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Public support to innovative ventures: Does it have any impact

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Foreword

Over the last decade governments around the world have understood that elements of knowledge are important for economic performance. Components of the economy related to innovation have a dominant impact upon economic growth and development. Therefore governments are striving in different ways to increase the degree of innovations. A common government solution for facilitating innovation has been to provide different kinds of seed funding programmes.

The aim of this study is to identify whether a public seed programme has had any impact.

The authors show that there is positive impact from early-stage public support and they argue that it is important that policy makers ensure that the programmes are evaluative.

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Summary

Many countries invest large sums of government money on the support of emerging firms in order to create national growth and development. It is therefore important to gain knowledge into whether such investments in fact create value. Hence, the aim of this research is to investigate whether an impact, in terms of additionality, can be traced among the ventures supported by the studied public support programme. The study also strives to provide a methodological contribution by investigating whether administrative data can be used as a tool for assessment, and if so, under what circumstances. The results are drawn from quantitative analysis based on a Swedish sample in which both supported and rejected firms are included. The main conclusions are: (1) supported firms perform slightly better than rejected firms, (2) annual report data is a inexpensive source of information, but cannot be used as a shortcut and (3) public support programmes need to carefully prepare for evaluation.

1   Introduction

With research demonstrating the alleged difficulties by innovative technology-based ventures in obtaining sufficient finance for development (Penrose 1959 for a discussion; Storey and Tether 1998), it is not surprising to find that large amounts are being invested in public support programmes directed at emerging firms, especially as such ventures are commonly regarded as making an important contribution to growth and societal development (Klofsten and Lindholm-Dahlstrand 2000; COM 2005). Technology-based ventures are also associated with certain characteristics (such as well-educated owners, new technology and in some cases also new markets), needs (such as management and business skills) and obstacles (such as a lack of credibility and short windows of opportunity) that differentiate them from new firms in general (Storey 1994; Storey and Tether 1998; Oakey 2003; Norrman 2005).

To date, the common government solution for facilitating innovation has been to provide different kinds of seed funding programmes (Storey and Tether 1998; North, Smallbone et al. 2001). Most of these support programmes include different types of finance that are commonly combined with business support or advice (Storey and Tether 1998; Lindholm-Dahlstrand and Cetindamar 2000, p 5). According to initiatives such as the European Commission's Competitiveness and Innovation Framework Programme, actions in support of innovative firms seem set to increase in the future (COM 2005). Given this, the costs of such programmes must be weighed against their wider benefits because it is important for policymakers to know how successful their efforts are when investing in innovation (OECD 2006, p 56). The impact of public interventions regarding the socio-economic value of these programmes has also been discussed (cf. Klofsten, Jonsson et al. 1999; Oakey 2003) and the opinions of its impact are divided. A review of the literature shows that broad follow-up studies of supported ventures generally indicate positive programme results, while the less frequent control group approaches indicate less clear-cut or even an absence of impact (Bager-Sjögren and Lööf 2005). A possible explanation to this division in minds might just be the different approaches used. Storey (2000) has investigated this issue and makes a separation between "monitoring" and "evaluation". The first approach refers to studies based on descriptions of schemes and/or the opinions and views of the programme as estimated by its recipients, and the latter to the more rigorous types of studies that relate their results to a "counter-factual". The issue of reliable evaluations is of current importance (COM 2005) and there is need for more knowledge, but also for identification of early, consistent, reliable and inexpensive information that can serve as a basis for evaluations (Mosselman, Prince et al. 2004).

However, the full socio-economic value of a particular investment is complicated to measure. Alternative costs and benefits as well as the mere task of identifying and measuring "additionality"[1] resulting from the programme (a necessary condition to make further cost-benefit calculations) need to be calculated or at best "guesstimated". The aim of this paper is therefore merely to attempt to identify the existence of the above-mentioned additionality, or in other words, to identify whether a public programme really has had any impact according to the information that can be obtained through administrative data such as programme-specific data and annual reports. We also discuss and analyze the data qualifications that are needed to reach the above aim, and how these qualifications can be obtained. As a consequence of this, we hope to contribute to the discussion regarding the measurement of the dynamics of new innovative ventures in early stages, and to the debate of evaluation of public support of such ventures.

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[1] *Additionality can be defined as consequences that would not otherwise have been there. See, for example, Mosselman, Prince et al. (2004) for a discussion on the concept.*

2   The support system studied

For this study we use the case of the Swedish Innovation Center (SIC) (1994–2003) that supported *"innovators in their absolute earliest phases of development with financial capital, advice and networks"*. SIC's main objective was *"to create a better innovation climate in Sweden … where people's attitudes to innovators is positive. And where it is easy for an innovator to receive help to develop his or her concept into a commercialized product or service"* (SIC 2002, p 24). *"When giving support, the prerequisites to commercialization and customer contacts should be emphasized"* (Prop. 1993/94:206, p 7, translation from Swedish).

