Growth and efficiency in subsidized firms

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Abstract

The literature aiming at an evaluation of the impact of subsidies on firm behaviour is now extensive. However, only few of the papers we have reviewed use evaluation methods based on microeconometric studies of firm level data. Moreover, almost all the studies apply a parametric approach: impact is evaluated through an econometric estimation of a function, usually specified linearly. In this approach the evaluation results critically dependent on assumptions about functional forms, and this tends to generate substantial biases in several cases. The purpose of this paper is to provide a statistically robust evaluation of the impact of subsidies allocated by Law 488/92 on subsidized firm, using a nonparametric approach. We evaluate if the receipt of financial assistance from public funds actually makes a difference to firm performance in terms of investment, new employment, profit and labour productivity. The analysis is based on a new data set that merges the financial statement database with the 488 administrative database by firm. The data set include information related not only to firm performances but also to the length of the subsidized investment.. Our approach applies difference-in differences estimator using a matching procedure, considering selection on observables and unobservables. The analysis shows that growth in turnover, employment and fixed assets has been more dynamic in the subsidized firms. The results are statistically significant and robust to different econometric specifications and changes in the underlying hypotheses. However, the labour productivity of subsidized firms grows less than in the non subsidized firms. This behaviour can affect long run efficiency and growth. The paper highlights the trade-off between the increase in employment and turnover and the increase in labour productivity that the firm faces applying for the 488 subsidies.

Keywords: matching estimator, policy evaluation, State aids.

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1. Introduction

State aids to manufacturing and to (few) service sectors, in the form of grants and subsidies, have been for many years a key component of regional policy in less developed Italian areas, such as Mezzogiorno. The use of such policy instruments has been aimed at influencing the regional allocation of investments and employment, in order to increase competitiveness, self-sustaining growth, and new employment in low income regions. Since 1950 the government has implemented a range of policy instruments to subsidise firms, mainly in the southern regions, directed, up to 1992, mainly to the development of industrial structure and job creation. In 1992 the regional policy in Italy faced a dramatic change associated to the end of the "extraordinary intervention", resulting in a sharp cutback of financial resources and in the dismantling of the institutional framework for the assistance to the South of the country. The long subsequent phase of uncertainty ended with the design and the implementation of a new regional policy, named "new programming" (Barca and Pellegrini, 2003). In this policy framework a new instrument to subsidize investment in the so-called disadvantaged areas has been implemented: the law 488/1992, founding private capital accumulation by project-related capital grants.

Law 488/92 has been in the last ten years the main policy instrument to boost private investments. From 1996 (the first operative year) thought 2005, this law has sustained more than 27,000 projects with over 16 billions of Euros of subsidies, whereas investments have added up to over 50 billions of Euros, 70% of which in the South. The expected additional employment from these investments amounts to about 355,000 new units. After ten operative years, and in view of the extent of spending on 488, it is reasonable to ask if 488 made a difference (or not) to the industrial structure of Mezzogiorno in term of growth, employment and productive efficiency.

The literature aiming at an evaluation of the impact of subsidies on firm behaviour is now extensive. It is generally accepted that regional capital incentives induce additional investment (Faini and Schiantarelli, 1986; Harris, 1991; Daly et al., 1993; Schalk and Untied, 2000), even if they can have unpleasant effects on income inequality across different areas (Dupont and Martin, 2003). Besides, they have some effect in attracting plants to low income areas (Faini and Schiantarelli, 1986; Midelfart-Knarvik and Overman, 2002).

The employment impact of capital subsidies is more doubtful: the question is if the size of substitution effect, associated to the reduction in the user cost of capital relative to the labour cost, is larger or smaller than the output effect, related to the increase in production (and therefore in local labour demand), due to the reduction in total costs and to the attraction of new investment in the area (Schalk and Untied, 2000). Several studies found that the substitution effect outweighs the output effect (Driehuis and van den Noord, 1988; Harris, 1991; Gabe and Kraybill,2002), others found the opposite (Wren and Waterson, 1991; Dyle et. al., 1993; Schalk and Untied, 2000; Roper and Hewitt-Dundas, 2001).

Few studies evaluate if the receipt of financial assistance from public funds actually makes a difference to firm performance in terms of improved plant efficiency or productivity. Increase in investment, both in additional productive capacity and in replacement investment, modernizes the

[1]The paper is based on the data and some considerations prepared for the evaluation of the PON Sviluppo locale (the national operative program for local development). We are grateful to the Independent Evaluator (Nova-Ismeri) for conceding us the use of the data. Founding from Ministero dell'Università e della Ricerca scientifica e Tecnologica and University of Bologna is gratefully acknowledged.

firm stock of equipment and results in higher efficiency and productivity. On the other side, capital subsidies can also have potential negative effects on productivity, by increasing allocative inefficiencies if lower relative capital costs leads firms to overinvest in capital, and by encouraging rent-seeking behaviour by firms for subsidies (Harris and Trainor, 2005). All the studies show that the effects of subsidies on efficiency and productivity are negligible or negative (Lee, 1996; Bergstrom, 1998; Harris and Trainor, 2005).

There are few studies concerning ex-post evaluation of the impact of 488[2]. A positive effect of 488 on investment is found in Ministero dell'Industria (2000) and in Bronzini and De Blasio (2005). Pellegrini and Carlucci (2003) and Carlucci and Pellegrini (2005) present empirical evidence of a positive employment effect. Bronzini and De Blasio (2005) indicate the presence of intertemporal substitution: financed firms slowdown significantly their investment activity in the years following the program.

The correct evaluation of the effect of a policy intervention requires a counterfactual analysis, where the behaviour of subsidized firms is confronted with what would have taken place without the subsidies. The main problem here is the construction of a valid control group in this setting, because neither the firms receiving support, nor those non applying, can be considered random draws. There are several econometric methods for evaluation studies based on non-experimental data. Only few of the papers we have reviewed use evaluation methods based on microeconometric studies of firm level data. Moreover, all the studies apply a parametric approach[3]: impact is evaluated through an econometric estimation of a function, usually specified linearly. In this approach the evaluation results critically dependent on assumptions about functional forms, and this tends to generate substantial biases in several cases (Heckman et al., 1998; Klette, Møen and Griliches, 2000). Heckman et al. (1998) suggest that evaluation results are only reliable when they are based on a suitable control group, that include "non-treated" units which are similar to some of the "treated" units. An alternative non parametric approach is the matching estimator, proposed by Rosenbaum and Rubin (1983) and developed in several evaluation papers[4].Recent research has showed that this matching should focus on finding treated and non treated units who are as similar as possible in their estimated "propensity score", which is an estimated probability, given observed variables, that the unity will use the subsidy (Rosenbaum and Rubin,1983; Heckman, Ichimura and Todd,1997).

The purpose of this paper is to provide a statistically robust evaluation of the impact of 488 on subsidized firm, using a nonparametric approach. In the estimation of the counterfactual we exploit the auction mechanism that 488 uses to allocate the subsidies across firms. The group of subsidized firms are compared with the group of firms that applied for the incentives but were non financed ,since they score low in the ranking. These non financed firms, then, are especially eligible to be part of a control group, as they show a propensity for investment and a need to invest which is very similar to that of subsidised ones. As suggested by different authors (Brown et al.,1995; Pellegrini and Carlucci, 2003; Bronzini and De Blasio, 2005), the rejected application group is very similar to the treatment group in terms of its characteristics, and allows to isolate the effects of policy intervention.

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[2] Several papers analyze the properties of the selection mechanism, that mimics an auction procedure, of 488. See, among others, Chiri and Pellegrini (1993) and (1995), Chiri, Pellegrini and Sappino (1998), Del Monte and Giannola (1999), Pellegrini (1999), Potestio (2000), Scalera e Zazzero (2000), Parascandolo e Pellegrini (2001). The territorial effects of 488 are studied in Ministero delle Attività Produttive (2003) and De Castris and Pellegrini (2005).

[3] To our knowledge, the only exception is Carlucci and Pellegrini (2005) .

[4] See, among others, Dehejia and Wahba (1999, 2001), Heckman, Ichimura, Smith and Todd (1996), Heckman, Ichimura and Todd (1997, 1998) and Becker and Ichino (2002).

The paper differs from the previous literature mainly in three aspects: (i) the data. The analysis is based on a new data set that merges the financial statement database, available on the market (AIDA), with the 488 administrative database by firm. The data set include information related not only to firm performances but also to the length of the subsidized investment. Consequently, we can estimate the impact of the subsidy after the investment is really concluded; (ii) the analysis of the subsidized firm. We estimate the impact of 488 on a set of variables that include investments, employment, profits and labour productivity. As a result, we obtain a complete picture of the firm behaviour after subsidization; (iii) the econometric method. Our approach applies difference-in differences estimator using a matching procedure, considering selection on observables and unobservables. The recent literature suggests that this approach shows considerable improvements relative to simpler estimators (Blundell and Costa Diaz, 2002; Smith and Todd, 2005).

