WITH AND WITHOUT SUBSIDY
EVALUATION OF INNOVATION SUPPORT IN SLOVAKIA[1]

Valeria Szitasiova[2], Maria Siranova[3], Miroslav Sipikal[4]

University of Economics in Bratislava

ABSTRACT

Innovations are considered one of the key drivers of economies, therefore the evaluation of their support is frequently discussed also within the European Union. Even though innovations are supported through various channels, European Union structural funds represent a significant proportion of this aid in Slovakia. The empirical literature provides list of important factors affecting the impact of institutional support. The aim of this article is therefore to evaluate success of innovation support by impact evaluation of subsidized and not subsidized firms in Slovakia with use of unique detailed micro dataset. Impact of particular measures of innovation support of the Competitiveness and Economic Growth Operational Programme is analyzed by fixed and random effect model. Taking into account regional and sectoral specificities of supported and not supported entities various selected characteristics of firms, such as size, sales, capital and labor stock are tested in the Cobb-Douglas production function framework. Our results suggest that the support of innovation within the 2008-2014 program period phase had a positive and significant impact on firm's labor productivity Results from this analysis might offer valuable input for policy makers in order to effectively set framework for support of innovation in the starting phase of the programming period 2014 – 2020 within the European Union.

KEYWORDS: evaluation, innovation, support, European Union Structural funds

JEL: H25, R58, O30

---

[1] This article was supported by the Slovak Research and Development Agency under contract no. APVV- 14-0512 and also by VEGA under the contract No. V-13-005-00.

[2]University of Economics in Bratislava, Department of Public Administration and Regional Development, Dolnozemska cesta 1, 852 35 Bratislava, Slovakia

[3] University of Economics in Bratislava, Department of Banking and International Finance, Dolnozemska cesta 1, 852 35 Bratislava, Slovakia

[4] University of Economics in Bratislava, Department of Public Administration and Regional Development, Dolnozemska cesta 1, 852 35 Bratislava, Slovakia

INTRODUCTION

Evaluation of public spending as well as the funds of the European Union is extremely important in current time, when finishing the previous and starting the new programming period 2014-2020. According to proper assessment of outputs, results and impacts of support in the past should be the lessons learned. This is essential in order to increase the efficiency, effectiveness and relevance of the huge amount of support that is distributed through the regional policy of the European Union. This is also the case of innovation support. Innovations are one of key factors influencing the economic growth and lots of different measures are taken in order to support the innovation potential of regions and countries. However, most of this studies are done for European research area countries (Lenihan, 2004; Hewitt-Dundas and Roper, 2010; Bondonio and Greenbaum, 2014). A few studies deal with transition within these countries as e.g. Czarnitzki and Licht, 2006. The relevant studies for effectiveness of innovation in CEE countries are missing.

The key objective of this paper is to analyze effectiveness of the innovation support within the EU programme period 2008-2014 in the condition of Slovakia. Slovakia is only moderate innovation performer, so it is important to see if also in such country the innovation support will work effectively. With the unique set of micro data on individual firm level, this is the paper is the first one to do so using the standard panel data estimation procedures operating within the concept of the Cobb-Douglas production function. The structure of the paper reflects this setting in the following way. In the first chapter we provide brief overview of literature dealing with the institutional framework of EU regional policy aimed at supporting innovative processes in member states. Second chapter introduces methodological procedures employed to estimate effects of innovation policy in the Cobb-Douglas production function applied on panel data. Third chapter delivers empirical description of institutional setting of the EU innovation policy in the 2008-2014 period and presents estimation outcomes. Final chapter concludes.

1. LITERATURE REVIEW

Overall importance of regional policy grows by the increasing weight of support funds for the budgets of member states. This is especially true for lagging countries, where the majority of public resources consist of support from the European Union. The growing number of member states is also increasing the variety of regions which have different development potential as well as various socio-economic problems and specificities.

One of the most debated topics within the European Union is innovation promotion, which is placed in recent years much emphasis. Innovation is considered a key factor of development, therefore the policy of innovation and the promotion of innovation belong to the main agendas of the transnational grouping through so-called smart specialization strategy (Foray, 2014). This is evidenced by facts as the inclusion to ex-ante conditionality or the creation of new generation of innovation policy- the strategies of RIS3 (Regional research and innovation strategies for smart specialization).