The SIC system was aimed at a broad mix of businesses in order to create a more competitive edge, and supported the development of *"practical consumer products as well as advanced techniques for industrial and societal purposes"* (SIC 2004, page 2). Norrman (2005) describes the SIC selection strategy as a "survival of the fittest approach" in combination with a focus on the idea for which funding was applied.

At its inception, SIC established funds of EUR 56.7 M which were received from the public foundations of employees to help support new innovative projects (862/94; Prop. 1993/94:206). In total, SIC allocated EUR 122 M during the programme period, since its original fund was expanded through returns on capital investments.

SIC administered three types of financial support for new firms and private individuals:

- Innovation subsidy - a financial grant of approximately EUR 4,000

- Conditional loan - a 'soft' type of loan (maximum EUR 43,000)

- Scholarship - which was used in special cases.

In order to receive support, the project or idea had to fulfil the following three conditions: (1) the project/idea had to be new and firms could not be older than three years, (2) it must be possible to commercialize the project/idea and (3) the project/idea had to be technically or intellectually advanced (SIC; SIC 2002; SIC 2004 and interviews). Approximately two thirds of the funding were set aside for measures related to development and the protection of products, and the rest was allocated to supporting commercialization, marketing measures and other activities such as helping with negotiation (SIC 2004). The SIC system has now been inherited by another governmentally financed support actor – ALMI.

The SIC system focused on the type of ideas and projects that could be labeled as technology-based and in the early stages of development. Technology-based firms are defined, in this study, as those in which the strength and competitive edge derives from the engineering know-how of the people integral to the firm, and upon the transformation of this know-how into the firm's products and services (Klofsten 1992). It must be admitted though, that not all of the firms in this study can be labeled as high technology or founded by engineers. However, based on the requirements of technological advancement and novelty that were set up by SIC (SIC 2004), it is presumed that most of the studied firms must be considered to be engaged with new and innovative products or services or at least by means of the widest Schumpeterian definition of "carrying out new combinations". Early stage businesses are, in line with the programme studied, defined as firms or projects that are not older than three years.

3   Appropriate indicators and hypothesis generation

For innovations to survive in the long run, there must be a stable demand, a pricing strategy that admits profits, and a high level of development of the product (Åstebro and Michela 2005). Before these factors can be obtained, it is clear that the idea for the business needs to be developed in a way that makes it communicable i.e. that its basic concepts can be understood by different stakeholders. Theoretically, this can be expressed by using the idea development process of Klofsten (2005). His model illustrates the earliest stages of idea development and shows that ideas develop from a pre-commercialization stage, at which time the idea is un-formed, to a commercialization stage, at which time the idea can be communicated to the market. This then generates income to attract private investment for further development. From this stage, a company can be built and the idea can be developed enough to reach the next step of development, which Klofsten describes as "the business platform". When the "business platform" is reached, the firm has overcome its vulnerability and is equipped for survival and growth (Klofsten 1992). This paper assumes that public support programmes directed at the early stages of development ought to focus on ventures that reside in the pre-commercialization or commercialization stages. Hence, the aim of these support programmes ought to be to develop the supported ventures from these immature stages and to put them on the road to reaching the "business platform". We are interested in investigating whether the impact of such efforts directed at the supported firms can be traced.

In evaluation research, the cost effectiveness of programmes refers to the cost of inputs in relation to the outcomes generated. Outcomes are defined as goods that would not have been realized within a given time limit without the programme (Mosselman, Prince et al. 2004). In governmental programmes that support entrepreneurial and innovative activity there are political visions of spurring growth and general well-being. However, the outcome in the form of ideas that have been realized into commercialized products or services ought to emerge. Hence, generating sales can be considered a relevant outcome indicator. Reaching break-even and delivering profits are also of high interest. Finally, and of great importance to society, is increased employment, which will result in an increased base for taxes.

Time patterns are an important and often neglected issue in the study of innovation dynamics. They may be influenced by randomness, but it is our belief that leaving the outcome discussion with fuzzy clichés of emergence of important consequences in the long run is not good enough (SIC 2002). Studies conducted by SIC show that the majority of the projects applied for have been carried through within a time span of 3.5 years (Pleiborn 2002). According to Klofsten (1992), the development process of obtaining a business platform ought to be carried out over a period of 2–3 years. Other research has argued that the type of financial support studied should produce pay-back streams at least five years after the project start otherwise, the project must be considered a failure (Reitberger 1983). Studies such as Oakey's (2003) also suggest that innovative ideas are associated with long lead times to market, which result in longer follow-up time spans.