The paper is structured as follows. In Section 2 we present a detailed description of the Law 488 and of its selection mechanism. Section 3 describes the data and Section 4 the econometric methodology. The empirical findings are the core of Section 5. Finally, Section 6 offers some concluding remarks.

2. Regional policy and Law 488/1992

Fifty years of rapid development of the whole country and of policies aimed at the Mezzogiorno development have not eliminated the gap with the rest of Italy, non even in the most developed areas. The gap in terms of per capita income, after being reduced until mid-1960s from 55 to 60%, widened again during the 1980s until it reached the 1950s value (55,3 on average in the 1990s). Only after the end of the '90s the gap shows a uninterrupted decrease, till 60% again in 2004. Also the unemployment rate, with a gap of about 1-2 points recorded at the beginning of the '50s was filled in 1965, but has then continued to progressively increase, remaining at about 3 points until 1985 and then exploding, reaching 15 points. After a slight decline, in 2004 was around 10 points.

During this period the policy instruments employed and the industrial development institutions operating in the Mezzogiorno have changed several time. However, despite the use of differing policy approaches throughout the post-war period, capital subsidies (both grants and reductions in the cost of borrowing) have always been among the adopted instruments. In the last two decades they can be considered the core of the regional policy for the South. The rationale was the gap in the availability of private capital in the Southern regions, that affected productivity and production capacity in these areas. Moreover, subsidies were perceived as a "compensation" for the productivity gap in the South, attributing to the limited availability of public infrastructure and negative territorial externalities. The result was that the subsidized projects were subject to very accurate administrative controls, but have never been selected basing on economic parameters and criteria: all investing firms could participate and benefit of the subsidies, the only limit being the availability of financial resources. This approach could have maximized the number of subsidized investment projects given the available resources, but it had negative effects on policy additionality and efficiency (Pellegrini, 1998).

The end of the "extraordinary intervention", the reduction in the financial resources, and the new approach of regional policy, more oriented to efficiency, competitiveness and self-sustaining growth, similar to what happened in many other countries in the European Union (Harris and Trainor, 2005), are all factors imposing a radical change in the policy instrument to offer financial support to private investments in Mezzogiorno. The new instrument, the Law 488/1992, allocates

subsidies through a "rationing" system based on an auction mechanism which guarantees compatibility of demand and supply of incentives. [5]

There are two main features of 488 that are very important for the evaluation analysis: (i) the 488 makes clear the targets of the policy intervention; (ii) the selection mechanism of 488 identifies projects that are viable but cannot be subsidized due to funds shortage.

The law 488 is basically a national tender for incentives to which single firms participate and where an automatic allocation is made based on general criteria, that express the policy preference.[6] Incentives are allocated on the basis of regional competitive auctions. In each auction the investment projects are ranked on the basis of these five pre-determined criteria[7]:1) quota of owner capital invested in the project; 2) number of new employees per unit of investment; 3) ratio between the subsidy requested by the firm and the higher subsidy applicable, given the rules determined by area by the EU Commission; 4) a score related to the priorities of the region in relation to location, project type and sector; 5) a score related to the environmental impact of the project. The five criteria carry equal weight: the values related to each criteria are normalized, standardised and added up to produce a single score that determines the position of the project in the regional ranking. The rankings are drawn up through the decreasing order of the score awarded to each project and the subsidies are allocated to projects until funding granted to each region is exhausted.[8]

The five indicators that empirically represent the criteria are a clear expression of the policymakers' preferences. The share of the own funds invested in the project can be considered an (imperfect) proxy of the entrepreneur assessment of the project viability and success: higher the share, greater the commitment of the owner to the project (Chiri and Pellegrini, 1995). In Parascandolo and Pellegrini (2001) we show that the share is highly correlated to the economic and financial situation of the firm: the more profitable firms choose to assign a higher share of own funds to the project. Therefore, the subsidized firms tend to be more profitable (and more efficient) than the non subsidized ones. The number of new job per unit of total investment is a central indicator, used to re-equilibrate the negative substitution effect of the capital subsidy to the firm labour demand. The policy makers express a preference for new projects and for labour-intensive investments. In order to increase the probability to receive the subsidy, the firms can choose to overshoot the optimal (i.e. the efficient) number of people to employ in the project. The amount of aid requested by the firm, relative to ceilings established by the European Union, is the key indicator that transforms the allocation procedure to an auction mechanism. The indicator aims to "reveal" the minimum amount of subsidy regards by the firm as indispensable for the project realization. In this way the firm can influence the likelihood of obtaining the incentive, self-reducing the "rent" granted by the subsidy, and the policy makers maximize the number of subsidised investments given the financial resources available, reducing the welfare losses due to a unique subsidy rate.

In this procedure the indicators are the selection variables, i.e. the indicators can explain almost part of the differences between the group of subsidized firms and the group of non subsidized firms.

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[5] The law operates non only in the Mezzogiorno but in all so-called disadvantaged areas (technically the areas designed as Objective 1, 2 or 5b for the purpose of EU Structural Funds and the areas subject to exemptions from the ban on state subsidies, as in paragraphs 97.3.a. and 97.3.c of the Pact of Rome). Eligible for assistance are firms in manufacturing, extractive sectors, tourism and other service sectors. Investment qualified for the intervention by the 488 are: setting-up, extension, modernization, restructuring, reactivation and relocation. The maximum subsidisation rates for SMEs range from 50 percent of total investment in Objective 1 areas to 20 percent in Article 92(3)c areas outside Objective 2 and 5b. The rates for larger firms are lower.

[6] For a detailed description of the law 488 see, among others, Pellegrini and Carlucci (2003), Carlucci and Pellegrini (2005), Bronzini and De Blasio (2005).

[7] The criteria 4 and 5 were introduced starting from the 1998 (3rd auction).

[8] There are also special rankings for large projects and reserved lists for small and medium-sized firms.

This is of paramount importance in the construction of the counterfactual scenario in the evaluation analysis. Being the indicators observable, we can reconstruct the selection processes, estimating the selection effect in the control group. Therefore, we can reproduce an experimental framework for the analysis while checking for selection factors.

Another interesting characteristic of the auction mechanism is the presence of a set of firms willing to invest, that have a valid investment project checked by an preliminary screening[9] (as they have been admitted into the ranking), but did non receive any subsidies because their scores were too low in the ranking. These firms, then, are especially eligible to be part of a control group, as they show a propensity for investment and a need to invest which is very similar to that of subsidised firms (Brown et al.,1995; Pellegrini and Carlucci, 2003; Bronzini and De Blasio, 2005). Moreover, a great deal of information of these firms is known, as they have participated in the selection. A possible objection is that these firms could have use different policy instruments, after being rejected by 488. Actually, a feature of the 488 regulation is that financing under 488 cannon be combined with other source of public financing. In particular, it is required that firms applying for the subsidies by 488 have to give up to other public subsidies. This characteristic reduces the possibility of a double subsidisation but also the use of other public subsidies by the firms applying to the 488 scheme.

3. The econometric evaluation procedure

In an experimental framework, the difference in performance between subsidized and non-subsidized firms is the estimated gross impact of the incentive schemes. The main assumption is that capital subsidies are allocated randomly to firms and projects. This assumption is clearly violated when the policy instrument (like 488) determines a deliberate selection process. In presence of selection, the performances of the non-subsidized firms may differ systematically from what the subsidized firms would have experienced in the absence of incentives. In this case the assumption of random distribution of the subsidies could lead to a significant bias in the estimated impact parameters. The selection bias problem can be tackled using the appropriate estimation method.

Let assume that the performance (in terms of turnover, employment, or other variables) of a firm i in period t, denoted Y_{it} , is given by[10]:

$$(1) \qquad Y_{it} = \beta X_{it} + \alpha_i D_i + \gamma_i + \lambda_t + U_{it}$$

where X_{it} is a set of observable covariates, D_i is a dummy variable which is one if the i firm has received the subsidy and zero otherwise, γ_i is a firm specific intercept, that represents permanent differences in firm performance due to unobservable firm specific characteristics , λ_t reflects shocks common across firms, and U_{it} represents temporary fluctuations in unobservables. Note that eq. 1 incorporates heterogeneous responses to subsidy, as indicated by the subscript i on the α_i coefficient. The distribution of these coefficients may differ systematically between the subsidized and the non subsidized firms.

If we assume that the selection bias can be mostly attributed to the presence of permanent firm characteristics γ_i, that are correlated to D_i, a fixed effects panel estimator can compute the impact parameter. The estimate parameter is non biased even if the subsidized firms are non-randomly selected, as long as the selection is based on firm characteristics that are invariant over time.

[9] The screening of the investment economic feasibility is carried over by a set of appointed banks, that receive a compensation by the government for the analysis.

