Does financial support from the EU structural funds has an impact on the firms' performance: evidence from Estonia

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Abstract. The purpose of this paper is to provide an empirical analysis to look for causal effects between government grant and performance indicators at the firm level. To analyze the impact of grants on the firms' performance we employ a difference-in-differences estimator. Such approach can be used separately for the firms that received the grant in different year. The second method we use is a panel-data framework. Results show different impact of various type of grant on firm's performance by economic activities.

Keywords: difference-in-difference, panel data, Estonia, government grant

JEL Classification: D24, H25, O32
AMS Classification: 62P20

1. Introduction

The main goal of government financial support is to promote business in order to accelerate economic growth. The financial support from government has been an important instrument of industrial policy especially in the transition countries. The Estonian Government has introduced different programs in order to support local enterprises. There are 15 programs available for SME for example the start-up and development grants, export grants, grants for research and development (R&D) activities and technology investments by companies.

In 2000 was established Enterprise Estonia (EAS) to promote business and regional developments in Estonia. Enterprise Estonia is one of the largest institutions within the national support system for entrepreneurship. Most of the EAS programs and grants combined with the co-financing from the EU structural funds. Since 2008, Enterprise Estonia has financed 960 projects with a total of 7.4 million euros from the European Social Fund [8]. A recent study by KPMG has revealed that between 2007 and 2009 Estonia was the most successful CEE country in utilizing grants from the European Union's structural and agricultural funds.

The stages of development of enterprise sector in Estonia a little differ from other transition economies. The liberalization and decentralization of the economy accompanied by lax monetary and fiscal policies contributed to overly fast growth of the number of firms. As a result of rapid privatization 90% of all Estonian enterprises were privately owned by 1995 and there are 58347 enterprises in Estonia in 2010. Within the group of small and medium sized enterprises (SMEs), a vast majority of the enterprises (88.9%) are micro enterprises, employing less than 9 persons. So, the typical Estonian firm is a micro firm. There are about 9.1% small and 1.8 % medium enterprises. On average, it was found that there is an increase of about 6% enterprises annually in the periods 1995-2010. At the moment there are approximately 44 SMEs per 1000 inhabitants and 81.91% of total employment is provided by SMEs.

Thus, it is important to evaluate the effectiveness of government financial assistance. Girma et al. [10] has argued that the evidence on effectiveness is mixed due the indicators for measuring effectiveness have been very various. Masso et al [15] pointed out that the effectiveness has been measured as the better use of technology, higher productivity, higher probability of firm survival or creating new jobs, whether subsidies crowd out or add to the firm's private expenditures (e.g. concerning R&D subsidies).

It is now widely acknowledged that increases in productivity are the main source of long-run economic growth. Lack of growth-oriented firms is argued to be one of the main obstacles to economic growth and increase in employment. Therefore the main hypothesis of the paper is that financial support from the government has positive impact on the firms' performance and accelerates economic growth through improved productivity. The present paper contributes to the literature on evaluating the effectiveness of government grants given to enterprises in Estonia. To analyze the impact of grants on the firms' performance we employ a difference-in-differences and a panel-data framework. We therefore evaluate the effectiveness of grants and

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distinguish the effects of different types of grants on firms' performance. Data of the firms, both supported and unsupported, are collected from Enterprise Estonia and Estonia Central Commerce Register from 2004 to 2010.

The remainder of the paper is organized as follows. Section 2 gives an overview of empirical research in the existing literature. The following section 3 contains data and methodology. In the section 4 are performed the econometric analysis and discussion. The final section includes conclusions.

2. Literature review

It is important to evaluate the effectiveness of the governmental assistance. There are many empirical studies estimating the impact of government grants to enterprises in different countries (Bergström [2], Almus [1], Crepon and Duguet [5], Girma et al [10], Ege [7], Sissoko [16], Criscuolo et al [6]). Estonian evidence on the determinants of firm growth is scant. The main studies in Estonia were done by Masso and Vildo [14] and Lukason and Masso [13]

