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The Swedish Business Development Program – Evaluation and some methodological and practical notes

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The Swedish Business Development Program

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Evaluation and some methodological and practical notes

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Abstract

In this study we evaluate a special form of business support – support to cover costs associated with business counselling. The policy question is whether firms that receive this support within the Regional Business Development programme have a better outcome compared with firms that do not. The study also addresses some methodological issues based on the fact that impact evaluations of different kinds of business support generally suffer from a number of methodological problems. A first problem is that firms have a different and more complicated heterogeneity than is the case in e.g. labour market policy evaluations. This raises the question of how firms in the comparison group should be selected. Since the selection process is not known in most cases of business support, we use a stratified matching approach that allows matching in several dimensions. A second problem is that there are many ‘actors’ on the state support market. This means that in the absence of full information about other support givers we may end up in a situation where the firms in the comparisons

group have received a similar support from another support provider, and has in fact been treated. In the most extreme cases, treated firms are compared with firms that have received exactly the same type of support from another provider. This problem is referred to as ‘contaminated data’. A final problem is that provision of business support often is a ‘two stage’ process where firms apply for funding, and an administrative organisation decides whether or not to approve the application. This gives rise to two types of selection; self-selection (whether to apply) and administrative selection (obtaining funding). In the final analysis we address the issue of selection. The results of our evaluation lead to the following conclusions: business counselling give positive impacts on value added, growth in investments and employment, and more efficient production, if we include selection and allow contaminated data. Not allowing for contamination in the data reveals positive, but smaller, impacts on value added and investments and a slightly larger impact on employment. Finally, if we restrict the data so that self-selection is eliminated we find no significant impacts. A preliminary conclusion from the analysis is that it is the time firms set aside to formulate e.g. investments strategies, problems etc. that generate impacts rather than the support itself.

JEL: R11, L26

Key words: Investment support; business counselling; heterogeneity; matching strategy; contamination; selection

Introduction

In this study investigate the impact of firms receiving investment support in intangible assets, i.e. business counselling, paid for by the state within the Regional Business Development programme (RBD). There is some evidence that such business aid will have a positive impact on firm growth (see e.g. Wren and Storey, 2002; Mole et al, 2008; Gadd et al, 2009). However these evaluations also reveal some methodological problems pertaining to constructing the counterfactual situation for treated firms, i.e. those that receive state aid. Two of the problems relate to the nature of the support and one is to the fact that many actors provide state business aid. A first problem is the heterogenic nature of business. Many forms of state aid to businesses are to a great extent targeted towards a specific group of firms. This could be motivated by formal eligibility rules but also by the construction of the support and the amount of funding that is available. This implies that the type of firm that can serve as comparison group for the treated firms has to be as similar as possible to the treated firms in terms of important and observable firm characteristics. One solution to this problem is to use matched samples. A second problem relates to who apply and who get granted, i.e. self-selection and administrative selection. The administrative selection can for example be rules and prioritization conditions formulated by those who own or administer the aid programme. Self-selection, in contrast, is characteristics within the firm that makes it more or less likely to apply for support. The existence of selection has been known to bias impact estimates and also make inference questionable. Finally, in Sweden and in many other countries there is no comprehensive information about what type of aid – if any – any given firm has been granted. Under normal circumstances this means that the evaluator only have information on the type of aid that is relevant for the evaluation at hand. A common problem with business aid is that several actors provide similar, and in some case identical types of support. In these cases there is a possibility of data contamination. In addition to evaluating the support we will address and discuss each evaluation problem stated above.

The outline of the following sections is as follows: in section 2 we give a short overview of the support evaluated in this study. In section 3 we review previous research with respect to support that are similar to the RBD-program. In section 4 we discuss what can be expected from a theoretical point of view and derive our outcomes from this theory. Section 5 presents the evaluation design and its ingoing components; identification, model and matching strategy

are discussed. In section 6 data and the result of matching is presented. In section 7 the results are presented and finally, in section 8 we give conclusions and some concluding remarks.

2. Institutional framework

Regional Development Grant is a type of state aid that provides investment funds for firms operating in the sparsely populated north of Sweden and in rural areas elsewhere. The purpose of the grant is to stimulate growth, while maintaining balanced regional development. The intended effect of the grant is to create a competitive advantage to firms operating within the eligible region in relation to firms operating outside of it, but to be competitively neutral among firms within the region.