We have limited our study to limited companies exclusively, which entails that the idea owners have already invested EUR 5,500–11,000 since this sum is required to register a limited company in Sweden. Hence, our selection of applications does not consist of individuals who are merely considering starting a firm, as they are already a couple of steps ahead on the entrepreneurial path.

In any kind of evaluation or assessment, it is important to have the goals of the evaluation object in mind when the study is conducted. As shown above, the selection process adopted by the SIC programme was fairly broad. Unfortunately, SIC has not explicitly

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developed its own indicators for activity evaluation and, aside from turnover and number of employees (SIC 2004), no measurements have been created to rigorously test the impact of the programme.

We are, in this dissertation, interested in investigating whether the information in annual reports is suitable for detecting and measuring the development of the firms studied. It is not a question of business ratios, since most of the firms studied are rather immature, which implies that strict ratios may give a skewed picture (Klofsten 2002). Therefore, we focus on four items that we consider of special relevance for the evaluation of the economic performance in the early stages of new ventures:

- "Commercialization incidence" measures the presence of positive turnover, e.g. an indicator of realization of the invention applied for. It is used to check whether SIC, in applying a broad "experiment maximization" strategy (or the opposite of a "picking winners" strategy), managed to help supported firms to commercialize to a larger extent than the rejected firms. This indicator can also be used as a measure of "survival", especially since survival, as such, is normally complicated to measure because firms can be registered without having economic activity.

- "Accumulated sales" are the accumulated amounts derived from the turnover of the firm. These reveal the extent of the economic activity of the firm. The variable is used to take advantage of the longitudinal information in the data. The accumulated sales measure will, in opposition to annual levels, integrate erratic sales and thus treat enterprises with economic fluctuations fairly.

- "Total assets" are the sum of debts and equity and reveal the total size of the business. The level and growth of assets is of high relevance for early stage analyses. The firms studied are in the very earliest stages of their development. They might have invested their returns in the development of their product or service and they might have borrowed money or taken on investors to finance their development. Hence, increased total assets might be a consequence of the venture developing and reducing the uncertainty of future performance.

- "Number of employees" is of interest from a societal point of view, since it is coupled to tax payment. Organic development and the growth of employment are correlated with the growth in turnover. The organization of the production is usually a consequence of successful penetration into a market and the change in strategy of the entrepreneur to attain more control of the production of the product or service.

These indicators can be translated into four hypotheses:

- SH 1: Supported firms have better commercialization incidence than rejected firms.

- SH 2: Supported firms have larger amounts of accumulated sales than rejected firms.

- SH 3: Supported firms have larger amounts of total assets than rejected firms.

- SH 4: Supported firms have better employment rates than rejected firms.

Taken together, these four hypotheses can be summarized into one superior hypothesis, expressed as follows: *Supported firms perform better than rejected firms.*

4   Method and data

The study is based on a Swedish case, the Sweden Innovation Center, which is described above. The method is quantitative and the sample has been drawn as follows: During 1994 to 2003, SIC received a total of 5,839 applications for conditional loans. In this study we are focusing on 2,577 limited companies that, opposed to other liabilities, can be supplemented with annual report data. The overall support rate for all projects, irrespective of firm type, was approximately 57 percent and 66 percent for limited companies (Norrman 2006).

In contrast to qualitative studies that focus on maximization of specifics, quantitative analysis implies the need to check for differences in order to be productive. Therefore, we have striven for the maximum level of similarity of background variables of the cases studied. Hence, the data was qualified before analysis was conducted. Approximately 1,800 individual firms made up the limited company applications. To avoid the risk of analyzed firms belonging to both the supported and the rejected groups, it was important to only analyze firms that only submitted one application, reducing the selection to 1,335 cases.

The success of a single firm that can be attributed to public support does not equate to the success of the entire public support programme. Storey (2000) analyzed follow-ups of public support programmes directed at small businesses and new ventures for which the results were considered successful. His main remark highlights the absence of information that contrasts the firms supported - the issue of quasi-control/comparison groups, that is, all statements of the relative merit of a programme depend upon the availability and relevance of a counter-factual to relate the results to. However, the quasi-control group must also be qualified and we have therefore removed rejections for administrative reasons as well as in cases in which the application rules were not followed. Furthermore, 31 cases for which the diary system showed conflicting variables (there was information of supported sums and rejection) were removed.

