(0.300)	(0.131)	(0.953)	(0.280)
Average cost of debt	-0.006	-0.005	-0.002	-0.002
	(0.100)	(0.157)	(0.232)	(0.327)
ROE	0.162	-0.261	0.168	-0.090
	(0.292)	(0.198)	(0.231)	(0.203)
ROA	-0.010	-0.016	-0.006	-0.010
	(0.200)	(0.131)	(0.205)	(0.123)
ROI	0.049	-0.032	0.106	-0.079
	(0.266)	(0.301)	(0.400)	(0.267)
# observations	424	278	498	372

The size variables and the raw level of investments are measured in thousand euros.
Significance level reported between brackets.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).
Full window sample: 1999-2008.
Reduced window sample: 1999-2000 and the 3 years immediately following treatment.

Table 5: Mean differences in the dynamics of the main variables before the beginning of the policy measures (1997-2000) for the full window and reduced window sample

	Full window		Reduced window	
	Measure A	Measure B	Measure A	Measure B
Variation of intangible fixed assets	-1.254	-9.107	0.737	-11.781
	(0.617)	(0.182)	(0.830)	(0.108)
Variation of tangible fixed assets	28.269	-9.843	33.088	7.321
	(0.122)	(0.584)	(0.102)	(0.648)
Variation of total assets	72.897	32.168	57.008	-23.397
	(0.124)	(0.589)	(0.200)	(0.638)
Variation of sales	58.019	-18.214	65.855	-82.952
	(0.219)	(0.849)	(0.300)	(0.227)
Variation of intangible investments	-2.808	-3.490	-10.574	-2.116
	(0.494)	(0.690)	(0.134)	(0.770)
Variation of tangible investments	-0.334	-20.203	7.418	18.063
	(0.987)	(0.184)	(0.674)	(0.500)
# observations	424	278	498	372

Thousand euros.
Significance level reported between brackets.
Full window sample: 1999-2008.
Reduced window sample: 1999-2000 and the 3 years immediately following the treatment.

Table 6: Difference-in-differences results during the project and after: net investments

	Years during the project			Average during the project	Years after the project				Overall average
	1	2	3		1	2	3	4	
Measure A									
Intangible investments over intangible fixed assets	0.64	1.23	1.78	1.01	0.22	-1.57	-0.73	0.72	0.25
	(1.17)	(1.15)	(2.52)	(0.83)	(2.00)	(0.96)	(1.31)	(1.38)	(0.71)
Tangible investments over tangible fixed assets	**0.48*****	0.10	0.38	**0.33****	-0.25	**-0.52****	-0.05	-0.21	0.00
	(0.18)	(0.25)	(0.40)	(0.16)	(0.25)	(0.25)	(0.26)	(0.43)	(0.15)
# observations	424	324	114	862	300	280	230	180	1852
Measure B									
Intangible investments over intangible fixed assets	**2.94***	1.97	1.28	2.18	1.46	1.46			1.92
	(1.53)	(2.14)	(2.60)	(1.59)	(2.40)	(2.58)			(1.22)
Tangible investments over tangible fixed assets	0.16	0.27	0.24	0.22	-1.14	0.80			0.03
	(0.25)	(0.36)	(0.42)	(0.23)	(1.74)	(0.56)			(0.38)
# observations	278	276	170	724	230	174			1128

Clustered standard errors by firm included between brackets.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).
*,**,*** for significance levels of the coefficients respectively of 90%, 95% and 99%.

Table 7: Difference-in-differences results: reduced window

	Years after the beginning of the project			Average
	1	2	3	
Measure A				
Intangible investments over intangible fixed assets	1.77 (1.98)	-1.06 (2.37)	-0.71 (2.83)	0.06 (2.10)
Tangible investments over tangible fixed assets	**0.42**** (0.19)	-0.05 (0.20)	-0.07 (0.20)	0.11 (0.15)
# observations	498	470	418	1386
Measure B				
Intangible investments over intangible fixed assets	**4.06**** (1.81)	2.36 (5.77)	1.99 (1.78)	2.80 (2.25)
Tangible investments over tangible fixed assets	0.55 (0.37)	0.33 (0.32)	0.16 (0.36)	0.34 (0.27)
# observations	372	372	370	1114

Clustered standard errors by firm included between brackets.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).
*,**,*** for significance levels of the coefficients respectively of 90%, 95% and 99%.

