Efficiency Analysis of Subsidies for Investments Using Stochastic Frontier Analysis: Case of Serbia

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Abstract

Historically, a great number of countries worldwide used subsidies in order to promote or protect specific economic sector. With the process of globalization, Governments also began utilizing subsidies with the intent of attracting foreign direct investments. This practice has remained until today, when many countries, including Serbia, still use subsidies and other instruments (e.g. tax incentives) in order to encourage both foreign and domestic investments, increase employment and accelerate regional and technological development. Challenges and questions about optimal institutional design, minimal criteria that investors have to fulfill, optimal level of subsidies remain the same.

Bearing in mind the increase in expenditures on this type of subsidy in Serbia, there is a need to assess the efficiency of this policy. In this paper, it is done using stochastic frontier analysis (SFA). To the extent of the authors' knowledge, this is the first paper in which stochastic frontier analysis is implemented in an attempt to capture inefficiencies of subsidizing policy. The results show that there were potential budget savings that could have been achieved. In other words, there were some investment projects that were overpaid by the Government of Serbia. In addition, we believe that framework established in this paper could be used as a guide for future policy practice. In the end, suggestions are given for further research which would give broader and more precise results.

Keywords: subsidies, state aid, FDI, efficiency analysis, stochastic frontier analysis
JEL Nr.: F21, F23, H25, C21, C51

1. Introduction - topic relevance from international and domestic perspective

In the past, great number of countries worldwide utilized subsidies in order to promote or protect specific economic sector. With the process of globalization, Governments also began using subsidies as a mean of attracting foreign direct investments. This practice has remained until today, when many countries, including Serbia, still use subsidies and other instruments (e.g. tax incentives) in order to encourage both foreign and domestic investments, increase employment and

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accelerate regional and technological development. However, through the process of harmonization of national legislations[1], countries worldwide face with many challenges and questions - what is optimal institutional design for conducting subsidizing policy, what should be minimal criteria that investors have to fulfill, is there optimal level of subsidies, and the most fundamentally, should governments provide subsidies for investors. Therefore, it is not difficult to conclude that this research topic is relevant from international perspective.

The reason why this topic is significant from domestic perspective is an increasing nature of expenditures on subsidies in Serbia in recent years. Therefore, a need to assess the efficiency of this policy in Serbia arises. In other words, there is a need to determine whether some investment projects were overpaid by the Government of Serbia, and what is more important, to identified the best policy practice, which would lead to increase in efficiency in implementation of this type of policy in Serbia and potentially worldwide.

In the next two subsections we will briefly explain international policy practice in selected Central and Eastern European countries[2] and the importance of analyzing the efficiency of subsidizing policy in Serbia.

1.1. International perspective – overview of selected CEE countries' policies

In the past few decades, the competition between countries has being intensified in terms of attracting foreign direct investments (FDI), due to the development of new technologies and the reduction of transportation costs that enabled the breakdown of the production process to a large number of parts and their organization and operationalization in different parts of the world (Harding and Javorcik, 2007). This is one of the reason why a very large number of countries have founded agencies for investment promotion. With the intention to encourage FDI, agencies offer various types of incentives and support. Direct subsidies are, in most cases, the most important type of incentives for attracting investors. There are usually two types of programs – one focused on employment and another one focused on investments. The amount of subsidy depends on various criteria established by each country or supranational body. In addition, a substantial number of countries offer various types of tax exemption, primarily from corporate income tax and personal income tax.

Numerous Central and Eastern European (CEE) countries use a variety of instruments to encourage direct investment, and incentives for investments and employment differ between countries (Table 1). In most countries, the maximum amount of incentives is set at 50% of the value of the eligible costs, which are the basis for calculating the amount of subsidies or other form of state aid[3]. The eligible

[1] Since most of countries in the world are or want to be part of World Trade Organization or some other international union (e.g. European Union, NAFTA, ASEAN, etc.)

[2] We chose these countries since they are, according to the economic, political and geographically factors, comparable with Serbia.

[3] According to the Law of state aid control (2009), state aid is defined as any actual or potential public expenditure or reduction of public revenues, whereby the beneficiary of state aid acquires favorable market position relative to its competitors, thus distorting market competition (or there is potential risk of distortion). State aid may be in the form of subsidies, loans under favorable conditions, state

costs can be the amount of investment or the amount of two year gross earnings. The amount of state aid depends on the development level of the region, and in line with that some countries do not offer any kind of incentive for the most developed regions or capital cities. Also, the amount of subsidy changes based on the industry to be invested in, and often on the number of employees. Thus, some countries offer additional incentives if the number of new employees exceeds a certain criterion.