Another problem that arose when examining early stage financing within this project was the actual recipient of funds because the SIC programme directed its support to project ideas, not to individuals or firms. Since available data is on a firm level, difficulties measuring the effects of the support arise. For example, the development of a firm may be attributable to a project other than the one applied to. We have resolved this by removing firms that displayed economic activity during the three years prior to the SIC application. After this, the final selection consisted of 510 applications. Of these, 398 were supported and 112 were rejected.

In spite of these measures, there is still a risk that the performance of the firms studied derives from other projects than the one applied for. To control for this, we have divided our sample into three groups before running the analysis. The first group (Group 1) included all of the 510 applications shown above. Turnover during the year of application was allowed for this group. For the second group (Group 2), we removed the 25% most successful firms based on turnover during the year of application, leaving 396 firms (84 rejected and 312 supported). Finally, for the third group (Group 3), all firms with positive turnover during the year of application were removed leaving 297 firms (60 rejected and 237 supported).

Although quantitative indicators may not display the full complexity of a phenomenon, we believe that, if properly selected, they serve their purpose by detecting and describing the issue studied. We therefore address the problem of detecting the impact of public interventions by combining the register data of the programme with annual report data, revealing the economic performance of the firms that have applied for public innovation

support. Our opinion is that such data has the advantage of being relatively inexpensive and easy to obtain and, in our case, that it adds a valuable longitudinal dimension to the analysis. The economic performance of the supported firms is then compared to the firms that were rejected following our hypothesis.

A standard approach for evaluation programmes does not seem to be on the horizon. Therefore, this study has chosen to measure a number of time periods. These are one, three, five, and, in a limited number of cases, seven years from the year of application.

In Sweden, all limited companies are obligated by law to file annual reports which are then registered. We find it reasonable to assume that the data collected according to legal requirements is objective and measured appropriately. Our data comprises annual reports for almost all limited companies that have applied to the SIC programme between 1990 and 2004. The longitudinal character of the data gives us the opportunity to perform analyses over time, an important aspect when analyzing development in the early stages. The data contains information of sales, profit and number of employees at the year of application, three years before application and three years after application.

In order to treat the firms fairly irrespective of the year in which the application was filed, we used a price deflator from Statistics Sweden to deflate money terms. In the analysis, the applications were divided into rejected and supported applicants. These were then compared in order to see whether there are any traceable differences.

We estimate impact (additionality) using the difference-in-difference estimator, which provides valid estimates of programme impact given the assumptions of a similar development path before the intervention and that non-observable individual specifics influencing the outcome are constant over time (Heckman, et al 1999). Our hypotheses were tested using one-sided t-tests with the assumption of equal variances and with an alternative hypothesis for the differences between controls (0) and supported (1) being negative. Note that the negative is only a result of our coding of the groups, 0 and 1. Thus a significant negative estimate rejects the naught hypothesis in favor of the alternative, that is, the existence of the alleged programme impact.

Finally, Heckman et al. (1997) show four possible sources of systematic errors within quantitative research when estimating programme impact. These are (1) incompatible definitions of the dependent variable; (2) unequal economic circumstances for the observed groups; (3) incompatible populations for the observed groups; and (4) the existence of non-observable variables that govern the self–selection into the programme for one of the observed groups, making it incompatible with the other group.

In this study, systematic errors (1) and (2) are eliminated. Incompatible populations (3) might be of relevance if early stage dynamics are different in different industries and different for ventures run by women, for example. All analyzed cases applied as limited companies making them equal with respect to personal risks. The fourth point - the problem of self-selection into programmes - was also eliminated since data is available for the full population (both supported and rejected cases).

5 Results

The sub-hypothesis was tested 1, 3, 5 and 7 years after the application was filed. To control for the impact of other projects on the business in addition to the one applied for, the analysis was run on three qualified samples by taking into account the amount of sales during the year of application. Due to space constraints, table 1 shows the results of the most qualified sub-sample (group 3), in which none of the firms analyzed showed positive turnover during the year of application. The result will, however, be discussed for all three of the analyzed groups.

The annual report data that was used contains information of all supported and rejected applicant firms. The rejected firms are used as a quasi-control group. The problem of self-selection bias has been eliminated since both the rejected and supported firms have applied for funding from the same source.