[10] The equation is a slightly modified version of the model presented in Klette, Møen and Griliches, 2000.

Assuming that data are available before and after the policy intervention, i.e., at times t_0 and t_1 , a feasible solution is the well-know "difference-in-differences" (DID) estimator:

$$(2) \qquad \hat{\alpha}_{DID} = \left({}^{s}Y_{t1}^{*} - {}^{s}Y_{to}^{*}\right) - \left({}^{ns}Y_{t1}^{*} - {}^{ns}Y_{t0}^{*}\right) = \Delta^{s}Y^{*} - \Delta^{ns}Y^{*}$$

where $\Delta^{s}Y^{*}$ and $\Delta^{ns}Y^{*}$ are the average changes in performance from before to after the incentive scheme was operating, and the superscripts *s* and *ns* refer to the subsidized and non subsidized firms, respectively. The estimated parameter represents the average effect of the subsidy on the subsidized firms (ATT in this literature), and it could not be extended to the non subsidized firms.

Another source of selection bias is the correlation between U_{it} (the unobserved temporary shock) and the probability to be selected into the incentive program. For instance, in presence of a positive temporary shock to a specific sector, firms in this sector are more willing to invest and to apply for the subsidy. In this case there is a positive relation between the firms that apply to the scheme and the short term market perspectives, and the DID method tends to overestimate the effect of the policy intervention.

The recent econometric literature has suggested that kind of selection bias can be reduced by augmenting the DID estimator, by incorporating conditioning variables reflecting the pre-program performance (see Heckman et al., 1999; Klette, Møen and Griliches, 2000; Blundel and Costas Diaz, 2000 and 2002). The idea is that conditioning for the observable differences (in performances but also in characteristics), we should control for pre-program, temporary shocks that influence the probability of being subsidized. Moreover, if the subsidized firm are poorly similar to the non subsidized firms, the evaluation results are critically dependent on the parametric specification of the model (Heckman et al., 1998; Klette, Møen and Griliches, 2000). A non parametric estimator that it requires only weak assumptions about functional forms is the matching estimator (see Heckman et al., 1998;Blundel and Costas Diaz, 2000 and 2002 for details). The matching estimator assumes that selection can be explained purely in terms of observable characteristics, so that, conditioning to the observed variables, we can mimic a random experiment (this is the uncondfoundedness or conditional independence assumption). The matching is basically a bias-reduction technique: the focus on the closeness between the subsidized and non subsidized firms and the consideration of the common support problem (when any combination of characteristics seen among the subsidized firms is non observed among the non subsidized ones) leads to select a control group very similar to the subsidized firms, easing the evaluation of the policy impact.

The matching method estimator (MM) is given by:

$$(3) \qquad \hat{\alpha}_{MM} = \frac{1}{N_S} \sum_{i \in S} \left(Y_i^{s} - \sum_{j \in NS} \omega_{ij} Y_j^{ns} \right)$$

where Y_i and Y_j are the post-program outcomes for subsidized and non subsidized firm, respectively. S and NS refer to the groups of subsidized and non subsidized firms. ω_{ij} is a weight indicating the similarity between the two firms before the subsidy was provided.

The main advantage offered by the matching method is that it does non require any assumption about the functional form of the dependency between the outcome variable and the observed covariates. On the other hand, if the covariates are numerous, it could be difficult to identify a non-subsidized firm to match with every subsidized firm, unless the sample is huge. Empirically, as the number of characteristics used in the match increases, the chances of finding a match reduce. This obstacle was overcome thanks to an important result (Rosenbaum and Rubin, 1983) showing that

matching on a single index reflecting the probability of participation could achieve consistent estimates of the treatment effect in the same way as matching on all covariates. This index is the propensity score and this variant of matching is termed 'propensity score matching'. Its clear advantage is that it replaces high-dimensional matches with single index matches (Bryson, Dorsett and Purdon, 2002). Any standard probability model can be used to estimate the propensity score (p). For example:

(4) $p = Pr\{D_i = 1|X_i\} = F(h(X_i))$

where $F(.)$ is the normal or the logistic cumulative distribution and $h(X_i)$ is a function of covariates. In the paper we takes advantage of the selection mechanism that is used to allocate the incentives under the 488, inserting the selection indicators in the equation of the propensity score.

The correct use of propensity score requires that firms with the same propensity score must have the same distribution of observable (and unobservable) characteristics independently of treatment status. In other words, for a given propensity score, exposure to treatment is random and therefore treated and control units should be on average observationally identical (Becker and Ichino, 2002). This hypothesis (often called "balancing hypothesis") can be tested. We have followed the procedure proposed in Becker and Ichino, (2002), where: (i) the sample is split in k equally spaced intervals of the propensity score, (ii) a test on the equality of the average propensity score of treated and control units within each interval is carried out, (iii) and, if this condition is satisfied, the equality of the means of each characteristic between treated and control units is tested within each interval.

There are different methods to determinate the weights ω_{ij} in equation (3), and each method defines the matching estimator. Among the matching with replacement methods proposed in literature (stratification matching, nearest neighbour matching, caliper matching, local linear matching and kernel matching; see Smith and Todd, 2005)[11] we have chosen the nearest neighbour matching and the kernel matching.

In the nearest neighbour matching each treated unit i is linked to a set of untreated units C(i), which minimises the absolute distance between the respective propensity scores:

(5) $C(i) = \min_j \| p_i - p_j \|$

Set $C(i)$ becomes a single member if one chooses a one-to-one matching (single nearest neighbour matching). With the kernel matching method no unit is eliminated, although some matching between treated and untreated ones could be of poor quality if the values linked to the propensity score differ noticeably (but the attached weight should be also very low) . The general formulation for the ATT estimated by nearest neighbour matching (ATT^M) is the following (Becker and Ichino, 2002; Carlucci and Pellegrini, 2005):

(6) $W_{(i,j)} = \frac{1}{N_i^{NS}}$ *if* $j \in C(i)$ and $W_{(i,j)} = 0$, otherwise:

(7)
$$ATT^M = \frac{1}{N^S}\sum_{i\in N^S}\left[Y_i^S - \sum_{j\in C(i)} W_{(i,j)} Y_j^{NS}\right] = \frac{1}{N^S}\left[\sum_{i\in N^S} Y_i^S - \sum_{i\in N^S}\sum_{j\in C(i)} W_{(i,j)} Y_j^{NS}\right]$$
$$= \frac{1}{N^S}\sum_{i\in N^S} Y_i^S - \frac{1}{N^S}\sum_{j\in C(i)} W_{(j)} Y_j^{NS}$$

with $W_{(j)} = \sum_i W_{(i,j)}$

[11] See Carlucci and Pellegrini (2005) for more details.

In the kernel method each unit treated is linked to an average of all the untreated units with weights which are inversely proportional to the distance between the propensity score of the treated units and untreated units. The estimation of the average effect on the treated by kernel method (ATT^K) is the following:

$$(8) \qquad ATT^{\mathbf{K}} = \frac{1}{N^S} \sum_{i \in N^S} \left\{ Y_i^S - \frac{\sum_{j \in N^{NS}} Y_j^{NS} W_{(i,j)}}{\sum_{j \in N^{NS}} W_{(i,j)}} \right\}$$

where $W_{(i,j)} = G\left(\frac{p_j - p_i}{h_n} \right)$ is a kernel function and h_n is a bandwidth parameter.

The matching estimator assumes that, after conditioning on a set of observable characteristics, mean outcomes are conditionally mean independent of receiving a subsidy. However, Smith and Todd (2005) observe that there may be systematic differences between participant and nonparticipant outcomes even after conditioning on observables. Such differences may arise, for example, because of selection into the program based on unmeasured characteristics. This can be the case of Law 488, where the quality of the management or the links to the credit system can affect the choice of the level of subsidy demanded, and therefore the rank. Such differences violate the identification conditions required for matching. A possible strategy, suggested in Heckman, Ichimura and Todd (1997), Heckman and al. (1998), Blundell and Costa Dias (2002) and Smith and Todd (2005), is the combination of matching with DID. This "conditional" DID (CDID) estimator allows for temporally invariant differences (individual fixed effects and trend effects) in performances between subsidized and non subsidized firms. In other words, it weakens the identifying assumption for matching by allowing unobserved variables to influence performances (Bryson, Dorsett and Purdon, 2002). Moreover, Smith and Todd (2005) find that the CDID estimators perform substantially better than the more traditional econometric estimators and the corresponding cross-sectional matching estimators. The CDID estimator allows us to exploit the knowledge of the selection process, together to the longitudinal amplitude of our sample. Therefore the implemented estimator is the following:

$$(9) \qquad \hat{\alpha}_{CDID} = \frac{1}{N_S} \sum_{i \in S} \left(\Delta Y_i^s - \sum_{j \in NS} \omega_{ij} \Delta Y_j^{ns} \right)$$

We have imposed in all the estimations the common support restriction, in order to improve the quality of the matches. The standard error of the ATT are estimated by the bootstrap procedure (20 replications) described in Becker and Ichino (2002).[12]

4. The implementation of the dataset

The construction of the database used for the estimation of the model has required a complex process of normalization and integration among different sets of data. The complete procedure has been carried out in three different steps:

1) Identification of the eligible projects
2) Removal of the projects non activated in the temporal interval considered
3) Replacement of missing budgetary data

1) The financed projects group (*treated* group) consists of all the "winning" (i.e. funded) projects in Mezzogiorno (ob. 1 regions, excluding Abruzzo) according to the ranks of all regional auctions.