In empirical literature the definition of efficiency has included many different domains and opportunities – the effectiveness has been defined through improved usage of technology, increased productivity or whether it has increased the probability of enterprise survival (Masso and Vildo [14]). Some of the empirical studies are briefly listed below. Bergström [2] showed in case of Sweden that subsidization is positively correlated with growth of value added and that productivity of the subsidized firms seems to increase the first year after the subsidies were granted. Almus [1] found from analysis of German data using parametric selection approach that firms receiving assistance perform better in terms of employment growth over a six year period. Crepon and Duguet [5] showed in case of French data with propensity score matching that start-up subsidies increased significantly the survival of the firms created by former unemployed people; and the allocation of subsidies acted as a screening process improving the performances of the bank loans; the effect of subsidies was stronger than that of bank loans. Girma et al [10] examines the impact of enterprise support on firm survival and growth in case of Irish manufacturing enterprises. In particular their study was special that in Ireland the public grants to enterprises have been used in addition to the improvement of domestic firms' performance also for attracting the foreign firms' production units to the country. They used traditional matching techniques in combination with difference-indifference analysis and showed that especially capital (but also other types of) grants had important impact on firm survival and job creation. The main finding of Ege [7] is that the Small Innovative Research grants in USA stimulate both sales and employment growth. These results are robust across several alternative regression models and different groups of control variables. The most important control variables were the firm's sales in the year of application and the firm's employment in the year of application. Sissoko [17] investigates the role of R&D subsidies on productivity of the French firms. He explores their role on the firm performance measures like employment, capital and R&D expenditures using difference-in-difference techniques. The results suggest that, on average, total factor productivity of the subsidized firms is higher of around 15% towards the end of the 3-years grant period relative to the matched control group. There is also little evidence about a role of R&D subsidies on employment, capital, R&D expenditures and credit constraints. The recent research of impact of subsidy was done by Criscuolo et al [6] in Great Britain. They analyzed the impact of expenditure on the Regional Selective Assistance program over a 20-year period. They had over 2.3 million observations before and after receiving government support. Using IV estimates they found positive program treatment effect on employment, investment and net entry but not on productivity. Their research suggests that government grants to smaller firms in economically disadvantaged areas of Great Britain can increase employment, but that grants to larger firms have no effect.

Moving on to the existing studies in Estonia there is empirical research analyzing only the impact of start-up grants on firms' efficiency. Lukason and Masso [13] analyzed the performance of 39 Estonian start-up firms that received financial aid from the state in the form of start-up grant during 2005-2008. The results indicated that while many firms could not meet their reported goals (in terms of turnover, profit and the number of jobs created) and more than half of the firms had tax arrears, the estimated labor taxes paid by these firms were much higher compared to the sum of the grant, thus indicating the positive net impact of grants on the state's fiscal position. Also Masso and Vildo [14] found that start-up grants had positive impact on job creation in second year after getting the grant, but for all viewed years concerning the sales growth. At the same time they concluded that start-up grants did not increase firm's survival chances.

3. Data and methodology

This paper employs unique data from Enterprise Estonia and Estonia Central Commerce Register. The firms are grouped according to the Estonian Classification of Economic Activities (EMTAK). The period covered is 2004 to 2010. In current study we exclude the firms which do not have EMTAK code or were from economic activities which did not receive the financial support (agriculture, forestry and fishing). We exclude big firms

with more than 3000 employees. The number of firms by year of receiving grant as follows 2004 – 45 firms, 2005 – 53, 2006 – 24, 2007 – 48, 2008 - 291 and 2009 – 75 firms. The number of firms that received any EAS grant is 536. The comparison group consists of 40275 enterprises and comes from Estonia Central Commerce Register.

In the paper are used two different methods. To analyze the impact of the financial support we applied the difference-in-differences (DID) estimator using a regression framework and a panel data framework.

DID has become more popular in the estimation the causal relationship. The idea behind DID is to compare the outcome in the case of one group of the firms that received the grant with the outcome in the case of another group that did not and then to compare their before-and-after levels [9], [12].

The impact is calculated using the difference between pre- and post- intervention mean outcomes for the treatment and comparison groups and then subtracting the two differences:

$$impact = \delta = \left(Y_{post}^{treat} - Y_{pre}^{treat}\right) - \left(Y_{post}^{compar} - Y_{pre}^{compar}\right) \tag{1}$$

The first difference controls for time-invariant factors. The second difference controls for time-varying factors that are the same in both treatment and comparison group. Thus, selection bias is eliminated due to differencing.

The regression of output can be summarized in the following simple regression:

$$Y_{i10} = \beta_0 + \alpha T_i + \sum_{k=1}^{m} \beta_k X_{ki} + u_i. \tag{2}$$

$Y_{i10} = Y_{i1} - Y_{i0}$, where Y_{i1} is firm i dependent variable in the evaluation year belongs to the comparison group and Y_{i0} is the same variable in the base year. The parameter T_i=1 if firm belongs to the treatment group, 0 if it is comparison group. The treatment group consists of firms that received grants during the study period and comparison group are other firms according to Estonia Central Commerce Register. X_{ki} stands for the other observable characteristics of firm i, u_i error term. As there is heteroscedasticity in all models analyzing the relationship between financial support and firm's outcome by economic activities we imply heteroscedasticity adjusted standard errors [11], [4].