This concern is also reflected in the form of financial support for innovation activity of regions. Investing huge amounts of resources requires also proper assessment of results. In this context, particular attention is paid to the efficiency of spending (Lenihan, 2004) but also to evaluate the effectiveness of measures (Bondonio and Greenbaum, 2014). No matter whether were in fact achieved the intended results and that support measures had real positive impact on target groups (Cerqua and Pellegrini, 2014). Effectiveness of measures to support innovation activities of regions can be studied through analysis of supported companies. The effect of support may also be influenced by characteristics of investigated groups of firms, such as the size of the company, number of employees, type of ownership but also type of support measure (Bondonio and Greenbaum, 2014) or sectoral and regional distribution of aid (Reinkowski et al., 2010, Tokila and Haapanen, 2012).

1.1. Institutional Setting

In the paper we analyze effectiveness of EU funding through specific channel of innovation policy support - "Innovation and Technology Transfers" measure. The main aims of the measure is to enhance the competitiveness and innovation potential of supported enterprises, promote sustainable development and the development of ecological production. The support is designed for small and medium-sized enterprises as well as large companies up to 1000 employees.

The guide for applicants contains a list of economic sectors which are not eligible for assistance, including fishing, shipbuilding, coal and steel industry, synthetic fibers production and selected activities in agriculture and manufacturing replacing dairy products.

The application should contain in addition to basic identification data also other characteristics as number of employees, turnover, total value of annual assets during the last financial year preceding the application. It should also be noted the structure of revenues, share of the largest purchaser on total production and others. However, the beneficiaries may not include enterprises in difficulty and restructuring.

Regions eligible are Convergence areas in Slovakia, which means that aid can be implemented in NUTS 2 regions of Western Slovakia, Central Slovakia and Eastern Slovakia. It means that the implementation of a project cannot take place in Bratislava region, however firms located in Bratislava but operation in other regions might be considered for inclusion. The maximum duration of projects in Slovakia is set at 24 months, the intensity of the aid, however, is different for different regions, ranging between 0 - 50 %.

Regarding the evaluation and monitoring of results, measurable indicators are to be pursued during and after the project implementation that belong to groups: i) results indicators (growth in sales), and ii) impact indicators (number of new jobs created and an increase in value added). The evaluation process of all applications consists of two phases, particularly the formal and technical evaluation. In the first step, the officials evaluate fulfillment of formal requirements. Successful applications are advanced to the second phase carried out by an expert committee. This committee analyses the application for aid according to the so-called evaluation criteria (basic criteria, suitability and effectiveness, method of implementation, budget and efficiency, administrative, professional and technical capacity and sustainability of the project).

2. METHODOLOGY

In this paper we collect data on the measure 'Operational Programme Competitiveness and Economic Growth', 1.1. Innovation and Technology Transfers, sub-measure 1.1.1 Support for Introducing Innovation and Technology Transfer. This measure encapsulates state aid scheme to support the introduction of innovative and advanced technologies in industry and services. Within this sub-measure we analyzed six calls for grant applications for businesses in Slovakia. These calls (KaHR-111SP-0801, KaHR-111SP-0902, KaHR-111SP-1001, KaHR-111SP/LSKxP-1101, KaHR-111SP-1101, KaHR-111SP) were announced on yearly basis within the 2008-2012 period.

2.1. Model specification

As traditional in this type of literature (Cin, et al., 2014; Duch et al., 2007; Peeters and van Pottelsberghe de la Potterie, 2005), we use the standard Cobb-Douglas production function to estimate effect of EU subsidy on firm's performance. The production function in its general form is given by the following:

$$Q_{it} = exp^{\gamma_1 D} A_{it} K_{it}^{\beta_1} L_{it}^{\beta_2} \quad [1]$$

where Q_{it} represents the total production of a firm i at time t, A the total factor productivity, K_{it} level of capital stock of a firm i at time t, L_{it} labor input of a firm i at time t, β_1 total production elasticity of capital and β_2 total production elasticity of labor.