[12] All the estimates make use of the set of Stata programs proposed in Becker and Ichino (2002).

Projects are eligible for control group if are in the manufacturing sectors and if are admitted to evaluation to the regional auctions but non financed ("losers"). Projects that were funded in other auctions (special actions dedicated to Northern regions, or to areas devastated by an earthquake or to tourism and retail sectors) or *via* special regional ranks were discarded from control group. Duplicate projects – i.e. applications for more than one auction - have been excluded from analysis.

2) In this step a particular attention was dedicated to the selection of the projects that did not present anomalies and irregularities for the analysis. Firstly, financed projects whose investment program have not yet concluded have been discarded. Both treated and control group were subsequently purged of the projects which year of conclusion (actual and scheduled, respectively) has preceded the year of the auction[13]. Another group of discarded projects is represented by the programs started (or scheduled to start) before the year preceding the publication of the auction. Since their activation cannot be directly linked to law 488, these projects must be regarded as anomalous. Finally all the projects started (scheduled to start) after 1999 have been discarded: this choice has been motivated by the impossibility to evaluate the projects, missing a sufficient temporal lag with project information after its conclusion.

3) Integration of dataset with budgetary data has been perhaps the more delicate operation in the construction of our data. Budget data are obtained from the AIDA dataset, which contains the budgets delivered by a subset of Italian firms to Chambers of Commerce. AIDA contains the budgets of firms whose turnover is more than 1 million euro (or 2 billions of Liras before 2002), and therefore cannot be representative of the Italian firms population. The budget data imputation procedure has produced a unavoidable reduction of the share of small firms in our sample, introducing a strong risk of selection bias in the composition of the treated and control groups. Given our estimation procedure, however, we can obtain consistent result if the selection bias is similar between the two groups, even if they can be referred only to the particular set of treated firms. More specifically to the under-representation of small firms in the sample, it does non affect the estimation of the policy impact if the variation in the small firms share is the same in the financed projects group and in the control group.

The data suggest that the impact of the imputation procedure is basically the same between the two groups. The results in table 1 show that the corrected sample, after the reduction in the data set due to the identification of the eligible projects and the elimination of the anomalies, is equal to the 34.9% of the original sample in subsidized firms, to the 35.1% in non subsidized firms. The matching procedure with the budgetary data decreases again the corrected sample: the matched sample used in the analysis is equal to the 12.6% of the corrected sample for the subsidized firms, to the 14.4 % in non subsidized firms. However, a more detailed analysis of the matching procedure effect is presented in the following paragraph.

[13] The incongruity derives from the fact that in the first two auctions (years 1996 and 1997) the law 488 has inherited applications from the previous incentive instrument (law 64/1986), that was closed in 1992.

Table 1
The original and the matched dataset

		Subsidized	Non Subsidized
Original projects dataset		**15,172**	**29,586**
1) Identification of eligible projects	Non ob, 1 regions	627	110
	Financed by other auctions	-	3,726
	Presented in other auctions but non financed	-	3,942
	Total	**14,545**	**21,923**
2) Discarded projects because out of the temporal lag	Financed but non concluded	7,777	-
	Projects concluded (or scheduled to conclude) before the application year	200	320
	Projects started (or scheduled to start) before the year preceding the auction	1,158	5,931
	Projects started (or scheduled to start) after 1999	293	10,768
	Total	**5,295**	**10,370**
3) Budgetary data matching	Budgetary data in AIDA missing for the years used in the analysis	4,630	8,877
	Total	**665**	**1,493**

Source: our elaboration on Sinit e AIDA data

4.1 Adequacy of dataset

Measuring the impact of the procedure of construction of the dataset is a crucial operation for assessing the robustness of the results emerging from the analysis. We have already pointed out that the results critically depend on the absence of selection effect in the construction of the data set, i.e. on that the selection criteria and the missing data imputation procedure have the same impact on both financed projects and control group.
In the first step of the construction of the dataset, the eligible projects for the financed projects group and for control group were chosen on the basis of geographical location; this operation defines the object of the analysis. The second step it is non a selection procedure, but rather a coherence analysis, since anomalous projects in dataset have been intentionally discarded, in order to non affect the results by programs inherited from previous instruments or by projects still in progress. A considerable risk of modifying the composition of dataset is provided by the integration of dataset with budgetary data. A severe check of possible bias in the matching between budgets data from AIDA dataset has been therefore carried out.
The analysis is presented in table 2. The reduction of the dataset due to the exclusion of AIDA missing firms, even if substantial in absolute value, has a slight impact on the regional distribution of firms. The variations systematically maintain the same sign for both the financed projects and the control group; only in Puglia there is a higher reduction in financed projects with respect to the non financed ones. The impact on firm dimension distribution is analogous: the variations maintain the same sign for the three considered dimensional classes and there is no evidence of major differences.
The analysis of the distribution of the projects according to firms economic activity shows a less favourable scenario when considering jointly geographical location and firm dimension.

Table 2
Impact of data matching process on eligible projects distribution

		Not financed		Financed		Difference	
		Eligible projects (%)	Matched eligible projects (%)	Eligible projects (%)	Matched eligible projects (%)	Not financed	Financed
Geographical location	Molise	1.5	2.7	4.6	7.4	1.2	2.8
	Campania	25.4	33.6	28.7	34.9	8.2	6.1
	Puglia	23.9	23.3	24.0	19.5	-0.6	-4.4
	Basilicata	7.1	6.0	4.4	4.2	-1.0	-0.2
	Calabria	21.4	8.8	15.3	6.2	-12.6	-9.1
	Sicilia	15.4	18.6	18.4	22.1	3.2	3.7
	Sardegna	5.3	7.0	4.6	5.7	1.7	1.1
	Total	100.0	100.0	100.0	100.0	0.0	0.0
Firm dimension	Large	2.7	13.9	4.7	18.5	11.1	13.8
	Medium	5.0	23.1	6.0	27.4	18.1	21.3
	Small	92.3	63.0	89.3	54.1	-29.2	-35.1
	Total	100.0	100.0	100.0	100.0	0.0	0.0
Economic activity sector	Mining and quarrying of energy producing materials	0.0	0.0	0.0	0.2	0.0	0.1
	Mining and quarrying, except of energy producing materials	2.2	2.3	1.7	1.5	0.2	-0.2
	Manufacture of food products, beverages and tobacco	19.4	17.5	9.2	8.6	-1.8	-0.6
	Manufacture of textiles and textile products	8.3	5.3	10.9	8.4	-3.1	-2.5
	Manufacture of leather and leather products	2.6	2.5	3.9	5.0	-0.1	1.1
	Manufacture of wood and wood products	4.4	1.9	5.1	2.4	-2.5	-2.7
	Manufacture of pulp, paper and paper products; publishing and printing	6.2	6.4	5.4	6.9	0.2	1.5
	Manufacture of coke, refined petroleum products and nuclear fuel	1.3	4.4	1.2	3.6	3.2	2.4
	Manufacture of chemicals, chemical products and man-made fibres	2.9	5.0	2.8	6.2	2.1	3.4
	Manufacture of rubber and plastic products	4.4	6.6	5.1	9.3	2.2	4.2
	Manufacture of other non-metallic mineral products	10.8	11.9	9.2	10.2	1.1	1.0
	Manufacture of basic metals and fabricated metal products	12.6	13.7	13.1	13.2	1.1	0.2
	Manufacture of machinery and equipment n.e.c.	3.7	4.7	5.2	5.0	1.0	-0.2
	Manufacture of electrical and optical equipment	3.9	4.2	5.9	5.4	0.3	-0.4
	Manufacture of transport equipment	2.3	4.4	2.2	4.7	2.0	2.4
	Manufacturing n.e.c.	6.7	5.2	7.2	5.6	-1.4	-1.6
	Unclassified service activities	8.3	3.8	11.9	3.9	-4.4	-8.0
	Total	100.0	100.0	100.0	100.0	0.0	0.0
Project typology	Modernization	6.9	18.8	3.9	13.8	11.9	9.9
	Extension	19.7	43.1	25.1	53.1	23.5	27.9
	Setting up	70.1	31.9	69.3	28.3	-38.2	-41.0
	Reactivation	0.2	0.1	0.2	0.5	-0.1	0.3
	Reconversion	0.1	0.2	0.1	0.0	0.1	-0.1
	Restructuring	2.9	5.8	1.4	4.4	2.9	2.9
	Relocation	0.1	0.1	0.0	0.0	0.0	0.0
	Total	100.0	100.0	100.0	100.0	0.0	0.0

Source: our elaboration on Sinit e AIDA data

The matching process with AIDA reduces the incidence of firms that operate in the extractive sector in the financed projects group, while increases their share in the control group; the same happens for some sectors of the mechanical industry. However, considering the whole sample of projects, the disparity on the sign of the variation of the share of economic activity among treated and control group regards only a little more than 12% of the cases. In the remaining 88 % of the cases, the distribution according to the economic activity sector does non alter in a significant way. The impact of integration with AIDA on the distributions of the two groups, subsidized and non

subsidized, appears similar: the sign is the same in all considered distributions and the levels of differences do non show appreciable differences.