Several types of investments can be funded with Regional Development Grants. The rules allow funding grants to be awarded for investments in both tangible and intangible assets. Investments in intangible assets include investments in product development, marketing and competence building. These grants are generally awarded in the form of 'consultancy cheques', where firms are given a grant that allows them to freely choose the provider of the services. Firms can apply for grants covering up to 50 per cent of the investment depending on the planned localisation of the investment and the type of investment made. The average grant in 2009 was approximately € 20 000, while the average grant for investment in intangible assets (*consultancy cheques*) was around € 7 000.¹

The Regional Development Grant (*RDG*) is open for applications from small and medium sized firms in the private sector, that operate under market conditions. This is taken to mean that firms are expected to compete in a marketplace without relying on grants or subsidies for operating costs. A firm is assumed to operate under market conditions if it pays out a positive factor income, either in the form of wages or business income. Small and medium-sized firms are defined as firms with less than 250 employees and a net turnover of less than € 2 million annually. Over 99 per cent of registered firms in Sweden are small and medium-sized firms. There are some restrictions on the type of activity that is eligible for grants, either because of EU regulations or because the activity is highly mobile or the firm operates on a

¹ The Regional Development Grant is considered *de minimis* aid, which means that the grant cannot exceed € 200 000 (€ 100 000 before 2007) over a three year period. EC 1998/2006.

geographically restricted market, in which case the grant is not neutral among firms within a region.

3. Previous studies

The field has been surveyed in Johansson (2011), however, since this survey has been published only in Swedish we devote some attention to the literature. One conclusion drawn by Johansson (2011) is that few studies of the impact of investment aid have used differences between treatment and control groups in a true meaning to infer a causal relationship between aid and outcome. A major part of the studies in the field is more of monitoring reports rather than true evaluations. (see e.g. Chrisman et al 1987; Chrisman and Leslie 1989; Chrisman 1989; Chrisman and Katrishen 1994, 1995; Ulset and Reve 1983 Chrisman and McMullan 2004). There are however some studies that have addressed the impact question from an impact evaluation point of view. Wren and Storey (2002) study impacts with regards to 'The marketing initiative', a measure that to a large extent is similar to the Swedish support evaluated in this study. As a counterfactual the authors uses firms that applied for funding, got the application approved but did not use the money. The major advantage of this design is that it accounts for both self- as well as administrative selection, problems that gives rise to serious econometric problems. The major disadvantage with the design is that there are likely to be large systematic differences between firms that got used the funding and those that elected not to do so. One reason could be that the firms did not use the money because that they faced an increased demand and therefore had neither the time nor the motivation, to allocate time needed to complete the investment. This type of unobserved heterogeneity gives rise to another set of econometric problems. Wren and Storey (2002) conclude that counselling, at least when as organised within the Marketing Initiative programme, has a large positive impact on firm and employment growth. In another study Mole et al (2008), investigate the impact of 'The Business Link' (BL). The method of the evaluation was to use a telephone survey of firms that got support and another group of firms that did not receive the support. It is, however, unclear from the report if firms in the counterfactual group were asked if they had received support from other, similar measures. The evaluation reveals that investment support within BL had a positive impact on both growth within the firm and on employment. Norrman and Bager-Sjögren (2010) evaluate the impact of 'Swedish innovation centres'. The evaluation design in this study builds on matched firm data. This means that the counterfactual firms were similar to the treated firms in a number of important characteristics.

The gross population for the counterfactual group consisted of firms that had applied for the support but had not received it. This design makes it possible to deal with the problem of self-selection, but as also pointed out by the authors the administrative selection could remain. When this administrative selection is accounted for the results indicated that the programme has no impacts. A potential problem with, or maybe a potential benefit of this design is that this type of support is most likely connected with quite large deadweight losses, i.e. firms will make the investments even if they do not receive the support. These results are a natural consequence of this deadweight loss, given the evaluation design. That is, the design does not allow for distinguishing between the impacts on outcome variables and deadweight loss. Gadd et al (2009) investigates the impact of regional investments support by using a propensity score approach. Untreated firms are selected so that they are as similar as possible to treated firms with respect to the probability of receiving the support (see e.g. Rosenbaum and Rubin, 1983). A multilevel approach is used to explicitly control for regional heterogeneity on the predicted probability to get the support, since the regional support also includes a regional dimension. Besides matching on this probability data is also balanced on 21 other covariates. Thus firms have to have a close proximity in the probability to receive the support, as well as in the other 21 dimensions. A methodological problem with this approach is that the selection model is based more on available data than on a thorough theoretical foundation, and the lack of previous studies gives few guidelines on the selection process. This means that the conditional independence assumption might be invalid. To some extent this is dealt with the balancing done after matching on the probability. The result from the evaluation reveals short term impacts on employment and a more long term impact on firm growth, measured as increase in turnover.