Table 8: Difference-in-differences results during the project and after: other investment measures

	Years during the project			Average during the project	Years after the project				Overall average
	1	2	3		1	2	3	4	
Measure A									
Intangible investments over sales	0.003 (0.008)	0.011 (0.010)	0.010 (0.014)	0.007 (0.007)	0.000 (0.008)	-0.008 (0.007)	-0.007 (0.010)	0.002 (0.015)	0.002 (0.006)
Intangible investments over total assets	0.000 (0.009)	0.017 (0.014)	0.005 (0.019)	0.007 (0.009)	-0.008 (0.010)	-0.011 (0.008)	-0.009 (0.010)	0.000 (0.016)	-0.001 (0.006)
Tangible investments over sales	0.032 (0.027)	0.022 (0.041)	0.022 (0.036)	0.027 (0.024)	-0.034 (0.043)	-0.030 (0.036)	0.019 (0.058)	-0.043 (0.103)	0.001 (0.032)
Tangible investments over total assets	**0.051*** (0.027)	0.003 (0.043)	0.046 (0.097)	0.032 (0.026)	-0.050 (0.047)	-0.044 (0.037)	0.002 (0.057)	-0.024 (0.092)	-0.002 (0.032)
# observations	424	324	114	862	300	280	230	180	1852
Measure B									
Intangible investments over sales	0.027 (0.017)	0.016 (0.031)	0.009 (0.015)	0.018 (0.011)	0.005 (0.017)	0.026 (0.018)			0.017 (0.018)
Intangible investments over total assets	**0.020*** (0.011)	0.011 (0.017)	0.008 (0.019)	0.014 (0.010)	-0.005 (0.018)	0.035 (0.025)			0.013 (0.009)
Tangible investments over sales	0.010 (0.028)	0.011 (0.036)	0.029 (0.038)	0.015 (0.027)	-0.124 (0.081)	0.044 (0.038)			-0.009 (0.029)
Tangible investments over total assets	0.007 (0.029)	0.016 (0.038)	0.018 (0.045)	0.013 (0.029)	-0.109 (0.077)	0.069 (0.045)			-0.003 (0.025)
# observations	278	276	170	724	230	174			1128

Clustered standard errors by firm included between brackets.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).
*,**,*** for significance levels of the coefficients respectively of 90%, 95% and 99%.

Table 9: Difference-in-differences results during the project and after: robustness checks on standard errors

	Years during the project			Average during the project	Years after the project				Overall average
	1	2	3		1	2	3	4	
Measure A									
Intangible investments over intangible fixed assets	0.64	1.23	1.78	1.01	0.22	-1.57	-0.73	0.72	0.25
	(1.16)	(1.11)	(2.48)	(0.85)	(1.97)	(1.02)	(1.37)	(1.44)	(0.70)
	[1.19]	[1.29]	[2.15]	[0.69]	[2.06]	[1.01]	[1.31]	[1.45]	[0.66]
	{1.03}	{1.18}	{1.99}	{0.72}	{1.23}	{1.27}	{1.40}	{1.59}	{0.49}
Tangible investments over tangible fixed assets	0.48	0.10	0.38	0.33	-0.25	-0.52	-0.05	-0.21	0.00
	(0.18)*	(0.24)	(0.39)	**(0.16)***	(0.26)	**(0.25)***	(0.26)	(0.46)	(0.15)
	[0.13]*	[0.22]	[0.44]	**[0.12]***	[0.33]	**[0.23]***	[0.28]	[0.51]	[0.14]
	{0.18}*	{0.20}	{0.34}	**{0.12}***	{0.21}	**{0.22}***	{0.24}	{0.27}	{0.08}
# observations	424	324	114	862	300	280	230	180	1852
Measure B									
Intangible investments over intangible fixed assets	2.94	1.97	1.28	2.18	1.46	1.46			1.92
	(1.94)	(2.27)	(2.70)	(1.61)	(2.53)	(2.69)			(1.20)
	[1.47]*	[1.64]	[2.34]	**[1.29]***	[2.92]	[3.30]			[1.39]
	{1.82}	{1.82}	{2.32}	**{1.13}***	{2.00}	{2.30}			**{1.10}***
Tangible investments over tangible fixed assets	0.16	0.27	0.24	0.22	-1.14	0.80			0.03
	(0.25)	(0.34)	(0.41)	(0.22)	(1.83)	(0.56)			(0.37)
	[0.12]	[0.37]	[0.23]	[0.16]	[1.94]	[0.51]			[0.41]
	{0.56}	{0.57}	{0.73}	{0.35}	{0.62}	{0.72}			{0.28}
# observations	278	276	170	724	230	174			1128