The obtained results support an high level of confidence on the data set representativeness and, consequently, on the robustness of the analysis. The impact on the distributions according to dimension and sector of economic activity is null by dimension and very low by sector, demonstrating the robustness of the dataset. It is worth noting that activity sector and dimension are key variables in the evaluation procedure, since they are highly correlated with the social budgetary data, and a high bias in these characteristics would cause a low reliability of results.

The matching with the AIDA dataset necessarily generates an asymmetry in the projects sample towards larger firms for which the budgets are available and, even though in a more indirect way, on the distribution of the indicators ranking the projects and on the level of the investment. As a consequence, a further step in the consistency analysis consists in appraising the impact of AIDA integration on the selection indicators.
The analysis in Table 3 shows a quite homogeneous impact on the main indicators mean value. Moreover, when considering the median value – less sensitive to outliers – the level of homogeneity between financed projects and control group considerably increases.

Table 3
Effects of AIDA budgetary data matching on the rank indicators and the level of investment

		Eligible projects (%)		Matched eligible projects (%)		Difference (%)	
		Not financed	Financed	Not financed	Financed	Not financed	Financed
Own capital indicator	Mean	0.405	0.506	0.420	0.543	3.8	7.3
	Median	0.420	0.526	0.450	0.560	7.1	6.6
Employment indicator	Mean	0.006	0.011	0.004	0.006	-41.0	-48.8
	Median	0.005	0.008	0.003	0.004	-45.7	-51.9
Subsidy share indicator	Mean	1.320	1.373	1.359	1.408	2.9	2.6
	Median	1.333	1.333	1.333	1.351	0.0	1.4
Regional indicator	Mean	8.393	7.775	8.130	6.338	-3.1	-18.5
	Median	7.000	-	7.000	-	0.0	-
Environmental indicator	Mean	9.997	4.187	9.886	3.486	-1.1	-16.7
	Median	8.000	5.000	8.000	-	0.0	-
Investment (Euro)	Mean	1498512	1418342	2713237	3399220	81.1	139.7
	Median	689470	614067	1312833	1345835	90.4	119.2

Source: our elaboration on Sinit e AIDA data

With respect to regional and environmental indicators, differences seems instead remarkably high. This is primarily due to the temporal reference of our analysis, which *de facto* implies the exclusion of more recent projects: in fact, the regional and environmental indicators have been introduced only from the 8th auction. Considering then the impact on the level of the investment, it turns out that AIDA matching have remarkably increased mean value for both groups. Such effect is non unexpected, given the AIDA dataset characteristics. The increment of the mean value of investment is higher for the financed projects, however, the difference decreases considering the more robust median value. The joint analysis of mean and median values of investment reveals a certain degree of dispersion and a marked asymmetry of the distributions of investment in the two groups, rather than some distortion elements. It is worth noting that the median values of the treated and control groups in the final dataset are very similar, the same applies for the mean value in the eligible projects dataset. Such evidences induce to conclude that a robust techniques of estimation in the evaluation model is sufficient to cope with the different impact of the integration procedure on budgetary and investment level data .

4.2 Between groups homogeneity measures

After verifying that the cleaning and integration procedures do non have a different impact on financed projects and control group, the attention is focused on the final dataset final on which the evaluation model has been implemented. The dataset consists of 665 financed projects and 1,493 non financed projects.
For the validation of the control group the analysis of the homogeneity between the two samples is required. We present a comparison of the main characteristics of the projects and of the ranking indicators in the sample of subsidized and non subsidized firms. Moreover, we analyze similarities in the two sample referring to budgetary data, both for year before the start of the project (year 0)

and for the year following the conclusion (year 1) of the investment program. The results are presented in tables 4 and 5.
As far as the distribution of projects is concerned, a substantial homogeneity between the two groups is found, according to region, firm dimension, economic activity sector and investment typology.

Table 4

Distribution of projects according to main characteristics in the final dataset

		Projects			Distribution %		
		Not financed	Financed	Total	Not financed	Financed	Total
Geographical location	Molise	40	49	89	2.7	7.4	4.1
	Campania	501	232	733	33.6	34.9	34.0
	Puglia	348	130	478	23.3	19.5	22.2
	Basilicata	90	28	118	6.0	4.2	5.5
	Calabria	131	41	172	8.8	6.2	8.0
	Sicilia	278	147	425	18.6	22.1	19.7
	Sardegna	105	38	143	7.0	5.7	6.6
	Total	1493	665	2158	100.0	100.0	100.0
Firm dimension	Large	207	123	330	13.9	18.5	15.3
	Medium	345	182	527	23.1	27.4	24.4
	Small	941	360	1301	63.0	54.1	60.3
	Total	1493	665	2158	100.0	100.0	100.0
Economic activity sector	Mining and quarrying of energy producing materials		1	1	0.0	0.2	0.0
	Mining and quarrying, except of energy producing	35	10	45	2.3	1.5	2.1
	Manufacture of food products, beverages and	262	57	319	17.5	8.6	14.8
	Manufacture of textiles and textile products	79	56	135	5.3	8.4	6.3
	Manufacture of leather and leather products	38	33	71	2.5	5.0	3.3
	Manufacture of wood and wood products	28	16	44	1.9	2.4	2.0
	Manufacture of pulp, paper and paper products;	96	46	142	6.4	6.9	6.6
	Manufacture of coke, refined petroleum products	66	24	90	4.4	3.6	4.2
	Manufacture of chemicals, chemical products and	75	41	116	5.0	6.2	5.4
	Manufacture of rubber and plastic products	99	62	161	6.6	9.3	7.5
	Manufacture of other non-metallic mineral products	178	68	246	11.9	10.2	11.4
	Manufacture of basic metals and fabricated metal	204	88	292	13.7	13.2	13.5
	Manufacture of machinery and equipment n.e.c.	70	33	103	4.7	5.0	4.8
	Manufacture of electrical and optical equipment	63	36	99	4.2	5.4	4.6
	Manufacture of transport equipment	65	31	96	4.4	4.7	4.4
	Manufacturing n.e.c.	78	37	115	5.2	5.6	5.3
	Unclassified service activities	57	26	83	3.8	3.9	3.8
	Total	1493	665	2158	100.0	100.0	100.0
Project typology	Modernization	281	92	373	18.8	13.8	17.3
	Extension	644	353	997	43.1	53.1	46.2
	Setting up	476	188	664	31.9	28.3	30.8
	Reactivation	1	3	4	0.1	0.5	0.2
	Reconversion	3		3	0.2	0.0	0.1
	Restructuring	87	29	116	5.8	4.4	5.4
	Relocation	1		1	0.1	0.0	0.0
	Total	1493	665	2158	100.0	100.0	100.0

Source: our elaboration on Sinit e AIDA data.

Some difference are found for what concerns large firms, which represents 13,9% in the control group and 18,5 % in the treatment group; similarly the share of small enterprises turns out to be smaller in the financed projects group (54% vs. 63,0%). Regarding economic activity sector, the food industry share is double in the control group (8,6% vs. 17,5 %); textile and leather industry share among the groups balance quite completely this difference. The distribution according to project typology does non introduce remarkable differences.
The levels of the indicators, crucial parameters for the application of the model, show a marked homogeneity between the two groups; it is worth to none again, with regard to this aspect, the absence from the final dataset of projects with valid values for the regional and environmental indicators, introduced from 8th auction.