A correlation between support and success can be regarded as an indication of programme impact. No correlation implies either that the system studied was a failure or that the method or indicators chosen were not appropriate for the purpose. If this is the case, both results need to be carefully examined. Having several success indicators is problematic if they exhibit a non-coherent pattern. This is an important issue for both evaluators and policy makers. In principle, public programmes should identify one principal success indicator that is considered as the most relevant for its action. Except for the first indicator of success - the dichotomous commercialization incidence, for which realization (i.e. 1 instead of 0) can be considered conditional for the remaining indicators - we have posed the general hypothesis that a positive programme impact or success generally implies greater sales growth, total assets and employment in firms supported by the public programme. We have not performed an overall statistical test but rather supply a tallying of estimates that supports or contradicts the conclusion of programme impact.

Sub-hypothesis 1: Supported firms have better commercialization incidence than rejected firms.[2]

The hypothesis is not clearly corroborated for the first group, except for year 1 for which the hypothesis is significantly supported. For groups 2 and 3 the tendency towards corroboration of the hypothesis is stronger. Our hypothesis is significantly supported for years 1, 3 and 5 and leans in the right direction for year 7.

The argument that high-risk projects are selected into support programmes might imply lesser commercialization incidence. We however find this argument difficult to apply in this case since all applicants are in an early stage of development and since the evaluation of the projects for support have been relatively modest, at least compared to the more thorough due-diligence procedure used by investors such as venture capitalists. Moreover, it has been argued that radical innovations face a longer time to market than incremental or ordinary products (Oakey 2003). The fact that the evidence for this argument is scarce in this study, can be explained by the fact that most of the SIC projects do not represent radical innovations or that the time span of 7 years is too short. A notable observation is that the commercialization incidence decreases from year 5 onwards, both for supported and rejected firms and consistently for all groups.

Sub-hypothesis 2: Supported firms have larger amounts of accumulated sales than rejected firms.

The figures concerning group 3 significantly support the hypothesis for years 1 and 3. For years 5 and 7, the tendency is to support the hypothesis. The figures for group 2 are similar

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[2] *For tables regarding groups 1 and 2, please contact the authors.*

to for group 3, with the exception that the figures for year 7 are also significant for group 2. For group 1 the result is less clear-cut as there are no significant figures in either direction. The tendency is to reject the hypothesis for year 1 and to support it for years 3, 5 and 7. Our conclusion regarding the follow-up of accumulated sales is that there is an indication of a positive programme effect if the sample of supported firms is more strictly qualified, as it has been in groups 2 and 3.

Sub-hypothesis 3: Supported firms have larger amounts of total assets than rejected firms.

If the supported firms have experienced successful project implementation, this might have, in turn, attracted both lenders (banks) and investors. Therefore, new investments ought to show up in form of an increase in the total assets of the firm, which is measured as the sum of debt and equity in the balance statement. From year 3 onwards, the trend is for all groups to support the hypothesis. However, for groups 1 and 2, there are figures that significantly reject the hypothesis for the initial year and for year 1. For group 3, the figures significantly support the hypothesis for the initial year and for year 1.

The variance between the firms concerning the total assets is large and, if reduced[3], (as in the second half of table 1) the result becomes more stable. For all groups, the result is significantly in favor of the hypothesis for the initial year, year 1 and year 3. For years 5 and 7 the figures are headed in the right direction.

Sub-hypothesis 4: Supported firms have better employment rates than rejected firms.

Finally, for the last indicator of success - the number of employees - similar results to those above have been found. From year 3 onwards, the supported firms have a higher number of employees than the rejected firms. This holds true for all groups of rejected firms. For group 1, the trend points towards supporting the hypothesis for years 3 and 5. The results for group 1 significantly support the hypothesis for year 7. For group 2, the support is significant for years 3 and 7 and is headed in the right direction for year 5. For group 3, as shown, the support is significant for years 1, 3 and 7 and is headed in the right direction for year 5. The levels on the mean estimate of number of employees are low for both supported and rejected firms.

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[3] *We have transformed the absolute values to their natural logarithms. This maneuver implies that we have compared the difference as a percentage rather than as absolute figures.*

Table 5-1 Results of test of difference–in-difference for group 3[4].