Boostrapped clustered standard errors by firm (1000 replications) included between round brackets.
Clustered standard errors by ATECO sector included betweens square brackets.
Non-clustered standard errors included betweens braces.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).
*,**,*** for significance levels of the coefficients respectively of 90, 95 and 99% when using the reported standard errors.

Table 10: Difference-in-differences results (with control variables) during the project and after: net investments

	Years during the project			Average during the project	Years after the project				Overall average
	1	2	3		1	2	3	4	
Measure A									
Intangible investments over intangible capital	0.68	1.05	1.73	0.96	0.03	**-1.69***	-0.93	0.85	0.16
	(1.19)	(1.12)	(2.53)	(0.88)	(2.08)	(0.98)	(1.34)	(1.49)	(0.74)
Tangible investments over tangible capital	**0.47***	0.13	0.36	**0.32***	-0.24	**-0.46***	0.16	-0.16	0.05
	(0.18)	(0.25)	(0.38)	(0.15)	(0.26)	(0.20)	(0.29)	(0.44)	(0.16)
# observations	424	324	114	862	300	280	230	180	1852
Measure B									
Intangible investments over intangible capital	**2.67***	1.81	1.62	2.10	1.16	3.05			2.05
	(1.58)	(2.21)	(2.57)	(1.60)	(2.55)	(2.72)			(1.26)
Tangible investments over tangible capital	0.12	0.31	0.24	0.22	-0.15	0.57			0.20
	(0.25)	(0.35)	(0.43)	(0.23)	(1.71)	(0.37)			(0.35)
# observations	278	276	170	724	230	174			1128

Clustered standard errors by firm included between brackets.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).
*,**,*** for significance levels of the coefficients respectively of 90%, 95% and 99%.

Table 11a: Difference-in-differences results for Measure A during the project and after: other variables