In summary: given the problems of both data and methodological nature the previous research give clear indications on positive impacts of state aid in the form of business counselling on employment as well as firm growth.

4 Theoretical expectations

The counselling services are evaluated against three main criteria: The effect of support on firm *survival*, *growth* and *profitability*. The purpose of the support is to improve profitability in order to improve the chances of firm survival and stimulate firm growth.

A firm is said to survive if it remains in business two years after treatment. Growth is measured as growth in value added. A growing firm should increase value added, either through gaining market shares from other, less successful firms or by increasing the market size for the firm's product. The growth in value added can be broken down into *increased used of labour and capital* and *increased technical efficiency*. Increased technical efficiency means that production may increase without an associated increase in the use of labour or capital, and is closely linked to the concept of profitability.

A Cobb-Douglas production function that shows the link between the factors of production and volume (value added) is used to illustrate the empirical strategy.² Value added is represented by y , L is the amount of labour used, and K is a measure of capital, measured as the book value of physical assets. The production function is:

$$[1] \quad y = A \cdot K^{\alpha} \cdot L^{\beta} \cdot \exp(\varepsilon_v + \varepsilon_u)$$

Because of the stochastic nature of the model, it also contains an error term. In our model the error term has two parts: one part captures deviations from the production function due to differences in technical efficiency between firms (ε_v), and the other captures traditional measurement errors (ε_u).

The model has at least three factors that may explain an observed change in production. A may be seen as a technological constant, and if a change in production is due to a technological change, this will be captured by changes in A . An alternative explanation for an increase in production is that treated firms increase the use of labour (L) and capital (K), which will increase production. A third possibility is an improvement in technical efficiency, i.e. a decrease in (ε_v). Notably, an improved efficiency can be linked directly to profitability, since increased efficiency means an increase in production without additional resources. The measure of inefficiency is derived from a stochastic frontier approach. (see e.g. Greene, 2003).

The results above are contingent on firm survival, since firm death would mean that there is no outcome to evaluate. Because of this, the effect of treatment on the probability of firm

² We have used a Translog functional form of the production function (see e.g. Christensen et al., 1971). Using the relations between different functional forms stated in Färe and Mitchell (1989) we have tested the interaction variables (separately and jointly) and on basis of the statistical result collapse the Translog into the commonly known Cobb-Douglas functional form.

survival is important. Firm survival is closely linked to firm profits, which depend not only on factors within the firm, such as production technology and the use of factors of production, but also on factors outside the firm, on product- and factor markets. This in turn will depend on the number of competitors on the relevant market, as well as market size. Changes in the firm's external competitive environment are central to firm survival.³ The model used is a random profit model, where a firm will survive (and hence have an outcome on the other criteria) if the profit is at a (firm-specific) acceptable level. Firms that do not reach a profit at an acceptable level will not survive.

5. Evaluation design

5.1. Identification

One of the fundamentals for an impact evaluation design is the possibility to distinguish between, in this case, firms that received support in the form of consultancy cheques within RBD, and a comparison group of firms that did not receive this support – in the best of worlds firms that did not receive any support. A general problem with measures directed to firms is to identify the group of possible comparison firms. One of the problems is that firms seeking support may differ from firms that do not. In the total population, some firms, due to eligibility conditions or their own preferences, will never apply for aid, just as there will be firms that regularly will apply for external support. A random sample of firms from the population of firms that had not received the support will thus include both types of firms. If the eligibility conditions for the aid programme are clear and known, ineligible firms can be excluded from the comparison group. For example, the support evaluated in this study (RBD) is limited to small and medium-sized firms and because of this limitation large firms can be excluded from the potential comparison group. However, even with this limitation there are other problems in identifying firms that belong to the counterfactual. Among the eligible firms we can assume that there are certain firm characteristics that affect both the probability to apply for and the likelihood to receiving the support. In the evaluation literature this is labelled selection problem. The selection problem can in turn be divided into two components – self-selection and administrative selection. There are a number of methods to deal with this

³ There are relatively few studies on the effects of environment factors on firm survival from firm-level rather than industry-level data. See e.g. Everett and Watson (1998). Box (2008) and SOU (2008:21) are studies on Swedish firm-level data.