TABLE 1. INCENTIVES AND CRITERIA FOR INVESTMENT IN SELECTED CEE COUNTRIES

Type of Incentive, criteria and financial benefits	Bulgaria	Czech Republic	Hungary	Poland	Slovakia	Romania	Croatia	**Serbia**
Maximum amount of subsidies (% of eligible costs)[4]	50	0-25	0-50	15-50	0-35	40-50	10-60	**50-70**
Minimum investment (mln euro)	0.25-2	0.4-20	10-20	0.23-115	0.1-10	10	5	**0.1-0.5**
Minimum number of new employees	10-150	20-500	50-100	35-750	40	10	50	**10-50**
Subsidies for investments (% of investment value)	10-50	10	4-10	2-10	10-20	YES	10-20	**10-30**
Subsidies for employment[5]	YES[6]	3,700-11,000	up to 3 mln euros	800-3,700	4,000-8,000	YES	3,000-15,000	**3,000-7,000**
Subsidy for training employees	YES	3,700-11,000	up to 3 mln euros	800-3,700	4,000-8,000	YES	3,000-15,000	**3,000-7,000**
Income and profit tax release or reduction	25% of total costs	YES	0.5-2 mln euros	NO	NO	NO	UNKNOWN	**up to 1700 euros**[7]
Property tax exemption	YES	YES	YES	YES	YES	YES	UNKNOWN	**YES**
Other tax exemption	NO	YES	NO	YES	NO	YES	UNKNOWN	**NO**
Possibility to sell assets below the market price	YES	NO	NO	NO	NO	YES	UNKNOWN	**YES**
Specific incentives	YES	YES	NO	NO	YES	NO	UNKNOWN	**UNKNOWN**

Source: "Investment incentives in the chosen Central and Eastern European countries" (report by Polish Foreign Investment Agency, 2016), modified by the authors

In practice countries use the following instruments to boost direct investment:

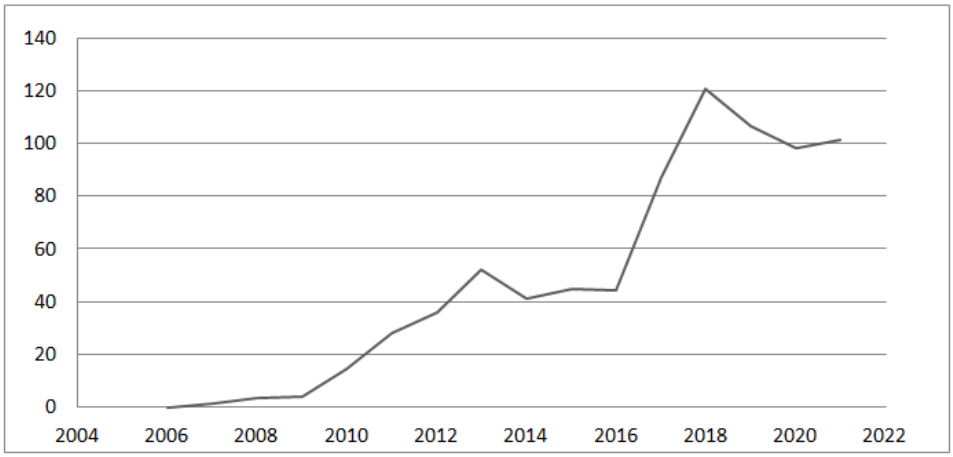
- Subsidies for investments;
- Subsidies for employment;
- Subsidy for employee training;

guarantees, tax incentives and tax exemptions, sales of public property under special conditions, by granting land in public ownership at a price lower than the market and others.

- Income and profit tax release or reduction;
- Property tax exemption;
- Possibility to sell assets below the market price.

1.2. Domestic perspective – growing expenditures for subsidies in Serbia

In the period 2006-2016, the Government of Serbia paid around 200 million euros or approximately 20 million euros annually for the program of subsidizing investors. Moreover, during this period the Government has obliged to pay additional 200 million euros in the following years. Since the new regulation was adopted in 2015, expenditures for subsidies have been steadily increasing. Our estimations show that if the Government continues with the same policy, the expenditures for subsidies will reach the level of 100 million euros per year (Graph 1). Partly, this is due to the rise in the number of investors, and partly it is a result of the increase in the amount of subsidies compared to the level of eligible costs. Bearing in mind the tendency of growth in subsidies, it can be concluded that investigating efficiency of conducted policy is of high importance for future policy-making practice in Serbia.