	Years during the project			Average during the project	Years after the project				Overall average
	1	**2**	**3**		**1**	**2**	**3**	**4**	
Sales	411.3	66.9	448.0	581.78	**851.8***	**876.1***	**1011.7***	537.1	838.65
	(314.3)	(539.9)	(538.2)	(415.88)	(478.7)	(530.6)	(564.6)	(819.8)	(542.90)
Total assets	273.0	638.9	677.0	464.02	408.0	312.3	697.3	580.5	472.33
	(436.6)	(825.2)	(468.9)	(555.17)	(526.2)	(699.7)	(559.0)	(610.5)	(558.84)
Intangible fixed assets	-1.78	-1.59	11.42	0.03	-9.37	-2.82	2.92	51.70	3.46
	(29.36)	(93.04)	(52.27)	(50.09)	(70.69)	(78.86)	(54.49)	(64.60)	(54.87)
Tangible fixed assets	89.60	98.77	131.18	98.55	47.84	35.13	36.20	36.32	66.95
	(88.08)	(115.44)	(166.44)	(94.98)	(119.56)	(151.16)	(166.97)	(230.70)	(108.60)
Net working capital over sales	-0.040	0.002	-0.080	-0.030	0.066	-0.013	0.136	-0.027	0.009
	(0.079)	(0.083)	(0.058)	(0.073)	(0.098)	(0.092)	(0.176)	(0.142)	(0.091)
Net working capital over total assets	-0.040	0.005	-0.046	-0.024	0.021	-0.021	-0.004	-0.089	-0.020
	(0.068)	(0.065)	(0.044)	(0.060)	(0.077)	(0.074)	(0.105)	(0.092)	(0.068)
Value added per employee	0.015	0.013	0.023	0.015	0.000	-0.007	-0.014	-0.007	0.004
	(0.020)	(0.022)	(0.034)	(0.019)	(0.022)	(0.027)	(0.028)	(0.034)	(0.019)
Cash-flow over sales	0.010	0.004	0.006	0.007	0.007	-0.043	-0.072	-0.073	-0.018
	(0.013)	(0.014)	(0.011)	(0.011)	(0.012)	(0.031)	(0.053)	(0.437)	(0.018)
Cash-flow over total assets	0.016	0.016	0.000	0.014	0.022	-0.001	-0.010	-0.044	0.004
	(0.010)	(0.013)	(0.012)	(0.010)	(0.015)	(0.013)	(0.014)	(0.034)	(0.009)
Leverage	0.043	0.012	0.051	0.033	0.008	0.011	0.036	0.040	0.026
	(0.045)	(0.037)	(0.034)	(0.037)	(0.040)	(0.046)	(0.048)	(0.048)	(0.038)
Long-term financial debts over (equity+debts)	0.048	**0.063****	0.048	**0.054***	0.060	0.036	0.066	-0.019	0.047
	(0.033)	(0.029)	(0.042)	(0.030)	(0.038)	(0.046)	(0.046)	(0.062)	(0.034)
Average cost of debt	**-0.009*****	**-0.007****	**-0.006***	**-0.008*****	**-0.006***	-0.004	-0.001	0.000	**-0.005***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)
ROE	0.27	0.26	0.53	0.32	0.46	0.24	0.36	0.26	0.34
	(0.46)	(0.34)	(0.47)	(0.62)	(0.40)	(0.42)	(0.48)	(0.47)	(0.63)
ROA	-0.01	-0.02	-0.01	-0.02	-0.01	-0.02	-0.02	-0.03	-0.02
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
ROI	0.40	0.39	0.21	0.45	1.06	0.32	0.19	0.31	0.51
	(0.30)	(0.33)	(0.23)	(0.40)	(0.94)	(0.75)	(0.23)	(0.24)	(0.51)