The total factor productivity can be further decomposed to factors that affect the efficiency of utilization of inputs in productions in the following way (Cin et al., 2014):

$$A_{it} = C(R\&D)_{it}^{\beta_3}(Edu)_{it}^{\beta_4}(Age)_{it}^{\beta_5}X_{it}^{\beta_6} \quad [2]$$

where C is a constant term, $R\&D$ are research and development stock, Edu accumulated education and job training expenses for employees, Age firm age, X other factors that can affect utilization of inputs in production and β_3, β_4, β_5 and β_6 represent respective elasticities.

By the nature of the EU regional innovation policy, the subsidy provided to the company is expected to affect the firm's production in two ways. Firstly, the innovation subsidies are expected to increase research and development expenditures thus affecting the total factor productivity. Therefore, the effect of the subsidy in the first case might be modeled in the following way:

$$A = C(R\&D)_{it}^{\beta_3+\gamma_1 D_{it}}(Edu)_{it}^{\beta_4}(Age)_{it}^{\beta_5}X_{it}^{\beta_6} \quad [3]$$

where γ_1 represents the effect of the subsidy on total factor productivity and D is a zero-one indicator for subsidy to a firm i at time t.

Combining equation [2] and [3], dividing both sides by labor stock L_{it}, assuming constant returns to scale ($\beta_1 + \beta_2 = 1$) and taking logarithms we get the following labor productivity model:

$$\log(Q_{it}/L_{it}) = \log(C) + (\beta_3 + \gamma_1 D_{it})\log(R\&D_{it}) + \beta_4\log(Edu_{it}) + \beta_5\log(Age_{it}) + \beta_1\log(K_{it}/L_{it}) + \beta_6 X_{it} \quad [4]$$

Secondly, EU funding might be expected to affect responsiveness of labor productivity to an increase of capital stock of a company while investing into purchase of new machinery or other intangible assets. This effect might be modeled in the following way:

$$Q_{it} = A_{it}K_{it}^{\beta_1+\gamma_2 D_{it}}L_{it}^{\beta_2} \quad [5]$$

Combining [2] and [5], dividing both sides by labor stock L_{it}, assuming constant returns to scale ($\beta_1 + \beta_2 = 1$) and taking logarithms we get the following labor productivity model:

$$\log(Q_{it}/L_{it}) = \log(C) + \beta_3\log(R\&D_{it}) + \beta_4\log(Edu_{it}) + \beta_5\log(Age_{it}) + \beta_1\log(K_{it}/L_{it}) + \gamma_2 D_{it}\log(K_{it}) + \beta_6 X_{it} \quad [6]$$

Based on the previous reasoning and with respect to the data availability for the Slovak firms we estimate the effect of EU subsidy by two models; once assuming that the subsidy affects total factor productivity of a firm and once accounting for the effect of a subsidy on elasticity of a labor productivity to total capital stock. Due to the perfect collinearity of effect on total factor productivity and effect on capital stock we estimate both models separately. Additionally, we assume that the effect of a subsidy granted in year t affects firm productivity with a lag of one year due to the administrative requirements related to the implementation of a project.

Based on the previous reasoning, the first empirical model subject to our estimation is expressed in the following way:

$$\log(Q_{it}/L_{it}) = \log(A) + \gamma_1 D_{it-1} + \beta_1 \log(K_{it}/L_{it}) + \beta_j X_{it}^j + \mu_i + \beta^t \tau_t + \varepsilon_{it} \quad [7]$$

where D_{it-1} denotes zero-one dummy having values of one for a firm i being treated by subsidy in year $t-1$, X_{it}^j is a set of other explanatory variables taken from the relevant literature, μ_i time-invariant firm-specific characteristics, τ_t time dummy for a year τ, and ε_{it} time varying error distributed independently across firms and independently across of all μ_i.

The second empirical model to estimate is specified in the following way:

$$\log(Q_{it}/L_{it}) = \log(A) + \gamma_1 \log(K_{it})\, D_{it-1} + \beta_1 \log(K_{it}/L_{it}) + \beta_j X_{it}^j + \mu_i + \beta^t \tau_t + \varepsilon_{it} \quad [8]$$

where D_{it-1} denotes zero-one dummy having values of one for a firm i being treated by subsidy in year $t-1$, K_{it} level of capital stock for a firm i at time t, X_{it}^j is a set of other explanatory variables taken from the relevant literature, μ_i time-invariant firm-specific characteristics, τ_t time dummy for a year τ, and ε_{it} time varying error distributed independently across firms and independently across of all μ_i.