GRAPH 1. ESTIMATED TOTAL EXPENDITURES FOR SUBSIDIES PER YEAR (IN MILLION EUROS)
Source: Development Agency of Serbia and authors' calculation

2. Literature review

In the context of foreign direct investments there is growing number of papers that use stochastic frontier analysis as the main methodological framework. Research has been focused on the impact of FDI on productivity growth and technical progress, presence of spillover effects, and generally on economic growth.

Kathuria (2001) used techniques from a stochastic production frontier and panel data literature to test for the spillover hypothesis that presence of foreign-owned firms and disembodied technology import in a sector leads to higher productivity growth for domestic firms. The results indicated that there exist positive spillovers from the presence of foreign-owned firms but the nature and type of spillovers vary depending upon the industries to which the firms belong. Mastromarco and Ghosh (2009) used stochastic frontier analysis to study which of the three channels of technology diffusion - foreign direct investment (FDI), imports of machinery and equipment, or

imports of research and development (R&D) expenditures, affect the total factor productivity of developing countries.

Wijeweera et al. (2010) estimated the relationship between FDI and the rate of growth of GDP using the same methodological approach, and found that FDI inflows exert a positive impact on economic growth only in the presence of a highly skilled labour. Yang (2015) has investigated the effect of foreign direct investment (FDI) and foreign trade on the efficiency of energy utilization of the Yangtze Delta region in China. The results show that FDI and foreign trade are both vital for the improvement of the efficiency of energy utilization. Stack et al. (2015) used the single-step ML approach to stochastic frontier analysis, in order to estimate the location and variance determinants of FDI using the knowledge capital (KK) model framework. Finally, Wang and Wong (2016) explored how FDI affects a Chinese manufacturing firms' technical efficiency improvement as well as its technical progress in a stochastic frontier model.

Second line of research addressed two questions: whether subsidies and other types of incentives increase level of foreign direct investments, and whether benefits outweigh costs of subsidizing policy.

Blomstrom and Kokko (2003) suggested that the use of investment incentives focusing exclusively on foreign firms is generally not an efficient way to raise national welfare, arguing that spillovers of foreign technology and skills to local industry, is not an automatic consequence of foreign investments. Morisset (2003) reviewed a debate about the effectiveness of tax incentives and examined the benefits and the costs of using tax incentives to attract foreign direct investments. He concluded that the costs were large, while benefits appeared to be uncertain. Czech National Incentive Scheme is evaluated by Mallya et al. (2004) in terms of three interrelated issues: "crowding in" additional FDI, cost-benefit considerations and quality of investments. Her findings suggest that to some extent (at best 10%) "crowding in" effect exists and that Government of Czech Republic had been successful in increasing quality of investments. She also calculated social price of one new job created. Miroslava (2013) generally discussed positive and negative sides of investment incentives and her results, on the case of firms in Czech Republic, indicated that it was mainly effective to provide investment incentives.

In the literature, a disagreement among economists exists about whether subsidies can compensate for disadvantages in business environment or not. Cass (2007) analyzed to what extent transition countries employed financial incentives relative to each other and over time and what types of incentives they offered. He showed that the incentives were not compensating adequately for disadvantages in the business environment used as a strategic tool in international competition for export-oriented investments. On the other hand, Arsic (2010) compared subsidies and improvements in business environment as two ways to encourage investments and employment and argued that subsides present a costly and an inefficient way of stimulation of investments and employment and that they cannot compensate disadvantages in the business environment. Generally, conclusion is that investment climate is especially crucial for determining the effectiveness of incentives in attracting FDI. Moreover, it

is suggested that the incentives should be used minimally, mainly to address market failures, and should be granted through automatic legal criteria (James, 2013).

Papers and researches mentioned above have not captured possible inefficiencies in implementation of subsidizing policy, and generally, they were not written with the aim to investigate if some investment projects were overpaid by the Governments. To the extent of authors' knowledge, this is the first paper in which stochastic frontier analysis is implemented in an attempt to capture inefficiencies of subsidies for both foreign and domestic investments.