type of selection problem in the literature. One of the most used methods is propensity score matching (see e.g. Rosenbaum and Rubin, 1983). The propensity score matching method relies on the fact that the selection process is known, so that the probability to be granted aid can be modelled. If this information exists, the method searches for firms with similar probability to get support, but have not done so. The control group is picked from the firms who did not receive aid, but whose probability to be granted aid is roughly equal to a firm that was granted aid. Even if this method is frequently used in other areas, e.g. evaluation of labour market policy programmes, the situation concerning firm support is usually more complicated due to the large heterogeneity among firms. If additional selection information is available it is possible to use the method on different sub-samples (strata), however, as the number of sub-samples increases, the propensity score method become more alike matching on firm characteristics.

The matching strategy used in this study is to match on a number of firm characteristics within different strata. The treatment group is those firms that have received support according to RBD and the counterfactual is different sub-samples of firms that did not receive this support.

Another problem, common in evaluation of business support programmes, is the lack of information on other forms of aid. This means that even if we possess good knowledge about what firms that have received aid within RBD it could be that our comparison firms have received similar, in some case identical, support from another public actor. In this case we end up with contaminated data. If this is the case it is likely that the impacts of a specific support vanish, or at least are heavily reduced. In our evaluation we have, in contrast to many other evaluations based on Swedish data, good information about other supports at firm level. We have the possibility to control for the fact that firms in the potential comparison group have sought for, and also been granted, other types of investment support. By using this information we can address the question of what kind of bias contaminated data will have on impact estimates.⁴

To summarise: We address three common problems in evaluating business support in general; heterogeneity, selection and contamination. The unobserved heterogeneity between treated

⁴ There is an ongoing work at the Swedish Authority for Growth Policy and Evaluation to construct a national support database including all major supports. We have for our research used available information from that data base.

and untreated firms is dealt with by using matching methods in the construction of comparison group. This will serve as our base line. The problem with, and the consequences of, data contamination is dealt with in a second analysis, where we exclude firms that have received other supports. Thus, we have one group that received business support within RBD and a control group consisting of a matched sample of firms that had not. In the third analysis we address the consequences of self-selection by using data for firms that all have applied for investment aid. The treatment group consists of firms that were granted consultancy cheques and controls will be a matched sample of firms that have applied for some kind of investment aid but who were not granted consultancy cheques. These firms may have applied for consultancy cheques, but the application was rejected, or they may have applied for some other form of public investment aid. The firms included in the comparison group are hence assumed to be (1) willing to apply for publicly funded aid to finance an expansion and (2) in a growth phase, where the firm intends to grow in the near future.

5.2. Evaluation model

The outcome of the support can be divided into two main questions: if the support has had a positive impact on firm performance, as defined above; and if the support has had a positive impact on the probability of firm survival.

For the firm performance we use a *Difference in Difference* (DID) approach for all the different outcomes related to firm performance.⁵ The DID approach conceptually means that we compare firms that received support before and after the support was granted. The same comparison is made for firms that are selected as control group. The DID estimate is then defined as the difference between these two differences. Let $w_{t,k}$ denote outcome k and t indicate the time period. Further, let d indicate treatment or not. The period pre-treatment is denoted $t-1$ and the post-treatment is done two years after, i.e. $t+2$. Period t is the year for treatment. Given these notations the evaluation problem can be described as follows:

$$[2] \quad \left[E[w_{t+2,k} | d = 1] - E[w_{t-1,k} | d = 1] \right] - \left[E[w_{t+2,k} | d = 0] - E[w_{t-1,k} | d = 0] \right]$$

⁵ See e.g. Card and Krueger (1994).

The first part of expression [2] is the difference over time for the treated firms and the second part measures the difference for the untreated firms over time. By rearranging expression [2] we arrive at:

$$[3] \quad \left[E[w_{t+2,k} | d = 1] - E[w_{t+1,k} | d = 0] \right] - \left[E[w_{t-1,k} | d = 1] - E[w_{t-1,k} | d = 0] \right]$$

The first part of expression [3] now shows the difference between treated and untreated after treatment while the last part show the initial difference, e.g. the selection effect.