The next method of the analysis is the panel data approach. This approach is used if the estimation effect has impact on the individuals in the different periods [12], [3]. The regression equation takes the form:

$$Y_{it} = \beta_0 + \gamma H_{it} + \beta_1 X_{1it} + u_{it} \tag{3}$$

where t denotes the time index and i the firm index. The parameter H_{it} has been defined as a dummy variable, where the variable takes 1 it the firm has obtained the grant before the evaluation year and 0 otherwise. X_{ki} stands for the other observable characteristics of firm i, u_{it} error term.

We use the fixed effects (FE) panel model in this paper. This choice is reasonable as our data consists of almost the all firms that received the grants. In that case we assume that the u_{it} may be correlated with some of the regressors in the model. Similarly, Hausman test shows that random effects model is redundant.

The model that provides the overall theoretical framework and estimating equation for this paper is derived from a Cobb-Douglas production function: $Q = AK^{\alpha}L^{\beta}$ where Q is output, K is capital and L is labor, which can be written in logarithmic intensive form as:

$$\ln(MT_{it}) = \beta_{0i} + \gamma H_{it} + \beta \ln L_{it} + u_{it} \tag{4}$$

Hereby t denotes the time index and i the firm index. The parameter MT_{it} stands for net sales as output, H_{it} represents the obtaining grant and L_{it} is the number of employees. Unfortunately, we have not obtained the data about capital so far, we could not apply firms' assets total into the model.

As the period 2004-2010 includes the both rapid economic growth and recession, we include to the model parabolic trend. We consider the fixed effects model by adding time effects to the model:

$$\ln(MT_{it}) = \beta_{0i} + \gamma H_{it} + \beta_1 \ln L_{it} + \beta_2 \cdot t + \beta_3 \cdot t^2 + u_{it} \tag{5}$$

Hereby the parameter t stands for time variable.

We used robust clustered standard errors to account for the possible within-group correlation. This is usual procedure for grouped data because the performance of firms within a country may be somehow correlated and it

is not possible to capture all of this correlation with available set of explanatory variables. Another reason for clustering arises from the inclusion of group level variables together with firm-level variables in the same regressions. The "cluster" adjusted standard error (as performed in programs such as Stata) is aimed at dealing with the within group correlation structure but does not impose homogeneity of the variances [15], [4].

4. Results and Discussion

Many types of subsidy have been used in Estonia to support enterprises. In this study, we concentrate on some of them that were received in EAS:

1. Start-up and development grants is to provide support for starting companies in investments related to starting and developing a business,
2. Research and Development (R&D) grant for creating the good products and services in cooperation with entrepreneurs and scientists,
3. Development of Knowledge and skills project grant is meant for projects aimed at developing entrepreneurship and increasing business knowledge and activity,
4. Technology investment grant for industrial enterprises,
5. Export grant is to promote the export activities.

Table 1 presents summary statistics of the received grants for the treatment group from Enterprise Estonia (EAS). It is evident that the number of firms that received development of knowledge and skills grants is greater among received firms. Also the sum of R&D grants is one of the biggest among other grants. It means that it is important measure of industrial policy to promote innovations and R&D activities.

Type of grant	count	mean	min	max	Std.dev	cv	sum
Development grant	24	11404	4470	12782	2428	0.213	273703
Start-up grant	93	3159	655	6391	910	0.288	293766
Export program	91	49372	1853	63912	20527	0.416	4492808
R&D grants	62	69664	3323	564117	124198	1.783	4319152
Development of knowledge and skills	246	5239	1598	65190	6959	1.328	1288873
Technology investment program for industrial enterprises	20	193987	30678	900510	221484	1.142	3879733
TOTAL	536	27142	655	900510	72528	2.672	1.45×10^7

Table1 Summary statistics for the firms that received grant, EUR

The presentation of our results is divided into two sections according to the method that is used for the analysis of impact of grant on firms' performance. Firstly, we used difference-in-difference approach (2). The results are presented in Table 2.

Variable	R&D grant		Development of knowledge and skills grant		Technology investment grant for industrial enterprises	
T	-5.98×10^5		1.45×10^6		1.53×10^6	
Significance of T	0.076		0.093		0.183	
Net sales 2008	-0.441 ***	-0.441***	-0.448 ***	-0.449 ***	-0.441 ***	-0.441***
Number of employees 2008	5.14×10^5 ***	3.29×10^4 ***	3.77×10^4 **	3.73×10^4 ***	3.29×10^4 ***	3.29×10^4 ***
R^2	0.475	0.569	0.519	0.519	0.569	0.569
Observations	24465		24615		24474	

Table 2 Difference-in-difference results. Dependent variable is net sales 2010, base year is 2008
*Note: ***, ** and * denote statistical significance at 1, 5 and 10% respectively. In all models constant and 16 dummy variables (by 17 economic activities) are included.*

An investigated outcome variable in this paper is net sales of firms. Explanatory variables are net sales and number of employees in the base year. Due the sample consists of the firms that received grants in the different years, we define evaluation and base year (2010 and 2008 respectively). We include to Table 2 only statistically significant results for R&D grant, development of knowledge and skills grant and technology investment grant for industrial enterprises. The indicator of received grant before evaluation period shows the negative impact on

net sales for R&D grant and positive for other grants. One can see that the impact of two grants, R&D grant and Development of knowledge and skills grant, is significant on 0.1 level.