3. Subsidizing Policy in Serbia – overview and some identified irregularities

Since 2006, The Government of Serbia has started the policy of subsidizing investors. At that time, the law defined that the amount of subsidies per employee could not exceed 10000 euros. The allocation of funds was made through public calls, and the law defined criteria that were used to calculate the amount of subsidies. Subsidizing policy was suspended during 2013, and relaunched in 2014. During the period from 2006 to 2016. Government has signed more than 300 contracts and has obliged to pay around 470 million euros. On the other side, investors have obliged to invest more than two billion euros and employ more than 70 thousand people[4]. In the following table total number of contracts, values of investments and subsidies and number of employees are given:

TABLE 2. MAIN INDICATORS (2006-2016)

Indicator	Including terminated contracts	Excluding terminated contracts
Number of contracts	307	209
Value of investments (in euros)	2,035,846,443	1,705,673,278
Number of employees	72,605	56,945
Value of subsidies (in euros)	467,795,948	407,507,448

Source: Development Agency of Serbia and authors' calculation

Currently, similarly to other countries, potential level of subsidy that one investor can get depends on the level of development of the municipal government[5] (Tables 3 and 4), as well as whether it is a project in the manufacturing sector or in the service sector[6]. There is an exemption from paying corporate income tax for investors if they

[4] During last ten years Government has terminated 98 contracts, mostly with domestic investors, since they could not fulfill obligation from contracts they signed.

[5] The development degree of local government is defined by the Ministry which has authority under local governments and it is determined by applying a basic and corrective indicators. The basic indicator is the sum of the salaries and pensions in the unit of local government and the revenues of the budget of the local government unit after the exclusion of funds received from another body in the name of removing the consequences of extraordinary circumstances, expressed per capita. Corrective indicators are demographic growth or decline, unemployment rate and level of education of the population. (Gnjatovic, 2016)

[6] Only products which can be the subject of international trade are included.

invest over nine million euros and employ at least 100 workers. Another kind of incentive for investors is a reduction in the payment of contributions and income taxes (from 65% to 75%, depending on the number of employees). An additional advantage to investors is exemption from paying value added tax if they start production in one of the free zones. Also, foreign investors are exempt from paying customs duties on imports of machinery and equipment, as well as raw materials and semi-finished products from abroad if their finished products are fully exported.

TABLE 3. INCENTIVES FOR PROJECTS IN MANUFACTURING SECTORS

Degree of development of municipality[7]	**I group**	**II group**	**III group**	**IV group**	**Devastated areas**
The minimum number of employees	50	40	30	20	10
Minimum level of investment (in euros)	500.000	400.000	300.000	200.000	100.000
Subsidies for investments (% investments)	10%	15%	20%	25%	30%
Subsidies for employment (% two year gross earnings)	20%	25%	30%	35%	40%
The maximum subsidy (per employee)	3.000	4.000	5.000	6.000	7.000

Source: Development Agency of Serbia (http://ras.gov.rs/podrska-investitorima/zasto-srbija/podsticaji-za-investiranje)

TABLE 4. INCENTIVES FOR PROJECTS IN SERVICE SECTORS

Criterion	Value
The minimum number of employees	15
Minimum level of investment (In euros)	150.000
Subsidies for investments (% investments)	20-40%
The maximum subsidy (per employee)	3.000-7.000

Source: Development Agency of Serbia (http://ras.gov.rs/podrska-investitorima/zasto-srbija/podsticaji-za-investiranje)

[7] Applying the basic and corrective indicators, all units of local government are divided into five groups. The first group consists of local governments whose level of development is above the average in the country; second group consists of local governments whose level of development ranges from 80 to 100% of the country average; the third of local governments with a degree of development ranging from 60 to 80% of the national average, and the fourth of local governments with a degree of development below 60% of the average. Additionally, local governments whose development level is below 50% of the national average are classified as a group of devastated areas. (Gnjatovic, 2016)

In our analysis, we have identified some irregularities in implementation of subsidizing policy which motivated us to investigate potential inefficiencies. First of all, the structure of investments by regions is unfavorable, despite that fact the current policies encourage investments in less developed regions[8]. The largest number of investments, more than 80%, measured by the number of projects, employees and the level of investments, is located in first and second group of local governments. Moreover, the value of subsidies per employee is not higher for a less developed municipality as it could be expected. Average subsidy per new employee for the investment projects in the first group is more than 2000 euros higher than the average subsidy per new employee for the investment projects in the last group (Figure 1).