Table 5
Summary of main covariates in the final dataset

		Mean			Median		
		Not financed	Financed	Total	Not financed	Financed	Total
Investment (Euro)		2713237	3399220	2924627	1312833	1345835	1325745
Ranking Indicator	Own capital indicator	0.420	0.543	0.458	0.450	0.560	0.480
	Employment indicator	0.004	0.006	0.004	0.003	0.004	0.003
	Subsidy share indicator	1.359	1.408	1.374	1.333	1.351	1.333
	Regional indicator	8.130	-	8.130	7.000	-	7.000
	Environmental indicator	9.886	-	9.886	8.000	-	8.000
Year 0	Turnover	295804522	207800146	267874209	3575628	3783176	3665954
	Employees	433	470	444	27	30	28
	Fixed assets	73591375	62286657	70003550	1293725	1420256	1349931
	Gr. margin / Turnover	0.075	0.031	0.061	0.089	0.102	0.093
	ROI	4.638	5.781	4.998	4.125	5.570	4.520
	ROE	7.488	11.021	8.606	4.195	6.990	5.090
	Fin. charges / Turnover	0.050	0.050	0.050	0.028	0.028	0.028
	Turnover / Employees	287745	264090	280255	169852	159485	166906
	Fin. charges / Debt	0.051	0.059	0.054	0.045	0.046	0.046
	Value Added	31285523	40820011	34311523	920671	1103340	975071
Year 1	Turnover	449313766	255229392	383864421	5250719	5998036	5582406
	Employees	438	361	412	31	42	34
	Fixed assets	139697036	138751258	139378100	2299919	3126801	2599767
	Gr. margin / Turnover	0.079	0.124	0.094	0.090	0.105	0.094
	ROI	3.559	3.297	3.470	3.550	3.260	3.420
	ROE	2.723	2.552	2.664	2.700	1.930	2.370
	Fin. Charges / Turnover	0.069	0.053	0.064	0.022	0.025	0.023
	Turnover / Employees	346931	243015	311673	186983	154387	173047
	Fin. Charges / Debt	0.036	0.048	0.040	0.033	0.035	0.033
	Value Added	59416379	55626971	58138511	1335058	1790353	1513162

The analysis does non indicate strong differences between the two sample in the budgetary data, especially if the median values, which are more robust and less sensitive to outliers values, are considered. The subsidized firms are slightly greater and more profitable, as expected, than the non subsidized firms. We are confident that the estimated probability model can capture the remaining dissimilarities. Moreover, the use of a non parametric estimator, as the matching estimator, seems particularly appropriate to our case, given the presence of anomalous values.

Our data set contains information on the years of the effective beginning and end of the investment project. Exploiting this information, we can estimate the impact of the subsidy confronting the balance sheet the year before the project is effectually started and the year after the investment is really concluded[14]. The information is relevant, because the 488 procedure requires neither the investment project to be actually started by the time of the first subsidy instalment, either to be over after two years since the beginning (in this case, however, also the payments of the following instalments are lagged). To our knowledge, this is the first analysis that exploit this information. Pellegrini and Carlucci (2003) and Carlucci and Pellegrini (2005) consider the 1995 as the beginning year and the 1997-1998 as the ending years for all considered projects (in the first and second auctions). Bronzini and De Blasio (2005) consider the time span 1995-2001 for projects financed by the second auction, and the time span 1996-2001 for projects financed by the third auction. In our analysis, the time span can differ for each project, depending on the beginning and end of the investment.

[14] This is the date corresponding to the end of the inspection carried out by the appointed bank. Therefore, it can overestimate the length of the investment period by 6-12 months.

This approach requires to determine a ending period also for the non subsidized firms. The hypothesis is that the ending data is equal to the data scheduled for the investment starting augmented by the average investment period by auction calculated for the subsidized firms sample. In the robustness analysis we adopted an alternative hypothesis, where we replicate each non subsidized firm for each year in the considered time span, imputing to this firm a different "ending date" for the "virtual" investment project.

5. Results

The results presented in this paragraph are based on the non subsidized firms sample without duplications (i.e. where the ending year for the non subsidized firms is imputed on the base of the average investment length by auction in the subsidized firms sample). Moreover, the results are integrated by a robustness analysis, where some hypotheses are relaxed.

5.1 Main results

Three variables sets are considered in the analysis: firm growth (turnover, average number of employees, fixed assets); profitability (gross margin/turnover, ROI, ROE, per capita turnover); leverage (debt charges/turnover; debt charges/debt stock).

The sample homogeneity was put at risk by the presence of several anomalous data, as signalled by the difference between median and mean by indicators. Therefore, we selected only firms with non-negative values for turnover, employment and assets, and trimmed the subsidized and non subsidized firm samples at the 5 and 95 percentiles.[15] This procedure, joined to the presence of missing values, explains the differences in the subsidized and non subsidized firms samples by indicators.

The first step in the evaluation procedure is the estimation of propensity score. We adopted a logit specification of the treatment variables $AGEV_i$, which is 1 if the *i* firm has received the subsidy and zero otherwise:

$$(10)\ P(AGEV_i=1) = \alpha_0 + \alpha_1*Ind1 + \alpha_2*Ind2 + \alpha_3*Ind3 + \alpha_4*Quadro1 + \alpha_5*Quadro2 + \alpha_6*Quadro3 + \alpha_7*Cubo1 + \alpha_8*Cubo2 + \alpha_9*Dum\_m + \alpha_{10}*Dum\_g + \alpha_{11}*Dum\_ban1 + \alpha_{12}*Dum\_ban2 + \alpha_{13}*Dumg1 + \alpha_{14}*Dumm1$$

where *Ind1*, *Ind2* and *Ind3* are own capital share indicator, the new employment to investment ratio indicator and the amount of subsidy demanded to the maximum amount ratio indicators, i.e. the main ranking indicators, *Quadro1, Quadro2* and *Quadro3* are the respective indicators squared, *Cubo1* e *Cubo2* are the first two indicators cubed, *Dum_m* and *Dum_g* are dummy variables by dimension (medium and large dimension by European Union Commission definition), *Dumg1* and *Dumm1* are their interaction with *Ind1*. *Dum_ban1* and *Dum_ban2* are dummy variables relative to the first and second auctions, that are some specific characteristics, especially the admission of projects already concluded. The environment and regional indicators were not introduced, because they are been inserted only from the 8th auction.

The adopted specification reflects the selection procedure, that is non linearly based on the three main indicators. We imposed the common support option in the estimate, to improve the quality of the matching. The estimated parameters are in table 6:

[15] A similar procedure has been applied by Bronzini and Di Blasio (2005)

Table 6
Logit estimate : baseline sample

Variables	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ind1	15.0618	5.319028	2.83	0.005	4.636698	25.48691
ind2	199.9342	39.61265	5.05	0.000	122.2949	277.5736
ind3	3.433033	.6933546	4.95	0.000	2.074083	4.791983
quadro1	-17.45897	13.56129	-1.29	0.198	-44.03861	9.120668
quadro2	-1861.623	2965.726	-0.63	0.530	-7674.34	3951.094
quadro3	-.0014786	.0718606	-0.02	0.984	-.1423228	.1393656
cubo1	12.69705	10.95468	1.16	0.246	-8.773737	34.16784
cubo2	-18546.22	51620.36	-0.36	0.719	-119720.3	82627.82
dum_g	1.751421	.741368	2.36	0.018	.2983665	3.204476
dum_m	-.6124845	.6109584	-1.00	0.316	-1.809941	.584972
dum_ban1	5.611997	.4415473	12.71	0.000	4.74658	6.477414
dum_ban2	3.608609	.1958712	18.42	0.000	3.224708	3.992509
dumg1	-3.873398	1.331357	-2.91	0.004	-6.48281	-1.263986
dumm1	1.540251	1.181536	1.30	0.192	-.7755161	3.856019
_cons	-12.2518	1.126513	-10.88	0.000	-14.45972	-10.04387

Number of obs.	*= 2152*
LR chi2(14)	*= 1041.00*
Prob > chi2	*= 0.0000*
Log likelihood	*= -810.10232*
Pseudo R2	*= 0.3912*

The estimate is highly statistically significant and the coefficients have the expected sign. The selected common support for the propensity score is [.01546917, .9999167]. Splitting the sample by propensity score in 9 blocks, we tested that the balancing hypothesis was satisfied.

ATT is estimated using the previous propensity score. For turnover, employment, fixed assets and per capita turnover ATT is given as the difference in (weighted average) growth rates between subsidized and non subsidized firms, for the other variables as the difference in levels.

The estimates of ATT for the baseline sample is in the following table 7:

Table 7
Impact of law 488: Full sample

Variable	Kernel matching estimation					Nearest Neighbour matching estimation				
(differences)	Subsid.	Non subs.	ATT	Std. Error	t-stat.	Subsid.	Non subs.	ATT	Std. Error	t-stat.
Turnover	405	660	10.665	9.278	1.149	405	183	18.083	8.923	2.026
Employment	433	630	27.938	10.793	2.589	433	181	49.255	13.086	3.764
Fixed Assets	412	661	76.210	17.435	4.371	412	187	45.764	19.515	2.345
Gr. margin/turnover	409	651	0.742	0.679	1.093	409	187	1.349	1.014	1.330
ROI	391	659	0.033	0.835	0.039	391	182	1.355	1.270	1.067
ROE	390	637	-0.123	1.120	-0.110	390	169	0.961	2.069	0.465
Fin. charges/turn.	399	632	-0.000	0.005	-0.027	399	193	-0.008	0.009	-0.856
Per capita turnover	408	635	-17.388	6.981	-2.491	408	175	-25.755	10.884	-2.366
Fin. charges/debt	406	662	0.053	0.197	0.268	406	185	-0.003	0.612	-0.005

As expected, the growth impact of 488 on subsidized firms is positive and, by and large, statistically significant: the turnover increase is from 11 to 18 points higher in the subsidized firms than in non

subsidized ones, depending on the matching method; the number of employees is from 28 to 49 per cent points higher; fixed assets are from 46 to 76 points larger.