For obvious reasons we cannot use the same design to study firm survival. Here we instead estimate the probability for firm survival in period $t+2$, based on matched data in period $t-1$ and variables controlling for firm, industry and local market characteristics. Let θ_{t+2} indicate that the firm exist in period $t+2$. To survive the firm has to reach a profit level (π_{t+2}) that exceeds some threshold. In the profit function we allow for some variation in local prices around an average price (\bar{p}). The individual firm may set a price (p_i) different from the average price on the market. The possibility of the individual firm charging a price different from the average market price depends on the number of competitors in the market, transaction costs for a consumer to change providers, as well as perceived quality of the product sold by the individual firm. (The extreme case is perfect competition, where the number of competitors $N \rightarrow \infty$, homogenous products are assumed and $Var(P) \rightarrow 0$). An increase in the average price of the product will make existing firms more profitable and hence increase the survival rate of firms in that product market. An increase in the number of firms will generally increase price variation in the market and will probably decrease the survival rate

This means that the firm-centred analysis should be complemented by a market approach when studying firm survival. The factors assumed to influence the potential variability of prices are different aspects of market size. Firms are restricted in the choice of product price by the size of the local market and local market demand, as well as by the number of competitors for the firms' product both locally and nationally.

The expected profit for firm i can then be expressed as;

$$[4] \quad \pi_{i2} = P_i \cdot Q_i - w \cdot L_i(Q) - r \cdot K_i(Q) + \varepsilon \Leftrightarrow f(\mathbf{X}_{i-1}; \mathbf{Z}_{i+1}) + \varepsilon$$

where \mathbf{X}_{t-1} is a vector of firm characteristics measured in period $t-1$, and \mathbf{Z}_{t+1} is a vector of market characteristics in period $(t+1)$, that measure the competitive environment in which the firm operates.⁶

If λ_{t+2} is the level of profits associated with shut down, firm survival can be expressed in terms of profits as:

$$[5] \quad \theta_{t+2} = \begin{cases} 1 & \text{if } \pi_{t+2} \geq \lambda_{t+2} \\ 0 & \text{if } \pi_{t+2} < \lambda_{t+2} \end{cases}$$

The average survival rate among treated firms should be higher if counselling improves efficiency and profitability, given the competitive environment. We control explicitly for the competitive environment, since firms are not matched on the competitive environment.⁷

To capture the problems addressed before the model is estimated on all three previously defined sub-samples. The first comparison is against a matched sample ignoring both contamination and selection. Again this will serve as a baseline, since most previous evaluations have used that type of data. In the second sub-sample we choose untreated among firms that never have applied for investment aid, thus eliminating the contamination problem. Differences between these two analyses will give some indication about the magnitude of the contamination problem. Finally, we use firms that applied for investment aid of a different kind or at a different point in time (see e.g. Norrman and Bager-Sjögren, 2010). This eliminates self-selection, but the sample will be contaminated. Comparing the previous results with these results will give some indication about the effect of the self-selection problem.

5.3 Matching strategy

There are a number of ways in which treated firms can be matched with untreated firms. In this study we use Coarsened Exact Matching, CEM (Blackwell, Iacus and King, 2009). The

⁶ Specifically, the variables are: regional population and regional income growth, number of local competitors (firms in the same industry in the same region), and national competitive pressure, measured by a Herfindal index.

⁷ Firms cannot be matched on the competitive environment since the regulations clearly state that the grants should be awarded in a way that is competitively neutral, i.e. treated firms should *not* operate under similar market conditions as untreated firms.

method primary focuses on reducing the imbalance on observable characteristics between treated and untreated firms.

When matching on continuous variables, such as the value of the capital stock or the number of employees, the number of potential matches depends on common support in several dimensions. CEM allows for deciding common support on a variable, by coarsening data into predefined strata that are analytically deemed to be comparable. All observations within a stratum are by definition inside common support if the stratum contains both a treated and an untreated observation. Matching is done on the coarsened data, and remaining imbalances are controlled for in the subsequent analysis. The method also allows for matching along the entire distribution, which is useful when the underlying distribution differ between treated and untreated firms.

This method does not address the unobserved heterogeneity (selection) in applying for or being granted support. If this were to be an issue, reducing the imbalance and restricting the observations to those inside the common support before applying some other matching solution, such as propensity score matching (see e.g. Rosenbaum and Rubin, 1983) or Nearest Neighbour (see e.g. Abadie et.al, 2004) might be used. Restricting observation to those within common support before addressing the issue of unobserved heterogeneity would improve the inferences from the subsequent analysis.

6. Data and matching results

6.1 Gross Firm Population

The data on the economic performance of firms are sourced from balance sheets and consolidated statement of income for all firms in Sweden, collected for tax purposes. These data are supplemented with additional information from Statistics Sweden concerning basic information from the Swedish Firm Registry, and Labour statistics based on administrative sources. Information on applications for and granted investment support are sourced from administrative sources from the granting agency, the Swedish Agency for Economic and Regional Growth.