During the period 2004-2010 firms received grants at different time and here are 16 different combinations of base year and evaluation year. DID method is applicable separately for each base year/evaluation year combination. Secondly, panel regression analysis used a cross-sectional database composed of 39484 firm observations. Table 3 shows the results according to received grants. We can see the positive impact of grant on the firms' performance almost in all models. It is significant at a 5% level for start-up grant, export grant, development of knowledge and skills grant and technology investment grant for industrial enterprises.

To sum up we can evaluate the impact of grant on Estonian firm performance indicator as follows:

1. Start-up grant increases net sales on average by 30%,
2. Export grant increases net sales on average by 11%,
3. Development of knowledge and skills grant increases net sales on average by 20%,
4. Technology investment grant for industrial enterprises increases net sales on average by 33%.

Variable	**Start-up grant**	**Development grant**	**Export grant**	**R&D grant**	**Development of knowledge and skills**	**Technology investment grant**
Impact of grant	0.301***	0.250	0.107***	0.106	0.204***	0.326***
Number of employees (logaritmic)	0.786***	0.786***	0.785***	0.785***	0.784***	0.785***
t	0.242***	0.242***	0.242***	0.242***	0.242***	0.242***
t^2	-0.034***	-0.034***	-0.034***	-0.034***	-0.034***	-0.034***
intercept	10.21***	10.21***	10.21***	10.21***	10.21***	10.21***
R^2 overall	0.524	0.524	0.529	0.525	0.531	0.525
Number of firms	39484	39417	39484	39451	39639	39413

Table 3 Panel regressions of different types of grants. Dependent variable is logarithmic net sales
*Note: ***, ** and * denote statistical significance at 1, 5 and 10% respectively.*

Variable	**Dummies for different grants**		**All grants with grant amount**	
	Coefficient	p-value	Coefficient	p-value
H	0.326	0.000	0.186	0.000
Development grant dummy	-0.076	0.649		
Start-up grant dummy	-0.025	0.810		
Export grant dummy	-0.220	0.002		
R&D grants dummy	-0.220	0.061		
Development of skills grant dummy	-0.123	0.063		
Grant amount			2.58×10^{-7}	0.216
Number of employees (logarithmic)	0.784	0.000	0.784	0.000
t	0.242	0.000	0.242	0.000
t^2	-0.034	0.000	-0.034	0.000
intercept	10.22	0.000	10.22	0.000
Sign. F-test (all grant dummies=0)	0.034			
R^2 overall	0.538		0.538	
Number of firms	39923			

Table 4 Panel regressions of all types of grants. Dependent variable is logarithmic net sales

Then we included into the model five dummies for six types of grants in the model (5). The results are showed in Table 4. The base type was the grant „Technology investment grant for industrial enterprises". The coefficient of the dummy variable H is now the same as in the model for "Technology investment grant" (Table 3). The coefficients of the other grants dummies are differential intercept coefficients and they tell us how much the impact of the other grants is different with respect to the base type. Using these differences we can calculate the values of the impact coefficients for all models in Table 4. To test whether categorization by grant types is relevant or not, we use the F-test on parameters restriction with null hypothesis that all grant dummies are jointly zero. P-value of the F-test was 0.034, so we can conclude that different grants have different impact to the net sales of firms.

Table 1 shows that various grants on average have different amounts and the observed differences may be due to this. To test the hypothesis we added into the model variable amounts of grants as are shown in Table 4. Since the contribution of the impact of grants on the net sale do not proceed in the same year, the impact of grants will be nonzero only in the evaluation year, if $H = 1$. It is seen that amounts of grants is not statistically significant (p-value 0.216). From the last table we can conclude that the impact of various grants is different on the net sales. The most impact can be seen for technology investment grant for industrial enterprises.

5. Conclusions

The paper contributes to the literature on evaluating the effectiveness of government grants given to enterprises in Estonia. Data of the firms are collected from Enterprise Estonia and Estonia Central Commerce Register from 2004 to 2010. The dependent variable is only the net sales in the paper. Econometric analyses show that these programs have positive impacts on firms' performance in case of the Estonian firms. Government grants have different aims and they are allocated in accordance with different criteria. Therefore, assessing the impact of grants on the effectiveness measures should be applied with different evaluation criteria.

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