The results for employment and fixed assets are very statistically significant. Being the average time span equal to around 3,5 years, the additional annual employment growth rate imputed to 488 fluctuates from 8 to 14 percent points, in line with the results reported in Pellegrini and Carlucci (2003) using a parametric approach. The impact on growth in fixed assets is also very high (an annual average of more than 5 points). The result does not necessarily contradict the finding of a investment intertemporal substitution presented in Bronzini and De Blasio (2005), even if the amount of additional capital in subsidized firms is so large than it cannot be easily installed by the non subsidized firms.

The effects of the 488 are in line whit the (explicit or less explicit) targets: the subsidized firms have invested more (in percent terms) than the non subsidized ones, achieving more turnover and more employment. The question is if the subsidized firms have also increased its the efficiency, measured by productivity and profitability, in order to maintain a positive long run growth rate.

Profitability is measured by three indicators: ROI, ROE and gross margin on turnover. The results show a slight positive difference for the subsidized firms, but the difference is not statistically significant. However, being the turnover growth higher in subsidized firms, the difference in the total amount of profit is larger.

Productivity is proxied by the per capita turnover. The impact of 488 is negative and statistically significant: the labour productivity growth is higher in non subsidized firms from 17 to 26 per cent points, depending to matching estimator. There are several explanations for the productivity growth gap. If the investment productivity curve is decreasing , the reduction in the investment cost generated by the subsidy drives the subsidized firm to invest in projects with a lower than average productivity. Moreover, in the 488 procedure, higher the employment on investment ratio, higher the rank of the project. Therefore, firms can decide to increase the number of new employees if this option can improve the probability to receive the subsidy. The equilibrium point is when the net cost of the new employees is equal to the gain given by the lower capital cost. Finally, if the option for a given sector is investing or restructuring, the non subsidized firms can have chosen to restructure, increasing the productivity, whereas the subsidized firm can have chosen to invest, increasing the production and employment.

As expected, the debt cost generally decreases more in the subsidized than in the non subsidized firms. However, the gap is not statistically significant. Therefore the subsidy has not radically changed the financial state of the firm. The reason can be probably imputed to the increase in debt that the subsidized firms have had to face in order to finance the new investment, whereas the non subsidized firms could refrain from investing. The difference could be clearer if the data time span would be longer.

The effects of 488 can be non homogeneous by firm. For instance, the subsidy can be very effective in firms where there is a credit rationing. Usually the probability to be rationed is higher for the small firms. Therefore, we have deepen our analysis, limiting the sample only to the small firms, following the EU definition, with a substantial reduction in the sample size.

The results are in table 8.

Table 8

Impact of law 488: Small firm sample

Variable	Kernel matching estimation					Nearest Neighbour matching estimation				
(differences)	Subsid.	Non subs.	ATT	Std. Error	t-stat.	Subsid.	Non subs.	ATT	Std. Error	t-stat.
Turnover	218	371	19.030	9.784	1.945	218	116	19.877	22.205	0.895
Employment	237	392	24.270	16.606	1.462	237	114	51.602	21.215	2.432
Fixed Assets	226	374	62.962	32.559	1.934	226	120	17.881	49.035	0.365
Gr. margin/turnover	219	399	0.413	0.656	0.630	219	122	-0.848	0.793	-1.070
ROI	212	392	-0.851	0.561	-1.517	212	116	-2.142	1.112	-1.926
ROE	219	377	0.765	1.504	0.509	219	98	-3.198	2.676	-1.195
Fin. charges/turn.	209	386	0.007	0.003	2.180	209	116	0.012	0.004	2.675
Per capita turnover	223	373	-20.039	8.782	-2.282	223	105	-34.745	15.04	-2.310
Fin. charges/debt	221	401	0.047	0.218	0.214	221	117	-0.612	0.418	-1.465

In general, the effect of law 488 on small firms growth is higher for the turnover (19-20 per cent points), lower for fixed assets (18-63 points). Statistically, the significance of the ATT is lower in this sample. This effect can be imputed to the reduction in the sample but also to the higher variability of small firms performances (for instance, the credit rationing can involve only a part of the sample).

The effect on profitability are negative, even if generally not statistically significant. The impact on labour productivity is very negative (from 20 to 35 per cent points less) and statistically significant. Also the (relative) slight increase in debt cost is significant. The results suggest that for the small firms is more difficult to fully exploit the subsidy in order to increase their chance of log term growth. A possible explanation is that at the end of the nineties the small firms faced more difficult market conditions and market perspectives than the larger ones, reducing the investment profitability.

The limited sample dimension does not allow to extend the analysis to single sectors or regions. Summarizing, the law 488 shows a significant positive impact on investment, production and employment, even if the productive efficiency growth is decreased in subsidized firms with respect to the non subsidized ones. In the last paragraph we present some conclusive remarks on the role of subsidies in affecting firms behaviour.

5.2 Robustness analysis

The robustness analysis is carried out by relaxing some hypothesis assumed in the baseline investigation. We have modified the following hypotheses:

1. The hypothesis on the final year for the non subsidized firm is changed. The alternative hypothesis is that each non subsidized firm could have different final years, depending on the balance sheet availability. Each non subsidized firm will be replicated in the sample, each time with a different final year, for each year after the expected ending year for which a balance sheet is available.
2. The hypothesis that projects in different auctions can be analyzed together is removed. If we assume that the composition effect in each auction is relevant, we should use each auction separately. As a robustness test we examine only the firms in the third auction, that is the largest in our sample (47% of projects).
3. The hypothesis that firms with a different investment length can be analyzed together is removed. A sample containing only firms with a investment time span of 3 years is selected. In this sample, the period from the starting year to the ending year is equal to 5 years for all the firm considered. The 41% of all projects are included in this sample.

The non subsidized firm sample with duplications is larger than the baseline sample. The cost is a firm distribution that it is more different from the effective firm distribution in the 488 auctions. The analysis is based on a empirical specification of the propensity score that is very similar to the specification adopted in the baseline sample.[16] The table 8 shows the results. Note the higher number of (fictitious) non subsidized firms.

Table 8

Impact of law 488: sample with non subsidized firms duplication

Variable	Kernel matching estimation					Nearest Neighbour matching estimation				
(differences)	Subsid.	Non subs.	ATT	Std. Error	t-stat.	Subsid.	Non subs.	ATT	Std. Error	t-stat.
Turnover	341	1910	12.534	9.60	1.305	341	436	22.725	13.07	1.739
Employment	359	1809	21.987	7.23	3.039	359	432	31.068	8.219	3.780
Fixed Assets	349	1921	78.347	21.62	3.623	349	459	44.907	25.745	1.744
Gr. margin/turnover	345	1879	0.979	0.374	2.615	345	374	1.413	0.482	2.928
ROI	319	1876	-0.023	0.316	-0.071	319	377	0.492	0.683	0.721
ROE	320	1822	-0.887	0.874	-1.015	320	384	-2.093	1.119	-1.870
Fin. charges/turn.	328	1920	0.002	0.002	1.287	328	423	-0.000	0.003	-0.079
Per capita turnover	346	1816	-14.50	4.871	-2.977	346	385	-25.187	8.058	-3.126
Fin. charges/debt	327	1898	0.121	0.216	0.560	327	395	0.112	0.186	0.604

The results are in line with the baseline estimations. There is evidence of additional growth in turnover, employment and fixed assets, even if the statistical significance is high for employment and fixed assets, less for turnover. The lower productivity growth of subsidized firm is confirmed. There is a positive and statistical significant difference for the gross margin on turnover, signalling a possible higher profitability of subsidized firms. An opposite tendency is in ROE. There are non substantial differences in the cost of debt.

Another test, exploiting the larger number of firms in the sample with duplication, is carried out by inserting in the propensity score equation a set of dummies related to the length of the investment period by firm. The hypothesis is that the investment time span reflects some unobserved characteristic of the firm. The specification "forces" the matching procedure to balance, for the different levels of propensity score, the subsidized and non subsidized firms with the same investment time span.[17] The approach implies a strong reduction of the sample, given to the greater difficulties in finding a right matching. The results are in table 9.