Estimation of the models [7] and [8] as a special case of the error component models requires a special approach. The best form of evaluation of public programs is "true experiment" that is based on random assignment. In reality, the decision about providing the EU support is based on a selective procedure that makes the random assumption difficult to meet. In order to minimize this problem the usual solution is to build a control group that shares most of the characteristics with the group of treated firms. This approach is linked to the setting of the panel data estimators in the following way.

When μ_i is a random component with a distribution independent of the observed right-hand side variables, then the conventional generalized least squares produces consistent and efficient estimator. However, if the firm specific effect is correlated with ε_{it} due to the existing link between D_{it-1} and μ_i, then the OLS estimator of the policy parameter γ_1 could produce a simultaneity bias. Since our dataset includes only firms that applied for the subsidy, thus manifesting the so-far unobserved innate abilities to some extent, we assume that the simultaneity bias is to be substantially reduced.

The set of other exogenous explanatory variables included into the X^j vector includes both firm, sector and regional characteristics. This set of control variables are taken from the relevant literature () and are adjusted with respect to data availability in Slovakia. In order to control for the size of a firm we use log of the number of employees emp, and investment intensity inv_int. In order to approximate investments into human capital we use data on average employee costs per one employer emp_cost. The dominant position of a firm within the sector is approximated by ratio of firm sales to total sales of a sector dom. The sector characteristics include log of total sales per sector sal_sec defined by the first number of the NACE 2 revised specification. Regional differences are captured by the variables measuring level of unemployment un, population lining in the nearby area pop, and economic development of a region measured by GDP per capita $gdppc$. Models are estimated by standard fixed effect model procedure with robust standard errors clustered on a firm level.

2.2. Data description

The panel data to estimate the model are taken from various sources. The list of indicators included into the regression specification is derived from various sources (Cin et al., 2014; Duch et al., 2007; Czarnitzki and Kraft, 2006; Sissoko, 2011; Peeters et al., 2005; Cappelen et al., 2013 and others). The financial variables for firms are taken from the Orbis database collected by Bureau van Dijk. Data for regional and sectoral characteristics on NACE1 level are taken from the Statistical office of Slovak republic. We do not include firms that operate in the Agriculture, Hunting and Forestry sector due to the missing data. Unemployment rate is allocated to the LAU1, population to the LAU2 level and GDP p.c. to the NUTS3 level. Specification of all the variables is available in the Table I.

Table 1 Data Sample Characteristics

Specification	Description	Source	Coverage
Treatment	Dummy variable, 1=treated	Ministry of Economy of the Slovak republic, Slovak Innovation and Energy Agency	2005-2013
Q	Total sales in th EUR	Orbis database	2005-2013
K	Amount of fixed assets, th EUR	Orbis database	2005-2013
L	Number of employees	Orbis database	2005-2013

K*	Amount of fixed tangible and intangible assets, th EUR	Orbis database	2005-2013
Cost	Employee costs, th EUR	Orbis database	2005-2013
Sector dominance	Ratio of firm's sales to total sales in sector of its activity at level 1 by NACE2 rev. classification	Statistical Office of the Slovak republic	2008-2013
Total sales in sector	Total sales of the sector at level 1 by NACE2 rev. classification, th EUR	Statistical Office of the Slovak republic	2008-2013
Unemployment	Unemployment rate at LAU1 level, %	Statistical Office of the Slovak republic	2005-2013
Population	Number of citizens at LAU2 level, %	Statistical Office of the Slovak republic	2005-2013
GDP p.c.	GDP p.c. in current prices at NUTS3 level, th EUR	Statistical Office of the Slovak republic	2005-2013

2.3. Descriptive Statistics of EU Innovation Support in Slovakia

In the next session are presented basic statistics of set of firms that applied for this type of innovation support. To compare sectoral and regional distribution of this subsidy we use basic descriptive statistics. According to the available statistics we analyze the amount of support with respect to the number of approved projects, number of assisted firms, and amount of aid in terms of selected firm characteristics as well as territorial and sectoral distribution of support. The application process was also analyzed by comparing statistics of applied firms – both supported and not supported. As a reference year for these statistics the year 2008 is selected due to data availability and for the reasons of treatment effect interpretation. As the implementation of the projects is expected to take place next year after the subsidy was granted data for your 2008 should remain unaffected by the EU policy treatment.