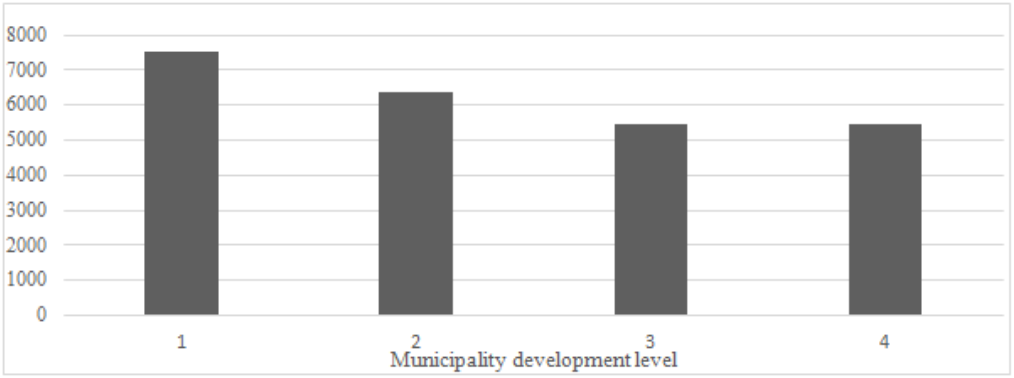


FIGURE 1. AVERAGE SUBSIDY PER EMPLOYEE (IN EUROS)
Source: Development Agency Of Serbia And Authors' Calculation

Secondly, present of a strong positive correlation between the value of the subsidy per employee and the average gross salary was expected, since the former presents the average costs for the Government and the latter the basis for future budget revenues (taxes, social contribution etc.). However, we have noted the lack of correlation[9] between the value of the subsidy per employee and average gross salary (Figure 2).

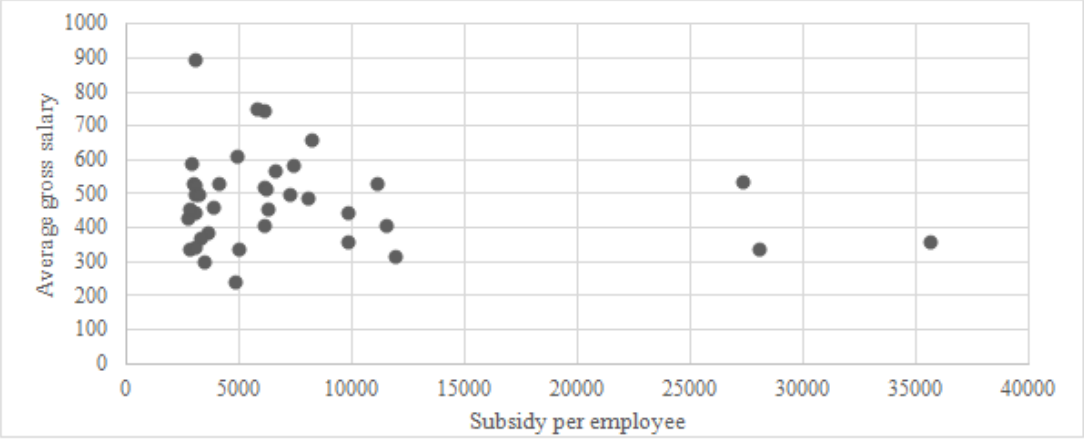


FIGURE 2. RELATIONSHIP BETWEEN AVERAGE GROSS SALARY AND SUBSIDY PER EMPLOYEE (PERIOD 2015-2016)
Source: Development Agency of Serbia and authors' calculation

[8] See Table 3 (especially last row).
[9] In our calculation, correlation was even slightly negative.

4. Methodology

The main methodological framework used to capture the inefficiencies of government subsidies is stochastic frontier analysis (SFA) popularized by Meeusen and van den Broeck (1977) and Aigner, Lovell and Schmidt (1977). Extended survey of papers which utilize SFA can be found in Greene (2012).