Table 9

Impact of law 488: sample with non subsidized firms duplication with controls for time span

Variable	Kernel matching estimation					Nearest Neighbour matching estimation				
(differences)	Subsid.	Non subs.	ATT	Std. Error	t-stat.	Subsid.	Non subs.	ATT	Std. Error	t-stat.
Turnover	210	1317	12.011	9.166	1.310	210	130	23.141	12.376	1.870
Employment	223	1326	9.725	9.878	0.984	223	135	11.481	17.734	0.647
Fixed Assets	217	1309	61.585	16.411	3.753	217	137	82.617	40.057	2.062
Gr. margin/turnover	220	1310	1.853	0.486	3.814	220	126	2.209	0.788	2.802
ROI	209	1294	-0.052	0.358	-0.145	209	122	-0.765	0.499	-1.534
ROE	206	1262	0.687	1.060	0.648	206	125	-0.082	1.468	-0.056
Fin. charges/turn.	211	1319	0.001	0.001	0.474	211	133	-0.001	0.003	-0.216
Per capita turnover	210	1303	-6.993	3.945	-1.773	210	134	-10.331	7.927	-1.303
Fin. charges/debt	215	1300	0.142	0.194	0.731	215	129	0.233	0.316	0.735

[16] The only difference is the introduction of the dummy variable *Dum_ban3* related to the participation to the third auction. The estimation results are similar to the previous ones (the pseudo R2 is 0.39), and the specification satisfies the Balancing Hypothesis. All the results are available by the authors.

[17] In the specification 4 new dummies (for the length of 2,3,4,6 years) are introduced. The specification is satisfactory (the pseudo R2 is 0.33) and it satisfies the Balancing Hypothesis. All the results are available by the authors.

A positive impact on turnover, employment and fixed assets is registered, but the ATT is statistically significant only for the fixed assets. The main reason is probably the low number of observation, affecting the estimates accuracy . The positive and significant effect on the gross margin on turnover is confirmed. The sign of ATT for labour productivity is negative, but less significant.

The impact estimation by auction is a way to eliminate some unobservabled non homogeneities. A similar approach is presented also in Bronzini and De Blasio (2005). The analysis focused on the firms in the third auction uses the sample without duplications. The results are in table 10.

Table 10

Impact of law 488: 3rd auction sample

Variable	Kernel matching estimation					Nearest Neighbour matching estimation				
(differences)	Subsid.	Non subs.	ATT	Std. Error	t-stat.	Subsid.	Non subs.	ATT	Std. Error	t-stat.
Turnover	94	355	0.285	23.437	0.012	94	54	27.563	23.661	1.165
Employment	99	345	9.547	24.753	0.386	99	58	31.603	30.479	1.037
Fixed Assets	99	351	59.935	46.098	1.300	99	58	57.047	48.163	1.184
Gr. margin/turnover	92	360	-0.604	1.039	-0.581	92	53	-3.087	2.042	-1.512
ROI	77	360	-0.714	0.532	-1.343	77	49	-0.751	0.784	-0.957
ROE	85	346	1.033	1.139	0.906	85	49	2.346	2.750	0.853
Fin. charges/turn.	92	362	0.001	0.003	0.188	92	55	0.002	0.005	0.333
Per capita turnover	91	347	6.925	6.142	1.127	91	50	6.488	8.510	0.762
Fin. charges/debt	93	315	-0.137	0.397	-0.345	93	53	-0.159	0.467	-0.340

The number of considered firms is very low in this sample, so that every estimated ATT results not statistically significant. However, there are a positive difference in the dynamic of turnover, employment and fixed assets. In this case also the difference in labour productivity is positive.

The final robustness test considers only the firms with a investment time span of 3 years, i.e. a distance of 5 year between the starting year of the project and the ending year (Table 11).

Table 11

Impact of law 488: sample with 3 years investment time span

Variable	Kernel matching estimation					Nearest Neighbour matching estimation				
(differences)	Subsid.	Non subs.	ATT	Std. Error	t-stat.	Subsid.	Non subs.	ATT	Std. Error	t-stat.
Turnover	178	278	7.346	10.572	0.695	178	85	12.435	20.67	0.601
Employment	203	264	28.288	12.429	2.276	203	86	38.470	20.03	1.920
Fixed Assets	191	271	59.622	29.798	2.001	191	85	24.611	51.39	0.479
Gr. margin/turnover	186	273	1.166	1.080	1.080	186	86	1.006	1.785	0.563
ROI	175	286	0.154	0.647	0.239	175	79	1.243	1.687	0.737
ROE	172	280	0.647	2.668	0.243	172	76	-5.274	4.982	-1.059
Fin. charges/turn.	180	266	0.010	0.005	2.071	180	81	0.012	0.004	2.805
Per capita turnover	188	262	-17.741	9.364	-1.895	188	81	-26.509	13.37	-1.982
Fin. charges/debt	185	262	0.334	0.332	1.005	185	77	1.049	0.397	2.641

Also in this sample the numbers of firms is scarce. There are a positive impact of the subsidy for turnover, employment and fixed assets. For the last two variable the impact is also statistically significant using the kernel matching (where the number of firms used in the estimation is higher). The negative impact on labour productivity, and the positive impact on the cost of debt are also statistically significant

On the whole, the robustness analysis confirms the main results. The growth in turnover, employment and fixed assets is always higher in the subsidized firms than in the non subsidized ones, even if the size of the sample affects the statistical relevance of the impact. Moreover, the negative impact of 488 on labour productivity growth is confirmed in several estimates. There are

not major differences in profitability between the two set of firms. Sometimes the profit share is higher for the subsidized firms.

6.Conclusions

The scope of the analysis is to evaluate changes in firm behaviour induced by the incentives to capital accumulation allocated by law 488. Therefore the ex-post effects of subsidies are considered: on a whole, only 7395 out of 15172 financed projects in the first 18 auctions[18] were completed at the time of our investigation and they were included in the analysis.

The evaluation analysis has indicated that growth in turnover, employment and fixed assets has been more dynamic in the subsidized firms. The results are statistically significant and robust to different econometric specifications and changes in the underlying hypotheses. As a whole, the law 488 has achieved the (implicit or explicit) targets selected by the policy makers: the subsidized firms have invested more than usual, and they have increased the number of employees more than the non subsidized ones (coherently with the use of the employment indicator in the selection process).

The positive impact of subsidies on firm growth is coherent with the most international literature (see the introduction). The effect on capital accumulation is larger of what is reported in Bronzini and Di Blasio (2005): they have an almost null cumulative effect of subsidized investment on assets after 5 years, where in our study the increase in assets is positive and significant.

Empirically, we observe that the output effect of subsidy on employment is greater than the substitution effect. Among others, one reason is strictly linked to the 488 selection procedure: there is an additional incentive to increase employment, given by the premium to the rank score. The size of the additional growth of employment in subsidized firms is in line with the results of other parametric analyses, using a different data set (Pellegrini and Carlucci, 2003).

Unfortunately, there is not a free lunch: the main consequence is that the productivity of subsidized firms grows less than in the non subsidized firms. The firms prefer to overshoot the optimal amount of employment in order to gain the subsidy. This behaviour can affect long run efficiency and growth. Moreover, employment levels probably cannot be sustained after the period imposed by the 488 regulation (5 years).

The analysis highlights the trade-off between employment and turnover and labour productivity (and firm competitiveness) increase that the firm faces: the higher the reduction in capital cost, the higher the additional investment and therefore the production and employment growth, the lower is firm labour productivity and therefore the chance to compete in the market in the long run.

The result is not unexpected. In fact, the policy makers use the financial incentive to change the firm preferences, and to push the firm to invest in projects that, without incentive, would be abandoned. The reason is that the social cost of the investment (and of the new employment) is lower that the cost for the firm, because there are positive externalities in the less developed areas. Therefore the policy makers prefer to subsidize project with higher employment, even if less productive. The results can be different if the incentive want to overcome imperfections in the credit market. In this case, the credit rationing can affect project with the expected profitability (and productivity) in line with the market average. Therefore, incentives can support projects with high

[18] Only the auctions oriented to the manufacturing and to the firms services sectors are considered in the analysis (auctions from 1 to 4, 8, 11, 14, 17, 18).

productivity. However, our results related to the small firms sample suggest that the credit rationing is not the most important problem for these firms.

The results are robust to change in some important hypothesis we adopted in the analysis. A problem we cannot cope with in this framework is the exclusion of new firms in the analysis. There is a significant number of new firms created and funded by law 488. The exclusion is unavoidable, because the new firm balance sheet before the subsidies cannot be reconstructed. In fact, their inclusion should lead to a widening, rather than a reduction, of the estimated impact, because new firms tend to be more productive and to create many new jobs with respect to the restructuring or expansion projects. However, the adoption of different research techniques, for instance, taking into account the probability to create a new firm in a subsidized area with respect to a non subsidized area, could overcome the problem. Another extension of the paper is the estimation of the total factor productivity (instead of the labour productivity) in the efficiency analysis of the subsidized firm. We leave these extensions to a future research.

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