# observations	424	324	114	1852	300	280	230	180	990

The size variables and the raw level of investments are measured in thousand euros.

Clustered standard errors by firm included between brackets.

*,**,*** for significance levels respectively of 90%, 95% and 99%.

Table 11b: Difference-in-differences results for Measure B during the project and after: other variables

	Years during the project			Average during the project	Years after the project		Overall average
	1	2	3		1	2	
Sales	-664.8	-260.1	51.2	-153.50	70.8	335.9	-153.50
	(761.2)	(508.1)	(452.3)	(467.88)	(483.0)	(634.1)	(467.88)
Total assets	-58.9	514.8	677.5	389.96	453.3	544.3	389.96
	(510.6)	(312.0)	(418.4)	(299.93)	(435.1)	(634.1)	(299.93)
Intangible fixed assets	42.83	13.86	20.91	26.64	39.19	54.31	33.47
	(43.37)	(54.69)	(44.94)	(40.77)	(68.01)	(89.06)	(47.91)
Tangible fixed assets	119.89	293.30	104.22	182.32	57.83	167.21	154.61
	(121.00)	(217.82)	(193.37)	(140.01)	(211.32)	(276.84)	(159.70)
Net working capital over sales	-0.015	-0.044	-0.015	-0.026	-0.027	-0.094	-0.092
	(0.037)	(0.052)	(0.050)	(0.034)	(0.055)	(0.069)	(0.100)
Net working capital over total assets	0.014	0.029	0.030	0.024	0.038	0.033	-0.037
	(0.017)	(0.029)	(0.020)	(0.019)	(0.029)	(0.039)	(0.036)
Value added per employee	-0.004	0.004	0.003	0.001	0.004	-0.005	0.028
	(0.018)	(0.016)	(0.013)	(0.015)	(0.028)	(0.033)	(0.022)
Cash-flow over sales	-0.029	-0.018	-0.009	-0.020	-0.002	-0.017	0.000
	(0.018)	(0.018)	(0.011)	(0.015)	(0.013)	(0.016)	(0.017)
Cash-flow over total assets	0.007	0.001	0.026	0.009	0.028	0.031	-0.016
	(0.022)	(0.034)	(0.027)	(0.024)	(0.032)	(0.029)	(0.012)
Leverage	0.042	0.020	0.007	0.025	-0.001	-0.005	0.016
	(0.029)	(0.026)	(0.022)	(0.024)	(0.027)	(0.025)	(0.022)
Long-term financial debts over (equity+debts)	-0.004	-0.007	-0.001	-0.004	-0.001	-0.003	0.015
	(0.003)	(0.006)	(0.005)	(0.004)	(0.004)	(0.005)	(0.021)
Average cost of debt	-0.015	-0.044	-0.015	-0.026	-0.027	-0.094	-0.003
	(0.037)	(0.052)	(0.050)	(0.034)	(0.055)	(0.069)	(0.003)
ROE	-0.47	-0.49	-0.30	-0.14	-0.05	-0.18	-0.14
	(0.36)	(0.37)	(0.26)	(0.26)	(0.17)	(0.18)	(0.26)
ROA	-0.03	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
ROI	-0.16	-0.07	-0.05	-0.07	-0.03	-0.04	-0.07
	(0.12)	(0.05)	(0.07)	(0.06)	(0.09)	(0.11)	(0.06)
# observations	278	276	170	1128	230	174	1128