According to Belotti et al. (2013), the stochastic frontier model is motivated by the theoretical idea that no agent is able to exceed the ideal production frontier, or go beneath the ideal cost frontier, and the deviations from these extremes represent individual inefficiencies. From the statistical point of view, this idea has been implemented by specifying a regression model with a composite error term ε_i comprising the classical idiosyncratic disturbance v_i, aiming to capture measurement error and other noises, and a one-sided disturbance u_i that represents inefficiency. Terms v_i and u_i are assumed to be independent of each other and independently and identically distributed across observations. These regressions are usually estimated using likelihood-based methods assuming certain distributions of both constituents of the composite error term, and we will be consistent with this practice. We consider the following model:

$$Y_i = \beta_0 + \boldsymbol{X_i'\beta} + \varepsilon_i \quad (1)$$
$$\varepsilon_i = v_i + u_i$$
$$v_i \sim N(0, \sigma_v^2)$$
$$u_i \sim F$$

where $i = 1,2 \ldots n$. We assume that the cost is defined by the Cobb-Douglas cost function. Therefore Y_i represents the logarithm of the cost (or the subsidy amount) of the *i-th* government subsidy contract, and $\boldsymbol{X_i}$ is a vector of logarithm of outputs (namely, investments promised by the receiver, number of employees arranged by the contract, etc.)[10]. We have also considered other specifications such as the translog, half-log, exponential and linear cost functions, but according to the Bayesian information criterion (BIC) the former is the optimal specification for the dataset at hand.

In order to make the equation estimable, we have to assume the distribution function F of the one sided inefficiency term u_i. Aigner et al. (1977) consider a half-normal distribution, $u_i \sim N^+(0, \sigma_u^2)$, while Meeusen et al. (1977) opt for an exponential distribution $u_i \sim \varepsilon(\sigma_u^2)$. Other adopted distributions include the truncated normal in Stevenson (1980) and gamma distribution in Greene (1980). In our analysis we choose the exponential distribution as the prevalent option in literature and as it is best fitting to our model according to the BIC holding the specification constant. The model can be represented in the equation:

$$lnSub_i = \beta_0 + \beta_1 lnEmp_i + \beta_2 lnInv_i + \beta_3 Amb_i + \beta_4 Reg_i + \beta_5 Rec_i + v_i + u_i \quad (2)$$

[10] From the Government's point of view, every investment projects can be seen from input-output perspective, where subsidy presents input (what the Government "invests") and amount of investments, number of employees and municipality development level present output (what the Government gets).

where $lnSub_i, lnEmp_i$ and $lnInv_i$ are the natural logarithms of the subsidy amount, number of employees and the invested amount implied by the *i-th* contract, respectively. Amb_i and Rec_i are dummy variables that are included in order to control for the changes in the business environment. Former takes the value of one if the contract was signed after 2013, since Serbia achieved a significant improvement in the period after 2013 according to the Doing business metric[11]. Latter is equal to one if the contract was signed in the years in which both the EU and Serbia were in recession that is in 2008, 2009, 2011 and 2012. Reg_i is a dummy variable used to control for the lower subsidies across regions. It takes value of one if the contractor company is stationed in the second region defined by the subsidy regulations. Formally, there should be a difference in subsidy amounts in all four regions, but we only found the second region to be statistically different in respect to others.

Model is estimated using the maximum likelihood method assuming the mentioned distributions for the random terms in the equation in the first step. Hence, the distribution of the composite error is just a convolution of the two component densities defined by:

$$f_\varepsilon(\varepsilon_i) = \int_0^{+\infty} f_u(u_i) f_v(\varepsilon_i + u_i) du_i \tag{3}$$

Therefore, the log-likelihood function for the sample of n units is:

$$l(\boldsymbol{\theta}) = \sum_{i=1}^{n} log f_\varepsilon(\varepsilon_i|\boldsymbol{\theta}) \tag{4}$$

In the second step from the estimated residuals $\hat{\varepsilon}_i$ we isolate the inefficiency term from the idiosyncratic term using the conditional distribution $f(u_i|\hat{\varepsilon}_i)$, where $\widehat{\varepsilon_i} = Y_i - \widehat{\beta_0} - \boldsymbol{X_i'}\widehat{\boldsymbol{\beta}}$. As proposed by Jondrow et al. (1982), estimate of the inefficiency for the i-th contract will be given by $\widehat{u_i} = E(u_i|\hat{\varepsilon}_i)$. Furthere, estimate of the cost inefficiency score is equal to:

$$Cost_i = e^{\widehat{u_i}} \tag{5}$$

The non-transformed model is defined as:

$$Sub_i = \beta_0 Emp_i^{\beta_1} Inv_i^{\beta_2} Amb_i^{\beta_3} e^{\beta_4 Reg_i} e^{\beta_5 Rec_i} e^{v_i} e^{u_i} \tag{6}$$

so the final factor is actually equal to the cost inefficiency score. Given that, the estimate of the cost inefficiency will be equal to the amount by which the subsidy was overpaid solely due to inefficiencies holding outputs constant. Using this fact, we are able to extract the total amount that could have been saved, had the regulations and/or decision makers been perfectly consistent with the established regulation.