SH 1, Sales incidence

Years at/after application	0	1	3	5	7
Controls (rejected)	0.000	0.217	0.340	0.265	0.278
No of controls	60	60	53	34	18
Supported	0.000	0.481	0.507	0.442	0.389
No supported	237	237	219	156	90
Controls – supported	0.000	-0.264	-0.167	-0.178	-0.111
t-test	0.000	-3.773	-2.199	-1.916	-0.886
p-value	0.000	*0.000**	*0.014**	*0.028**	0.189

SH 2. Accumulated sales

Years after application	0	1	3	5	7
Controls (rejected)	0	47 123	313 546	822 480	1 089 120
No of controls	60	59	46	23	16
Supported	0	292 509	1 341 730	4 531 820	5 908 767
No supported	237	232	206	95	78
Control – supported	0.000	-245 386	-1 028 183	-3 709 339	-4 819 646
t-test	0.000	-3.040	-2.658	-1.074	-1.143
p-value	0.000	*0.001**	*0.004**	0.142	0.128

SH 3. Total assets (sum of debt & equity)

Years after application	0	1	3	5	7
Controls (rejected)	424357	588957	1575981	1786939	1572368
No of controls	27	35	26	16	8
Supported	1111582	1917767	3601049	4683159	4687159
No supported	59	167	149	92	48
Controls – supported	-687 225	-1 328 809	-2 025 067	-2 896 220	-3114790
t-test	-1.962	-1.547	-1.094	-0.897	-0.550
p-value	0.027	*0.062*	0.138	0.186	0.292

SH 3. ln (sum of debt & equity) variance reduced by logarithm

Controls (rejected)	12.058	12.484	13.081	13.207	13.038
No of controls	27	35	26	16	8
Supported	13.023	13.425	13.862	13.650	13.248
No supported	58	166	149	91	48
Controls – supported	-0.966	-0.941	-0.780	-0.442	-0.210
t-test	-2.964	-3.838	-2.311	-0.866	-0.244
p-value	0.002	0.000**	0.011**	0.194	0.404

SH 4. Number of employees

Years at/after application	0	1	3	5	7
Controls (rejected)	0.117	0.267	0.264	0.176	0.000
No of controls	60	60	53	34	18
Supported	0.139	1.068	1.402	1.622	0.956
No supported	237	237	219	156	90
Control – supported	-0.023	-0.801	-1.138	-1.445	-0.956
t-test	-0.253	-2.722	-2.588	-1.150	-1.553
p-value	0.400	0.003**	0.005**	0.126	*0.062*

*Remarks: Group 3 implies no turnover present at the year of application. Italic text and * indicate significant support of the hypothesis at a 10 percent level; ** at a five percent level. Italic text indicates a positive point estimate. Missing values are coded as 0, this implies for SH3 that the number of observations are diminishing. Single sided t-test is used. No significant rejection of the hypothesis was found.*

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[4] *For standard errors please contact the authors.*

Main hypothesis: Supported firms perform better than rejected firms.

Overall the results for all three groups can be summarized for the main hypothesis as follows. For each group we have four points of measurement and five indicators i.e. a total of 20 indicators:

- For group 1 (n=510), four estimates significantly support our hypothesis. Additionally, 13 estimates show a degree of positive support. 1 estimate significantly rejects the hypothesis and two estimates show a degree of rejection. Taken together, 85 percent of the estimates significantly support the hypothesis or show a degree of positive support while 15 percent reject the hypothesis. All significant cases of rejection of the hypothesis are found during year 1.

- For group 2 (n=396), 10 estimates significantly support the hypothesis with an additional eight estimates showing some degree of positive support. One estimate significantly rejects the hypothesis and one of the estimates shows a degree of rejection. For group 2, 90 percent of the estimates significantly support or show some degree of support, while 10 percent significantly reject or show some degree of rejection of the hypothesis. As for group 1, the significant case of rejection of the hypothesis is found during year 1.

- For group 3 (n=297), 11 estimates (55 %) significantly support the hypothesis and an additional nine estimates (45 %) show some degree of positive support. None of the estimates reject the hypothesis. Summing up the third group, 100 percent of the estimates significantly support or show some degree of support.

6   Discussion and conclusions

The mission of the SIC programme can be interpreted as an intention to transform innovative ideas into economic value. Thus, the information provided in annual reports with a longitudinal extension for the firms studied must be considered valuable when the impact of the programme is to be evaluated. However, this builds upon the validity of the assumption that the economic information about firm performance is equal to the performance of the project applied for. In the case of SIC, firms that had a positive turnover that could be attributed to other business projects also qualified for SIC support and since project specific data is missing, we cannot know how much of a firm's performance is dependent upon projects other than the one applied for. Hence, these cases were excluded in the performance analysis. This is a weakness, since the number of valid observations diminish, which implies less precision in the estimated parameters.

A dismal comment on our above analysis is that we started with 1,335 firms and were forced to exclude a majority of the cases. For example, almost 50 percent of the firms were either not eligible to receive support according to the rules of the system or obviously had other business projects that demanded specific project data follow-ups in order to be included in our analysis. Another problem with the data is the relative few observations in the quasi-control group i.e. the firms rejected. The number of rejected firms is 60 and the number of supported is 237, which gives the impression of the presence of a liberal selection policy.[5] In addition to questioning the validity of the quasi-control group, the few observations imply less statistical precision. A further problem is the lack of insight into whether these firms obtained public support elsewhere.