The size variables and the raw level of investments are measured in thousand euros.

Clustered standard errors by firm included between brackets.

*,**,*** for significance levels respectively of 90%, 95% and 99%.

Table 12: Mean differences in firm characteristics in the pre-treatment period (2000) after matching for firms with low credit rating, small size, big size or high subsidy to investments ratio.

Measure	Low credit rating A	Low credit rating B	Small firms A	Small firms B	Big firms A	Big firms B	High subsidy to investments ratio A	High subsidy to investments ratio B
Intangible fixed assets	-17.114 (0.433)	29.280 (0.318)	9.495 (0.253)	-3.164 (0.852)	-21.291 (0.141)	-25.410 (0.117)	-13.767 (0.141)	1.478 (0.963)
Tangible fixed assets	-14.743 (0.327)	54.640 (0.467)	-16.762 (0.847)	-32.436 (0.738)	73.245 (0.567)	-53.988 (0.449)	-42.293 (0.700)	-116.754 (0.614)
Sales	60.457 (0.954)	45.400 (0.212)	129.564 (0.222)	-9.782 (0.944)	159.846 (0.388)	-135.976 (0.136)	83.284 (0.696)	-29.739 (0.355)
Total assets	-30.229 (0.969)	19.000 (0.386)	50.545 (0.202)	-60.091 (0.311)	28.273 (0.219)	-33.639 (0.135)	60.155 (0.469)	-14.261 (0.402)
Intangible investments	2.371 (0.786)	-1.400 (0.912)	-6.455 (0.202)	5.782 (0.193)	-2.691 (0.220)	2.602 (0.895)	8.267 (0.106)	42.652 (0.126)
Intangible investments over sales	0.002 (0.698)	0.027 (0.130)	-0.004 (0.105)	0.027 (0.141)	-0.002 (0.127)	0.001 (0.736)	0.004 (0.292)	0.012 (0.307)
Intangible investments over total assets	-0.004 (0.448)	0.015 (0.236)	-0.007 (0.126)	0.008 (0.452)	-0.003 (0.474)	0.003 (0.577)	0.000 (0.957)	0.015 (0.209)
Intangible investments over intangible fixed assets	-0.933 (0.310)	-0.978 (0.209)	-0.574 (0.229)	-0.096 (0.605)	-0.736 (0.105)	0.718 (0.628)	-0.534 (0.307)	2.893 (0.169)
Tangible investments	-55.400 (0.189)	15.720 (0.430)	-28.485 (0.197)	-42.582 (0.124)	50.373 (0.161)	-3.627 (0.942)	1.103 (0.970)	-1.551 (0.964)
Tangible investments over sales	-0.055 (0.212)	-0.070 (0.181)	-0.032 (0.158)	-0.042 (0.116)	0.005 (0.489)	0.005 (0.612)	0.002 (0.918)	-0.038 (0.110)
Tangible investments over total assets	-0.046 (0.166)	-0.029 (0.144)	-0.036 (0.292)	-0.061 (0.122)	0.004 (0.686)	0.010 (0.453)	-0.003 (0.807)	-0.019 (0.303)
Tangible investments over tangible fixed assets	-0.181 (0.348)	0.036 (0.858)	-0.208 (0.188)	-0.183 (0.541)	-0.020 (0.660)	0.010 (0.918)	-0.092 (0.394)	-0.019 (0.897)
Value added per employee	0.003 (0.922)	-0.042 (0.318)	0.036 (0.103)	-0.025 (0.456)	-0.002 (0.886)	-0.013 (0.493)	0.026 (0.126)	-0.031 (0.159)
Net working capital over sales	-0.085 (0.186)	-0.087 (0.155)	0.011 (0.846)	-0.076 (0.186)	-0.030 (0.375)	0.045 (0.170)	-0.061 (0.105)	0.006 (0.876)
Net working capital over total assets	0.008 (0.874)	-0.079 (0.112)	0.006 (0.867)	-0.022 (0.668)	-0.051 (0.184)	0.042 (0.254)	-0.035 (0.249)	0.022 (0.619)
Cash-flow over sales	0.005 (0.693)	-0.016 (0.266)	-0.019 (0.101)	0.006 (0.708)	-0.001 (0.505)	-0.001 (0.873)	-0.009 (0.134)	-0.008 (0.408)
Cash-flow over total assets	-0.006 (0.622)	-0.020 (0.162)	-0.003 (0.200)	0.006 (0.622)	-0.005 (0.449)	0.005 (0.546)	-0.002 (0.205)	-0.002 (0.826)
Leverage	-0.039 (0.139)	0.027 (0.297)	0.027 (0.228)	0.012 (0.700)	0.031 (0.158)	0.016 (0.497)	0.030 (0.129)	0.011 (0.668)
Long-term financial debts over (equity+debts)	-0.070 (0.224)	-0.053 (0.166)	0.007 (0.735)	-0.051 (0.140)	0.000 (0.968)	0.029 (0.143)	-0.001 (0.967)	0.004 (0.853)
Average cost of debt	-0.007 (0.202)	0.001 (0.886)	0.003 (0.240)	-0.004 (0.318)	0.002 (0.454)	0.001 (0.864)	-0.004 (0.372)	0.000 (0.917)
ROE	0.895 (0.220)	-0.273 (0.432)	-0.227 (0.138)	0.173 (0.122)	0.575 (0.318)	-0.040 (0.697)	0.299 (0.230)	0.011 (0.860)
ROA	-0.006 (0.591)	-0.022 (0.124)	-0.027 (0.302)	-0.014 (0.277)	-0.014 (0.274)	0.023 (0.175)	-0.030 (0.101)	0.008 (0.630)
ROI	0.489 (0.129)	-0.232 (0.199)	-0.030 (0.336)	-0.314 (0.120)	0.080 (0.113)	0.008 (0.754)	0.174 (0.119)	-0.092 (0.291)
# observations	70	50	202	110	222	168	232	138

The size variables and the raw level of investments are measured in thousand euros.
Significance level reported between brackets.
The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).

Table 13a: Difference-in-differences results during the project and after for Measure A (firms with low credit rating, small size, big size or high subsidy to investments ratio): net investments