As Kumbhakar and Lovell (2003) stress, neglected heteroscedasticity in the composite error term may affect inference in SFA models as well as lead to biased estimates of the inefficiency terms. Since the Glejser and White tests show that heteroscedasticity is present in the composite error, we find it justifiable to assume that heteroscedasticity can exist in either of the components or both at the same time. Glejser tests has shown that composite error variance varies only with the change of value of $lnInv_i$. Having that in mind, we try to control for the heteroscedasticity in

[11] http://data.worldbank.org/data-catalog/doing-business-database

one or both terms using the natural logarithm of investments as the exogenous factor, as suggested by Hadri (1999) and look for the specification that maximizes the BIC. Highest information criterion value is given for the model defined above with $lnInv_i$ included to control for heteroscedasticity in the idiosyncratic term v_i. Inclusion of other regressors in equations that parametrize the variances of distributions of both terms was considered, but only the investments yielded statistically significant effects in the mentioned case.

Thus the final model can be rewritten as:

$$lnSub_i = \beta_0 + \beta_1 lnEmp_i + \beta_2 lnInv_i + \beta_3 Amb_i + \beta_4 Reg_i + \beta_5 Rec_i + v_i + u_i \quad (7)$$

$$\sigma_u^2 = e^{\alpha_0}$$

$$u_i \sim \varepsilon(\sigma_u^2)$$

$$\sigma_{v_i}^2 = e^{\gamma_0 + \gamma lnInv_i}$$

$$v_i \sim N\left(0, \sigma_{v_i}^2\right)$$

5. Results and discussion

We estimate the model on the available sample of 307 contracts[12] signed in Serbia in the period 2006-2016. Estimated stochastic frontier and the inefficiency model are given in the following tables.

TABLE 5. ESTIMATED STOCHASTIC FRONTIER

Variable	*Coeff.*	*S.E.*	z	*p-value*
$lnEmp_i$	0.965835	0.031461	30.7	0.000
$lnInv_i$	0.022306	0.007679	2.9	0.004
Reg_i	-0.13963	0.068554	2.04	0.042
Amb_i	0.511468	0.084249	6.07	0.000
Rec_i	0.221017	0.07887	2.8	0.005
const	7.707289	0.253684	30.38	0.000

TABLE 6. INEFFICIENCY MODEL

Term	*Variable*	*Coeff.*	*S.E..*	z	*p-value*
u_i	α_0	-3.15783	0.552966	5.71	0.000
v_i	γ_0	-9.81899	1.35465	7.25	0.000
	$lnInv_i$	0.554888	0.08873	6.25	0.000
$Wald\ \chi_5^2 = 1912.58\ (0.000), logL(\hat{\boldsymbol{\theta}}) = -216.212$					
	σ_u	0.206199	0.057011	3.62	0.000
	$E(\sigma_{v_i})$	0.48214	0.462031		
$Mean\ inefficiency\ score = 1.240$					

[12] We have also included the terminated contracts in the estimation of the stochastic frontier.

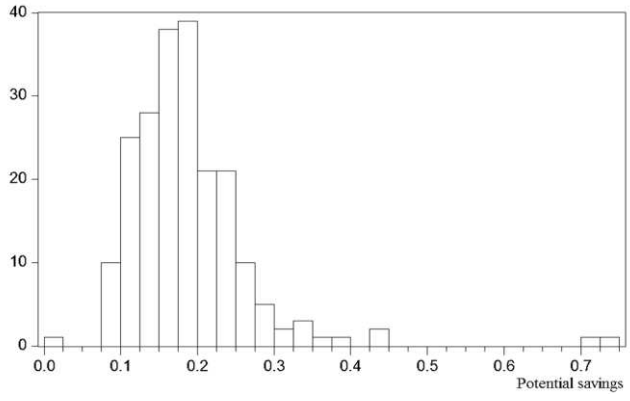
Observing the values of the estimated parameters for the variables $lnEmp_i$ and $lnInv_i$, the large discrepancy of the influence of the same relative increase in the number of employees and the increase in the invested amount becomes apparent. Namely, the one percent rise in the number of employees yields 0.966% higher subsidies, *ceteris paribus,* while on the other hand the same rise in the invested amount would elevate the subsidies by only 0.023%. Considering this fact, one could become suspicious of the Government's willingness to improve the regional or the total economic development. Rather it is possible that the subsidizing policy is used primarily as a means of achieving the goal of acquiring broader public support and affirming its position as a "job-creator" during the turbulent political period following the collapse of Yugoslavia characterized by high unemployment rates. We find that the influence of an increase of 1% in investments on the amount of the government subsidy is less than 50 times lower than the influence of the same change in the number of employees. Lagrange ratio test yields the statistic of $LR = 0.18$ for this restriction which has a p-value of 0.674.