The following requirements are imposed for a firm to be included in the gross firm population

1. The firm is registered in the Swedish firm registry and has paid wages or business income both the year before treatment and the year of treatment.

2. The firm must be active each year during the period. Firms that are in business intermittently, e.g. every other year, are excluded from the analysis.
3. For a firm to be considered active in a given year, the following conditions must be fulfilled: The firm must have a positive turnover, positive value added and the book value of capital assets must be positive, and the firm must have paid wages or business income to at least one person.
4. The firm must be eligible for Regional Investment Support given the rules of eligibility for the Aid programme. In this case this means that the firm must have fewer than 250 employees and a turnover below € 50M in the year of treatment. Aid cannot be granted to firms in all industries, which means that firms in some industries are excluded from the analysis. In practice, industries in which *no* firm has been granted aid are excluded.

The *gross firm population* is the pool of firms from which untreated control firms that function as counterfactual control cases are drawn. The number of firms in the gross firm population is presented in table 1.

Table 1: Number of firms in the gross firm population

Year	Untreated	Treated	Total
2004	218 634	337	218 971
2005	223 351	333	223 684
2006	234 145	266	234 411
2007	235 224	308	235 532
Total	911 354	1 244	912 598

As can be seen in table 1, only a small minority of firms, around 0.15 per cent, receive state aid in the form of consultancy cheques. These are not randomly drawn from all firms eligible for this type of state aid. The difference between the general gross firm population and treated firms can be illustrated by a selection of descriptive statistics, as in table 2. Treated firms are on average larger in terms of value added and in number of employees. The population of untreated firms is also highly skewed. Value added per employed illustrates the point. Average value added per employee in untreated firms is almost double that of treated firms, while the median is higher among treated firms. Value added per employee is in actuality higher among treated firms up to the 99th percentile, which means that a few specific observations skew the mean in the untreated population.

Table 2: Descriptive statistics for gross firm population, by treated and untreated firms.

	<i>Mean</i>		<i>Median</i>	
	<i>Untreated</i>	<i>Treated</i>	<i>Untreated</i>	<i>Treated</i>
Value Added 1 000 SEK (<i>t</i> -1)	2820.0	6400.5	749.6	3387.8
Capital stock 1 000 SEK (<i>t</i> -1)	4434.0	4216.9	231.9	1207.1
Value added per employed 1 000 SEK (<i>t</i> -1)	803.6	405.3	91.9	160.6
Number of employees (<i>t</i> -1)	4.7	13.1	1	7
				<i>N</i>
Other types of regional state investment aid (<i>t</i>)	0%	9%	2399	113
Regional state investment aid (<i>t</i> -1) or (<i>t</i> -2)	1%	30%	7957	375
Regional state investment aid (<i>t</i> +1) or (<i>t</i> +2)	0%	24%	4393	303
<i>N</i>	911 354	1 244	911 354	1 244

The differences in observable characteristics, as well as apparent differences in the underlying distribution of the treated subsample, motivate a sampling procedure where treated firms are matched with untreated firms on observable characteristics.

6.2 Matching results

In order to evaluate the effects of a program, it is desirable to have a group of firms that in several respects are similar to the treated group of firm to act as a counterfactual control group. For this reason, treated firms are matched with observably similar untreated firms from the gross population of firms. Matching is done on observable characteristics the year before treatment, in order to avoid the possibility that direct effects of the treatment influence the results.

The ambition is that group means on the outcome variables can be expected to be equal, except for the effect of counselling. We have highlighted two problems that may interfere with this expectation. The first is that untreated firms may be unfairly designated as untreated, as there is a possibility that they have been exposed to other forms of treatment, for which data is not available to us. The second problem is that there may well be unobservable differences between treated and untreated firms. One such unobservable difference is whether the firm is in a growth phase, i.e. intends to make an investment in order to significantly expand production, which is a precondition for even considering applying for a grant. Another unobservable difference is the propensity of the firm to apply for a grant as a means of funding an investment. We deal with this problem by identifying three distinct groups of firms to act as comparison. The first group of matched firms (*ALL*) is drawn from the pool of all

eligible firms in the gross firm population. The second group of matched firms (*Not contaminated*) is drawn from the pool of eligible firms in the gross firm population that have *not* applied for an investment grant at any time during the studied period. We interpreted this as a group of firms that has been uncontaminated by other forms of treatment. The third group of matched firms (*Self-selected*) is drawn from eligible firms that in the two years before the treatment year of the matched treated twin, has applied for an investment grant or investment loan from public sources. This group of firms is chosen to deal with the problem of self-selection: that only firms that want to grow, and are prepared to (partly) fund the investment with public funds are present in our data.