Our conclusions regarding the effect of the programme are primarily coupled to the difference between the supported firms and the quasi-control group, but also to the method chosen for estimation of the impact. While restricting the observations by disregarding those who had positive sales the year before the year of application, we in fact have made the data that fulfills one of the assumptions crucial for the difference-in-difference estimator (DiD) (Heckman, Lalonde et al. 1999). Thus, our result depends on the 'untested assumption' that firm-specific, bias-generating disturbances are static over time and are thus eliminated using the DiD estimator (Athey and Imbens 2002). From a growth point of view our conclusion is based on the differences stated in the absolute levels between the two groups. Nevertheless, when the changes in these absolute measures are transformed into relative ones, the differences in total assets, seem to disappear for group 3 and both the supported and the rejected firms show an equal annual growth of 33 percent. If the dynamics are regarded more closely, we can se that the supported firms, at the year of application, had 2.5 times more invested capital (sum of debt and equity) than the quasi-control group. Actually, this signals a problem, i.e. that our quasi-controls differ from the supported firms on one important dimension and that our result still has factors that need to be controlled for.

Taken together from a rigorous statistical point of view, the above results cannot, be concluded to be indisputable evidence for a positive programme effect on the supported firms. However, from the consistent direction of the indicators, especially when the sample was qualified (as in groups 2 and 3), we can conclude that there is something that could not be explained as a mere coincidence because it seems systematic. Given the DID assumption, as well as the assumption of the validity of the quasi-control group, we consider our results to be convincing because they indicate a positive impact of the programme in financing innovative ventures in the early stages. Based on these findings, we support the argumentation of Klofsten, et al (1999) that small sums of funding directed

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[5] *As mentioned above, the support rate for limited companies was 66 percent.*

at firms in the early stages of development are of importance. Still, the question remains whether the difference is large enough to generate benefits exceeding the costs of the programme. According to the significant results present for group 3 – all supporting our hypothesis - it can be argued that the SIC-supported firms perform slightly stronger than those that were rejected.

The extent of the programme effects stated can be measured by creating an aggregate, calculated by multiplying the estimated difference by the number of supported firms. In table 2, aggregates for years 1, 3 and 5 after the application are displayed (differences for the 7th year were excluded since they was considered too uncertain). As mentioned above the total sum invested during the programme was EUR 120 M, of these, EUR 27 M was spent on conditional loans directed to limited companies. The effect of the programme can be estimated by relating the below aggregates to the EUR 27 M invested.

Table 6-1 Aggregated sums from table 6.1 group 3.

	Years after application		
	1	3	5
Accumulated sales, EUR million	6	11	32
Total capital (sum of debt & equity), EUR million	30	21	25
No employed	165	108	113

Estimating effects is problematic for various reasons. Time patterns and appropriate intervals for follow-up make up such a reason. It is reasonable to assume that the values of the first year are the most reliable ones since they are close in time. Hence the influence of other factors ought to be smaller than for the following years.

The measure of accumulated sales shows an annual increase of approximately EUR 6 M per year and seems to be rather consistent over all the years measured. It is therefore hard to draw any clear conclusions from the accumulated sales measure. The next one, total capital, is a bit more interesting. The sum for year one exceed the sum invested, though modestly, which indicates positive effects. Concerning the last measure, number of employees, we can see that the EUR 27 M invested generated 165 jobs one year after the support was received. This implies that the average cost for one job was EUR 164,000 which, in our opinion, is a high figure.

This mathematical exercise is by no means complete, but it gives some perspectives on the figures. Our conclusion is that we can show a modest programme impact – based upon the difference in performance of supported and rejected firms, but when the statistics are more closely analyzed and related to the amounts invested, this impact cannot be considered large enough to pay the investment off.

The scale of the programme is another issue. The impact found in this study by an estimator that is only used to determine whether a programme should be started or finished is not sufficient to derive conclusions regarding relative changes in the size of the programme. This requires more sophisticated estimates of the local average treatment effect (LATE) (Heckman et al 1999) or the marginal effect of a programme change. Regarding the scale of the programme we can conclude that the EUR 120 M in expenses created 5,839 applications for support during the ten-year lifetime of the programme. On average, this means 260 applications from limited companies each year, of which, almost two thirds were supported. This can be related to the total number of new limited companies registered per year in Sweden, which is approximately 7,000.