Mean inefficiency score suggest that the average inefficiency across observations is around 1.24. However, this information can be a little vague. Considering that the inefficiency score measures by how much the subsidy was overpaid for the same level of output, it would imply that had the Government been more efficient in giving subsidies, expenditures could have been lower by about 19.35%. However, this is not completely precise taking into account two things. Firstly, when calculating these scores, the contracts that have been terminated and thus will have the subsidized amount reimbursed have been included. There have been 98 of these observations, and they should not be present in the calculation of the total potential savings. Secondly, to acquire the true mean inefficiency, the scores should be weighted by the subsidy amounts. Hence, we calculate the amount spent on contract i solely due to inefficiencies as:

$$Potential\ savings_i = \left(1 - \frac{1}{Inneficiency\ score_i}\right) Sub_i \tag{8}$$

Sum of individual potential savings of non-breached contracts amounts to 86,285,542.62 euros, and taking into account that the total subsidy expenditure for these contracts was 407,511,174 euros, the total saving potential was 21.117%, assuming perfectly consistent policy implementation.

GRAPH 2. HISTOGRAM OF THE INEFFICIENCY COEFFICIENTS



On the histogram (Graph 2) we see that most potential savings lay between 10% and 30% with two outliers of potential savings with over 70% and one under 2%. Two observations that have high inefficiencies have a savings potential of 72.392% and 73.977% and have received 853,498 and 2,250,000 euros in subsidies while managing to open only 24 and 27 new workplaces respectively. These amount to 35,562 and 83,333 euros of subsidies per new workplace, and considering the regulation, their high inefficiency scores are expected. On the other hand, one company which helped employ 1350 workers was granted 4,000,000 euros had the savings potential of only 2%.

6. Conclusion

A great number of countries in the world, including Serbia, use subsidies and other instruments (e.g. tax incentives) in order to encourage both foreign and domestic direct investments, with the aim of increasing employment and accelerating regional and technological development. Today, these countries face with economic, political and institutional challenges in conducting subsidizing policy. Bearing in mind the increase of amount for expenditure on this type of subsidy in Serbia, there was a need to assess the efficiency of this policy.

After brief discussion about topic relevance from international and domestic perspective, subsidizing policy practice in Serbia has been explained. What is more important, some irregularities in implementation of subsidizing policy have been identified. Specifically, we found that the value of subsidies per employee is not higher for a less developed municipality as it could be expected. We have also noted the lack of correlation between the value of the subsidy per employee and average gross salary, which is opposite from what is expectable.

In the fourth part, we used stochastic frontier analysis as a framework for capturing inefficiencies in implementation of subsidizing policy. The results showed that there were potential budget savings that could have been achieved. In other words, there were some investment projects that were overpaid by Government of Serbia. We estimated that Government of Serbia could have saved approximately 21% of allocated budget funds for subsidies, which is about 86 million euros. This amount of money has even more important value since Serbia has gone through the process of fiscal consolidation. Having that in mind, we believe that our Government can use our model as a guide for future policy practice, in order to estimate what is optimal value of subsidy that potential investor should be granted.

Finally, there are possibilities for further research. Due to the lack of data for expenditures of other countries, only “internal” efficiency of policy which has been conducted by the Government of Republic of Serbia for the last ten years was analyzed using an appropriate SFA model. In other words, we only compared investment projects that have been located in Serbia. In the future, if the data are available, it will be also possible to compare policy practice in Serbia with practice of other countries and estimate potential “external” inefficiencies and identify what is the best policy practice and institutional design. This will possibly help governments

in Europe and wider, to improve their policies and increase their efficiencies in implementation of this type of policy.

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