Total number of investigated firms which applied for funds within this framework is 1025 including both supported and as not supported companies.[5] 91 companies were excluded due to the non-availability of key data. The majority of the firms are private limited companies with second place belonging to public limited companies. Regarding the regional distribution, the most of applications were registered in the NUTS2 Middle Slovakia region that represents more than the third of total number. On the second place are applications from the NUTS 2 East Slovakia region which represents another third of all applications. Both Middle and East Slovakia are considered the least developed regions; the regional distribution thus might confirm dedication of the government to utilize this project to eliminate differences among poorer and richer regions. Majority of applications was also registered in these territories.

From the total number of 1361 applications, 400 were supported being managed by 352 firms in all regions of the country. The average amount of aid per firm surpassed EUR 1 mil., the lowest amount of

[5] From the total number of 1025 companies there are limited information available for 91 firms.

support per firm was allocated on the west of the country (51th EUR In district of Sabinov). The highest amount was allocated to the firm located on the east of the country (EUR 9,6 mil. in district of Prievidza). Regarding the regional distribution of firms support, almost equal number of firms was supported in the 3 convergence regions of Slovakia - in Middle Slovakia 114, in East Slovakia 111 and in West Slovakia 113. Only 14 firms were supported in the capital city (14) district that is the most developed among all NUTS 2 regions. However, as already explained the projects managed by those companies were required to be target regions located outside of Bratislava. Regarding the NUTS 3 level, four regions submitted most successful applications; regions located in the east (Presov region - 67 and Kosice region - 44) and in the middle of (Zilina region – 64 and Banska Bystrica - 50). The lowest amount of support was allocated into the most developed NUTS 3 regions in the west.

Table 2 Distribution of Financial Aid among Six Calls within the 1.1.1. Priority Measure

Measure of Innovation and Technology Transfer	Total applications	Supported applications	% of Success	Amount of Support (Eur)
Applications for call in 2008	300	25	8,33	34 830 990,89
Applications for call in 2009	158	66	41,77	81 705 947,68
Applications for call in 2010	152	35	23,03	25 021 753,59
Applications for call in 2011(1)	331	55	16,62	35 879 251,33
Applications for call in 2011(2)	107	43	40,19	23 517 592,22
Applications for call in 2012	313	176	56,23	164 527 468,00
Total	**1361**	**400**	**29,39**	**365 483 003,69**

Source: Author´s calculation.

As usual in all grant applications, in the last call of the programming period was observed the highest rate of success (56.23). This last call offered the highest amount of support, while the highest amount of money per year was allocated in year 2011 when two calls were announced. It means in total 176 supported firms that represent one half of all companies supported within the 1.1.1 measure. The average percentage of success was 29.39 for all of the investigated period (Table 2).

In the following section will be only the supported 352 firms characterized from different perspectives. According to the number of employees were the firms divided into 8 size categories. An important group of the firms represent those with number of employees between 20 and 50. But into this group was only the second highest support implemented.

Table 3 Innovation Support by Size Category

Size Category	Number of firms	%	Amount of Support (Eur)	%
1 (0_9)	73	20,74	88 715 545,22	24,27
2 (10_19)	51	14,49	44 070 347,66	12,06
3 (20_49)	85	24,15	59 790 066,69	16,36
4 (50_99)	57	16,19	55 961 418,80	15,31
5 (100_149)	30	8,52	29276666,9	8,01
6 (150_199)	22	6,25	35 942 209,41	9,83
7 (200_499)	32	9,09	41 473 286,36	11,35
8 (500_999)	2	0,57	10 253 462,65	2,81
Total	352		365 483 003,69	

Source: Author´s calculation.