One hundred seventy out of 7,000 is just over two percent. Thus we find it relevant question what it was that the policymakers responsible for support programmes such as SIC initially believed this kind of programme would add? Regardless of the above

evidence that this programme actually produced some kind of additionality, the level of the programme suggests that this addition might be negligible seen from a larger perspective. We described the idea behind the SIC programme as focusing on the "survival of the fittest" with respect to the idea of the venture. Because this kind of programme supports the formation of new ventures in such early stages, the concept of "picking winners" cannot be considered relevant. Furthermore, the support given was quite superficial as it was restricted to counseling and financial support in the form of relatively small sums per venture. In contrast to the "picking winners" strategy that is surging through the private equity industry, the public strategy focuses on maximizing the number of experiments with certain qualities. However, the small scale of the programme brings into question the credibility of such a "maximizing" pursuit.

A final issue of importance that emerged during this study is the importance of implementing evaluation as early as the inception of a support programme. Formulating structures for evaluation at an early stage enhances programme follow-up. For the case of SIC, the diary system was designed to catch important facts about the applicants, but unfortunately, this tool was never used. In order to make thorough assessments, project level data must be identified for both the supported and rejected firms. Therefore, it is our recommendation that public programmes that support firms be required to present their data collection strategies. These data collection strategies must be related to a realistic programme strategy, identified and prepared before the launch of the programme. Furthermore, we know from other studies that previous entrepreneurial experience and the entrepreneurial context of a person is important (Reitberger 1983), a fact that also holds true for factors such as the ability or desire to work in teams (Reitberger 1983; Storey 1994). We therefore suggest that facts such as education level, previous entrepreneurial experience and background, number of founders and the visions of the applicants be mapped for all applicants, regardless of whether their applications are approved or rejected.

7 Concluding remarks

The aim of this paper was to attempt to identify the existence of *additionality* of an investigated public support programme. We were also interested in examining whether the evaluation could be made by using administrative data. With regards to this aim, we can make the following conclusions:

- We hypothesized that supported firms performed better than the firms not supported, which were measured one, three, five, and seven years after filing their application. This hypothesis was not indisputably confirmed. But when the results of the sub-hypotheses were summarized, the results point towards support of the hypothesis. Even if this support was rather weak from a statistical point of view, it must be stressed that no evidence that supports rejection of the hypothesis was found. All in all, our results indicate a positive impact of the studied public support system.

- When, on an aggregated level, the impact of the programme was compared to the amounts invested in the programme, the impact was not great enough to pay off the investment.

- Annual report data is an inexpensive source of information regarding performance and could serve as a foundation for further investigations using a more qualitative approach. However, it cannot be used exclusively. Other sources of analysis are required. For thorough reliable evaluations, carefully collected project data is preferred.

- It is important to prepare an evaluation method from the inception of a support programme. If this is disregarded, evaluations become extremely difficult to conduct.

- The fact that there have been rather few applications for conditional loans compared to the annual Swedish stock of start-ups raises the question of whether this kind of programme really does matter on the whole, regardless of the evidence of it having a positive impact. Although the SIC system clearly aimed for a broad mix of businesses in their support efforts, there are some doubts as to how well-known the programme really was among the target group of emerging firms.

8 Implications and further research

Our indicators of success clearly exhibit the economic development and dynamics of early-stage technology-based ventures. From the above facts and limitations, we can, therefore, draw the conclusion that, given three assumptions (project-performance coherence, quasi-control group validity and static firm specifics), impact can be traced and measured from register data. We have also shown evidence of the likely positive impact from early-stage public support. However, data on a project level would have permitted a more thorough impact assessment.

Additionally, we supply evidence of the difficulties of making judgments based on limited ex post data, regarding, for example how to treat realized sales in the same year as the support application is filed. As a clear policy implication, we argue that it is of high importance that policy makers ensure that their programmes have developed evaluative awareness and the proper conditions for evaluation regarding clearly stated measurable goals.

We intend to continue and supplement the results of this study with matched case studies[6] in order to capture the more qualitative aspects of innovation support. We are convinced that solely making a comparison of quantitative data does not reveal all aspects of this issue and that there might also be valuable qualitative aspects which are currently disregarded. Our intention with the upcoming research is to use the register data as a tool for the selection of suitable cases for analysis. Such analysis can produce more in-depth answers regarding public innovation support and its possible impact on the idiosyncrasies of the early stage of venture development. The next step is, therefore, to perform a study of matched cases.

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[6] *By matched cases we mean a comparison of cases from the analyzed group and from the reference group, that are as similar as possible with regards to industry, geographic location and economic figures.*

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