Treated firms are matched with untreated firms on industry (3-digit NACE codes) and firm size by number of employees in size strata, where class size is small for small firms, and increases with firm size. Firms are also matched on labour productivity (value added per employed person) and capital intensity (book value of capital assets per employed person). These variables are coarsened into classes, similar to the method used to create a histogram, using Scott's choice for class size, and matched within classes. Untreated firms are observed and matched the same year as the treated firms. The number of observations in each comparison group after matching is presented in table 3. There are approximately 50 000 firms in the matched sample that act as comparison to roughly 1000 treated firms. The number of matched cases in the self-selected sample is much lower, mainly because the size of the pool of potential matches in the gross population of firms is significantly reduced when the criterion that potential matches must have applied for public investment funds of some other kind is introduced. Comparing means between treated and untreated cases gives some indication of whether the observable differences between treated and untreated firms has been addressed. The difference in group means of the matching variables between treated and untreated firms is generally below 5 per cent. The most problematic matching variable is capital stock and capital intensity per employee, where the difference in group mean between treated and untreated is approaches 10 per cent in the sample where treated firms are compared with firms that have not applied for public investment funds; the *Not contaminated* comparison group.

Table 3: Descriptive Statistics for matched comparison groups.

	ALL		Not contaminated		Self-selected	
	Untreated	Treated	Untreated	Treated	Untreated	Treated
Value added $t-1$ *	5478.0	5662.8	5352.9	5533.0	6109.6	6371.1
Capital stock $t-1$ *	2809.2	2963.4	2651.4	2919.6	3351.7	3150.7
Labour productivity $t-1$	431.2	429.1	431.9	428.7	403.3	405.5
Capital intensity per employed $t-1$	226.1	241.9	225.4	243.8	236.9	224.3
Employed $t-1$	12.7	13.2	12.4	13.0	14.4	15.1
Other investment grants t *	2%	9%	0	9%	8%	11%
Earlier investment grants ($t-n$, $n \geq 1$)*	5%	29%	0	29%	51%	14%
Later investment grants ($t+n$, $n \geq 1$)*	3%	25%	0	24%	70%	34%
<i>N</i>	52 613	1 010	53 328	1 009	1 384	311

Remark: * Variables are not explicitly matched on these variables

7. Results

The result of the different analyses is divided into three parts. Firstly we discuss the impact on value added, i.e. the total production effect. This effect can, as stated in section 4, be explained by changes in the use of factors of production (labour and capital), changes in technology or changes in technical efficiency. Finally, we report the impact on firm survival. For each of these outcomes we present three analyses depending on from what sub-sample in the data untreated firms is selected. In table 4 the average treatment effects on the treated (ATT) is reported. In column 1 we select our counterfactual among a matched sample of firms, but allow for data contamination and include selection. This is the normal situation when evaluating business support, at least in Sweden. In column 2 we limit the sample of possible comparisons firms to firms that, to as large an extent as we have possibility to control, never applied for nor have been granted support. This means that we exclude contaminated data. Finally, in column 3 we limit the possible firm sample with respect to untreated firms to those firms that have applied for public investment aid, but have not been granted aid of the type that is to be evaluated. This analysis contains no self-selection, but may be contaminated. The appropriation of other kinds of public investment aid, as well as remaining imbalance between treated and control group is controlled for in the regressions underlying the results in table 4.

ATT is interpreted as the difference, measured in per cent, between treated and untreated firms with respect to each outcome. A first result is that all coefficients are positive, i.e. firms are at least not negatively influenced by receiving support.

Table 4 Average treatment effects on the treated for different outcomes

<i>Outcome</i>	All (1)	Non contaminated (2)	Self-Selected (3)
	ATT	ATT	ATT
Value added	0.143*	0.137*	0.057
Investments	0.195*	0.170†	0.081
Employment	0.121*	0.126*	0.058
Technological shift	0.009	0.0003	-0.005
Technical efficiency	0.014†	0.009	0.016
Surviving ¹	0.042	0.035	0.18
<i>N</i>	44 094	44 522	1 464

* = significant at a 5 per cent level, † = significant at a 10 per cent level.