The second largest is the group of small firms with maximally 9 employees, where almost 90 mil Euros were allocated.. The third is the group of firms with 50 -99 employees with a total amount of support Eur 56 mil. After the size categories were the firms divided into four groups based on their development level that was in this cased measured by the level of unemployment.

Table 4 Innovation Support by Unemployment Level

Unemployment rate category	Number of firms	%	Amount of Support (EUR)	%
1(0-5%)	12	3,41	16 340 963,45	4,47
2(5-10%)	115	32,67	115 464 885,21	31,59
3(10-20%)	162	46,02	152 753 088,46	41,79
4(over 20%)	63	17,90	80 924 066,57	22,14
Total	**352**		**365 483 003,69**	

Source: Author´s calculation.

Largest group represent firms with unemployment of 10-20%, while into this group was also the half of the funds allocated. Into the group of 115 firms with an unemployment level of 5-10 % were 115,5 mil Euros invested.

3. EMPIRICAL ESTIMATION OUTCOMES

In order to examine the effect of EU subsidy on firm performance we estimate static labor productivity model by several methods. We estimate model with standard panel estimation methods such as fixed effects (FE) and random effect (RE) estimation methods. The empirical results can be summarized as follows.

Model I captures the possible effect of subsidy on improvement in total factor productivity. In all variations of the baseline model the coefficient measuring lagged treatment effect is statistically significant on 5 percent confidence interval, on average. This implies that the effect of EU subsidy let to improvement in utilization of capital and labor next year after the year when the subsidy had been granted. Since we do not have data that would allow for a more disaggregate analysis we cannot specify the channel through which the change occurs but can only conclude that the funding has been used to improve labor productivity via research and development expenditures, increasing the labor expertise or introducing new innovative procedures into the production process.

Table 5 Effects of EU Subsidy on Labor Productivity: FE and RE Estimates

	Model I			Model II		
Specification	FE	FE	RE	FE	FE	RE
Constant	9.402	4.880		7.875	4.938	
	(0.371)	(0.500)		(0.455)	(0.494)	
L1.treatment	0.045**	0.059***	0.044**			
	(0.025)	(0.005)	(0.026)			
% increase in A	[4.60%]	[6.10%]	[4.50%]			
*L1.treatment*log(K)*				0.006***	0.008***	0.006**
				(0.009)	(0.002)	(0.010)
Size = ln(L)	-0.399***	-0.328***	-0.292***	-0.392***	0.329***	-0.286***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital intensity = ln (K/L)	0.089***			0.098***		
	(0.002)			(0.002)		
Capital intensity = ln (K/L)*		0.091***	0.107***		0.090***	0.116***
		(0.001)	(0.000)		(0.001)	(0.000)
Employee costs = ln(Cost/L)	-0.493***	-0.563***	-0.564***	-0.498***	-0.571***	-0.568***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L1.Sector dominance	75.86***		92.49***	75.20***		91.68***
	(0.001)		(0.001)	(0.001)		(0.001)
L1.Total sales in sector	-0.157		0.103***	-0.172		0.104***
	(0.436)		(0.002)	(0.461)		(0.002)
L1.Unemployment	0.002	-0.004	-0.002	0.001	-0.000	-0.002
	(0.746)	(0.623)	(0.788)	(0.932)	0.963	(0.754)
L1.Population	-0.354	-0.141	-0.009	-0.313	-0.452	-0.010
	(0.497)	(0.782)	(0.719)	(0.550)	0.353	(0.686)
L1.GDP p.c.	0.052	0.029	-0.072	0.136	0.084	-0.075
	(0.898)	(0.918)	(0.583)	(0.736)	0.753	(0.562)
Time dummies	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
R_2	**0.245**	**0.389**	**0.425**	**0.259**	**0.391**	**0.433**
F	**201.68**	**166.58**	**xx**	**199.37**	**168.85**	**xx**
Number of observations	**3125**	**4764**	**3125**	**3125**	**4761**	**3103**
Number of groups (firms)	**726**	**745**	**726**	**726**	**745**	**724**
Number of years	**6**	**8**	**6**	**6**	**8**	**6**

Note: * denotes significance at 10 percent level, ** denotes significance at 5 % level, *** denotes significance at 1 % level. P-values in parenthesis. RE stands for random effect model and FE for fixed effects model. Treatment represents zero-one dummy variable for EU subsidy. K denotes stock of fixed assets, K* stands for stock of fixed tangible and intangible assets.