	Years during the project			Average during the project	Years after the project				Overall average
	1	2	3		1	2	3	4	
Low credit rating									
Intangible investments over	-0.97	-0.16	1.55	-0.37	1.26	-1.58	-1.89	-1.99	-0.61
intangible fixed assets	(0.84)	(0.75)	(3.30)	(1.48)	(2.27)	(2.58)	(2.23)	(2.22)	(1.95)
Tangible investments over	0.08	0.38	0.43	0.24	-0.75	-0.60	0.59	-0.79	-0.11
tangible fixed assets	(0.42)	(1.09)	(0.28)	(0.50)	(0.49)	(0.70)	(0.55)	(1.05)	(0.45)
# observations	70	60	16	146	56	52	42	26	322
Small size									
Intangible investments over	0.92	2.14	0.44	1.32	1.12	-0.97	-1.13	-2.63	0.22
intangible fixed assets	(1.44)	(2.11)	(4.08)	(1.34)	(2.57)	(1.71)	(3.04)	(4.32)	(1.57)
Tangible investments over	**0.46****	**0.34****	**0.64****	**0.43****	-0.23	-0.23	-0.10	-0.39	0.06
tangible fixed assets	(0.23)	(0.17)	(0.31)	(0.18)	(0.39)	(0.47)	(0.44)	(0.57)	(0.45)
# observations	202	142	40	384	152	140	112	84	872
Big size									
Intangible investments over	0.35	-0.04	5.01	0.91	2.34	-3.07	-1.62	0.12	0.17
intangible fixed assets	(0.97)	(1.41)	(3.85)	(1.26)	(3.29)	(3.63)	(2.48)	(1.82)	(1.61)
Tangible investments over	**0.49*****	0.01	0.03	**0.24***	-0.25	-0.30	-0.23	-0.26	-0.02
tangible fixed assets	(0.15)	(0.21)	(0.17)	(0.13)	(0.17)	(0.25)	(0.23)	(0.18)	(0.11)
# observations	222	182	74	478	148	140	118	96	980
High subsidy to investments ratio									
Intangible investments over	1.22	2.27	2.42	1.79	-3.79	-3.34	-1.97	-2.55	-0.79
intangible fixed assets	(1.41)	(1.69)	(4.01)	(1.30)	(3.41)	(2.11)	(1.62)	(3.27)	(1.29)
Tangible investments over	**0.55***	0.23	0.15	**0.37****	-0.20	-0.36	-0.33	-0.33	0.01
tangible fixed assets	(0.32)	(0.16)	(0.20)	(0.19)	(0.21)	(0.32)	(0.51)	(0.45)	(0.23)
# observations	232	186	70	488	156	148	122	94	1008

Clustered standard errors by firm included between brackets.

The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).

*,**,*** for significance levels of the coefficients respectively of 90%, 95% and 99%.

Table 13b: Difference-in-differences results during the project and after for Measure B (firms with low credit rating, small size, big size or high subsidy to investments ratio): net investments

	Years during the project			Average during the project	Years after the project		Overall average
	1	2	3		1	2	
Low credit rating							
Intangible investments over	**3.01***	4.08	**3.62****	**3.56****	-0.96	1.45	2.31
intangible fixed assets	(1.63)	(2.52)	(1.71)	(1.61)	(1.84)	(1.14)	(1.47)
Tangible investments over	0.16	0.51	2.25	0.76	0.28	0.88	0.68
tangible fixed assets	(0.72)	(0.79)	(1.88)	(0.55)	(0.46)	(0.92)	(0.49)
# observations	50	50	28	128	40	34	202
Small size							
Intangible investments over	**6.12***	2.32	**5.23***	**4.47***	-0.35	0.97	3.02
intangible fixed assets	(3.26)	(3.60)	(3.15)	(2.31)	(3.84)	(2.92)	(2.39)
Tangible investments over	0.01	1.55	0.49	0.70	0.50	-1.07	0.41
tangible fixed assets	(0.56)	(1.89)	(0.65)	(0.82)	(0.43)	(3.24)	(0.96)
# observations	110	110	74	294	88	64	446
Big size							
Intangible investments over	1.97	2.95	0.45	2.01	3.28	5.52	2.84
intangible fixed assets	(2.84)	(3.13)	(2.43)	(2.47)	(3.07)	(6.88)	(2.90)
Tangible investments over	0.13	-0.14	0.35	0.07	-0.11	-0.22	-0.01
tangible fixed assets	(0.25)	(0.28)	(0.60)	(0.22)	(0.26)	(0.54)	(0.19)
# observations	168	166	96	430	142	110	682
High subsidy to investments ratio							
Intangible investments over	1.61	4.79	1.94	2.88	1.99	3.02	2.73
intangible fixed assets	(9.24)	(4.52)	(4.98)	(4.61)	(2.86)	(3.72)	(3.13)
Tangible investments over	0.05	-0.57	0.67	-0.02	0.11	0.35	0.06
tangible fixed assets	(0.36)	(0.36)	(2.20)	(0.60)	(0.44)	(0.65)	(0.47)
# observations	138	138	94	370	108	84	562

Clustered standard errors by firm included between brackets.

The denominators of the investments ratios are measured in the pre-pre-treatment year (1999).

*,**,*** for significance levels of the coefficients respectively of 90%, 95% and 99%.

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