In the regression we also control for industry and year. In the model of firm survival we also include variables on local competition and region.

[1]: Outcome: the difference in the probability to survive between treated and untreated firms in percentage points.

Impact on total production

In the first row we report the impact on total production measured as value added. If we allow for both contamination and selection effects to be included, the impact on value added is 14.3 per cent. This means that firms that have received the support on average have a 14.3 per cent higher value added than firms that have not, and the difference is significant at a 5 per cent level. If we allow for selection but delete firms that have received other support from the comparisons group we obtain similar results. There is a positive and significant impact on value added however slightly smaller than before (13.7 per cent). Finally, if we, by data constriction, delete impacts that can be related to self-selection we do not see any significant impact on total production.

Impact on production components

If, as in the two first analyses, production has increased something in the production function has to be the cause of that. Therefore we also investigate the impacts on the components in and in relation to the production function that can be affected. First we investigate the impacts on factors of production (L and K in equation [1]), then we investigate if there has been a

technological shift (A in equation [1]) and finally if there is impact on technical efficiency (ε_v in equation [1]). If we allow for contaminated data and include selection, treated firms have on average 19.5 per cent higher investments than untreated firms. This impact is reduced if we restrict the data so that firms in the comparison group are restricted to firms that have not applied for investment aid. If this is done the previously significant impact on investments is now reduced to 17 per cent and only significant at the 10 per cent level. Finally, excluding self-selection reduces the result further and the impact becomes not significant. The second factor of production is employment. The first analysis reveals that treated firms on average have 12.1 per cent more employees than untreated firms. The impact is, surprisingly, 0.5 percentage points larger if contaminations are deleted. Finally, excluding self-selection removes all the previously observed impact. Technological changes can occur as a result, however, we are aware that this may take much longer than the two years that we use as a follow-up period. This could be the explanation why we not obtain any significant impact on technological changes. In the final analysis we address the question of changes in technical efficiency. Technical efficiency is estimated with the use of a stochastic frontier approach (SFA). If contamination is allowed and selection is included we obtain a small but positive impact on technical efficiency. On average the ATT is 1.4 per cent, i.e. treated firms become 1.4 per cent more efficient than untreated firms. This effect on technical efficiency vanishes if we delete contamination and self-selection, i.e. analyses according to column 2 and 3.

Impact on firm survival

To estimate the impact on firm survival we can for obvious reasons not use a difference in difference design on firm level. Even if the estimated impact is positive, i.e. more treated firms survive, the impact estimate is not significant for any sub-set of data.

Comparing the results

It should be mentioned that the difference between ATT in column 1 and 2 is not significant for any variables. This means that contamination of the data is less of a problem. In the last column we allow for contamination, due to sample restrictions, but control for repeated support by including a variable including the number of support applied for but self-selection is excluded. As revealed in table 2 the impact estimates are small and none of the ATT's are significant. It is for future research to investigate precisely why self-selection seems to play such large role for the impacts, or the lack of impacts. One explanation might, however, be

that by just to put time aside to formulate the application for the support means that firms have prepared for some changes. Thus, firms are aware of the need of changes and also have formulated a plan to implement them. Our results can be interpreted as that firms that have this plan at hand will go ahead and make these changes even in the absence a grant. To some extent this is supported by the fact that the standard errors are larger when firms that never have applied for support are the comparison group (column 1 vs. column 2). An interpretation is therefore that support to business counselling is connected with very large dead weight losses.

8. Conclusions and concluding remarks

In this study we have investigated impacts of firms obtaining investment support paid for by the state. In contrast to other support measures where the support means that a counsellor is assigned firms receive money and can choose whatever consultant the firm decides. Our results are to some extent ambiguous. Firms that have received support have on average larger production. This is to the largest extent explained by an increase in factors of production, however, also by reducing inefficiency. So far, investments support points towards positive impacts for the firm. At the same time our third analysis points to the fact that there are no such impacts, which may be explained by presence of large deadweight losses – when firms have applied they will take action whether they receive support or not. Given this conclusion, an obvious policy recommendation from this conclusion would be that the support should be abolished since the changes that are the goal of the support will take place anyway. However, we do mean that if the situation is as described above, one part of the treatment is that firms invest time to identify problems and formulate strategies. The results however highlight the fact that the construction of the support needs to be examined. One interpretation is that it is not the support in itself that leads to impact; it is the road to getting the support. Policymakers need to ask if it is possible to create the same type of impacts in a less costly way.

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