Source: authors´ calculation

Model II deals with possible effect of EU subsidy of capital elasticity of labor production. In a group of treated firms an increase in capital stock is more efficient that in the non-treated group of firms; a result that might be attributed to more efficient usage of capital in the production process. Robustness check by random effect model delivers practically the same outcomes.

The labor productivity is positively associated with the capital intensity and negatively associated with a size of a firm approximated by the number of employees. In Slovak environment the relatively bigger firms face disadvantages in increasing their productivity through increase in their size. Contrary, smaller firms are expected to achieve higher productivity due to other unobserved factor, such as more efficient management practices, higher flexibility or more skilled workers, on average. Additionally, positive increase in capital-labor ratio due to the building up of both tangible and intangible assets should lead to higher performance.

Regional characteristics are not significant, in general, in all cases. However the results might be biased do the missing data on lower than NUTS3 or LAU1 level in case of GDP p.c. or unemployment rate variable, respectively. On the other hand, sectoral characteristics seem to play a more important role. Sector dominance of a firm is associated with higher productivity in all specifications.[6] In the RE specification the effect of size a sector in national economy turns out to be positive and significant in both cases. If we assume that individual firm effect is randomly assigned to firms in our data sample then companies operating in the relatively bigger sectors achieve higher labor productivity. However, in the fixed effect model this feature is already incorporated in the individual fixed effect of a firm distinguishing it from its peers with relatively similar characteristics.

Extension of the dataset to cover more years before the treatment took place starting in 2008 is used as part of the robustness check. As presented in the Table 6, the estimated coefficients keep their statistical significance in all cases with even magnifying results for some of the model specification.

[6] One might suspect that inclusion of the sector dominance to models might lead to a bias due to the bi-directional relationship between productivity and sector dominance. In other words, higher productivity is expected to improve sector dominance. Yet, estimation outcomes are robust to inclusion of the sector dominance as the estimated coefficients in regressions remain significant and relatively stable.

CONCLUSION

Innovations are considered one of the key drivers of economies, therefore the evaluation of their support is frequently discussed also within the European Union. This article evaluates effectiveness of EU regional innovation policy within the operation measure 'Operational Programme Competitiveness and Economic Growth' in conditions of Slovak economy. By using unique set of microdata on firm level for program period 2008-2014 we test the effectiveness this measure with panel data fixed and random effect estimators within the Cobb-Douglas production function. Taking into account regional and sectoral specificities of supported and not supported entities we find evidence that EU innovation subsidy had a positive and significant impact on firm's labor productivity through increase of total factor productivity and improvement in firm's elasticity of labor productivity with respect to stock of capital. However, this effect looks only short term. This is different from previous studies from more "innovation oriented" countries. It suggest that such policy could work only is there is certain level of innovation capacities in the country of region. Further research should look more closely on different results at lower than national level to see if there are bigger differences within regions or sectors with different level of innovation capacities. This could be also more developed in presented model, with adding more regional and sectoral characteristics.

Results from this analysis might offer valuable input for policy makers in order to effectively set framework for support of innovation in the starting phase of the programming period 2014 – 2020 within the European Union. Firstly, it looks like the technology transfer as policy tool for innovation support could have only short term impact. For more robust evidence for policy, the effectiveness of other schemes needs to be evaluated (as e.g. scheme for common university – industry projects). However, this results show that companies are not able to used support for establishment of such innovation structures that could be competitive in the longer term. One of the reasons maybe also absence of human capital support together with this technology transfer scheme. Now, companies are supported only to buy technology, but not to train human workforce for it. This could lead to not full exploitation of possibilities that new technology offer.

Another interesting result for policy implementation is relatively high level of threshold where the support is still effective. This also need more investigations, but suggests that is better to concentrate support on bigger projects with higher long term impact. Rising the support level will also help to reduce administrative burden of dealing and evaluating lot of projects.

REFERENCES

Bartle, D., and Morris, M. (2010). Evaluating the impacts of government business assistance programmes: approaches to testing additionality. Research Evaluation, 19(4), pp. 275-280.

Bondonio, D. and Greenbaum, R. (2014) Revitalizing Regional Economies Through Enterprise Support Policies: An Impact Evaluation of Multiple Instruments in European Urban and Regional Studies, 2(1), pp. 79-103.

Cappelen, A., Raknerud, A. and Rybalka, M. (2013). Returns to public R&D grants and subsidies. Discussion Paper No. 740, Statistics Norway Research Department.

Cerqua, A., and Pellegrini, G. (2014). Do subsidies to private capital boost firms' growth? A multiple regression discontinuity design approach. Journal of Public Economics, 109, pp. 114-126.

Cin, B. C., Kim, Y. J. and Vonortas, N. S. (2014). The impact of Government R&D Subsidy on Firm Performance: Evidence from Korean SMEs. OECD Conference "Entrepreneurship, Innovation and Enterprise Dynamics", December 8-9, 2014. Available at: http://www.oecd.org/sti/inno/5_3_Cin-Kim-Vonortas_Final.pdf

Czarnitzki, D. - Licht, G. (2006). Additionality of public R&D grants in a transition economy - The case of Eastern Germany, Economics of Transition, Volume 14 (1) 2006, p. 101–131.

Czarnitzki, D. and Kraft, K. (2006). R&D and Firm Performance in a Transition Economy. Kyklos 59(4), 481-496.

Duch, N., Montolio, D. and Mediavilla, M. (2007). Evaluation of public subsidies oriented to firms' performance: a quasi-experimental approach. Document de Treball 2007/3, Institut d'Economia de Barcelona.

Foray, D. (2014). Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy (Vol. 79). Routledge.

Hewitt-Dundas, N. - ROPER, S. (2010). Output Additionality of Public Support for Innovation: Evidence for Irish Manufacturing Plants, European Planning Studies Vol. 18, No. 1, January 2010.

Lenihan, H. (2004). Evaluating Irish industrial policy in terms of deadweight and displacement: a quantitative methodological approach. Applied economics, 36(3), pp. 229-252.

Peeters, C., and van Pottelsberghe de la Potterie, B. (2005). Innovation Capabilities and Firm Labor Productivity. In Druid Tenth Anniversary Summer Conference, Copenhagen: Denmark, pp. 1-17.

Reinkowski, J., Alecke, B., Mitze, T., and Untiedt, G. (2010). Do Public Subsidies Add to Private Sector R&D Activity? Microeconometric Evidence for Regional Innovation Policy in East Germany. Working Paper. Gesellschaft für Finanz-und Regionalanalysen (GEFRA) Münster.

Rodriquez-Pose A. and Fratesi U. (2004) Between development and social policies: the impact of European Structural Funds in Objective 1 regions, Reg. Studies 38, 97–113.

Sissoko, A. (2011). R&D subsidies and firm-level productivity: Evidence from France. IRES Institute de Recherches Eqonomiques et Sociales Working Paper, Universite Catholique de Louvain.

Tokila, A., and Haapanen, M. (2012). Evaluation of deadweight spending in regional enterprise financing. Regional Studies, 46(2), 185-201.

CONTACT TO THE AUTHORS

Ing. Valéria Szitásiová, PhD.
Department of Public Administration and Regional Development
Faculty of National Economy
University of Economics in Bratislava
Dolnozemská cesta 1
852 35 Bratislava
SLOVAKIA
Phone : + 421 2 672 91 350
E - mail : valeria.szitasiova@euba.sk

Mária, Širaňová, PhD. Ing. MA.
Department of Banking and International Finance
Faculty of National Economy
University of Economics in Bratislava
Dolnozemská cesta 1, 852 35 Bratislava,
SLOVAKIA
Phone : 00421-2-6729-1371
E - mail : maria.siranova@euba.sk

doc. Mgr. Miroslav Šipikal, PhD.
Department of Public Administration and Regional Development
Faculty of National Economy
University of Economics in Bratislava
Dolnozemská cesta 1
852 35 Bratislava
SLOVAKIA
Phone : + 421 2 672 91 350
E - mail : miroslav.sipikal@euba.sk