# DOES THE ESF ASSISTANCE CONTRIBUTE TO SALES IN PRIVATE FIRMS?

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**Abstract**

The purpose of our study is to test whether the EU assistance on trainings helped to increase sales in private firms through their competitiveness and to improve the effectiveness of the policy implementation for the 2014 – 2020 programming period in the Czech Republic.

The paper is based on conducting a counterfactual impact evaluation of the Operational Human Resources and Employment Operational Programme, support area 1.1 in the Czech Republic. This support area finances private companies in the field of training and improvements in the systems of human resource development.

Our study has a quasi-experimental design, as the programme assistance has not been designed as a randomized experiment. We analysed a data sample of 31604 firms, of which 2630 were applicants for the ESF assistance. We applied the propensity score matching (PSM) method, the regression discontinuity design (RDD) method and the instrumental variable (IV) method to estimate the impact.

The estimated impact of the ESF on sales varies according applied methods and a size of firms. The PSM method indicates a positive impact of ESF on sales for all size groups of firms. On the other hand the IV method indicates a negative impact. There was no significant estimate for the RDD method.

**Key words:** Impact of the ESF assistance, Counterfactual impact evaluation, sales of private firms

**JEL Code:** C31, D61, H71

## Introduction

The Human Resources and Employment Operational Programme (HREOP), support area 1.1 is financed by the European Social Fund (hereafter ESF) and the Czech state budget. It is focused on investments in human capital in enterprises and development of systems that help to increase the flexibility of the workforce by increasing its knowledge and skills. Implementation of this intervention intend to *"prevent unemployment by encouraging*

*investment in human resources development by undertakings and organizations, the development of the professional knowledge, skills and competences of employees and employers, an expansion in opportunities for the application of more flexible forms of employment and the implementation of modern systems for the management and development of human resources"* (Ministry of Labour Affairs of the Czech Republic, 2010, p. 6).

According to the HREOP, through the support of education and training of workforce competitiveness of supported firms should be enhanced. One of the most important indicators of the competitiveness are sales. The dynamics of sales show whether the company has enough contracts. The article analyzes the dynamics of sales in firms for the years 2008-2010, a period when the financial and economic crisis hit the Czech economy. All the methods are based on a comparison of the situation in terms of sales in supported and unsupported firms.

The aim of the paper is to answer what is the impact of the ESF assistance on sales in firms. These results may help to target the support from the ESF in the programming period after 2014. The paper consists of a description of the used methodology and the data sample, and a discussion of results. The final chapter concludes.

# 1 Methodology and Data Sample

We applied the propensity score matching (PSM) using the difference-in-difference method, the regression discontinuity design (RDD) method and the instrumental variable (IV) method to estimate the impact of ESF assistance on sales in firms.

We used the comparison of supported applicants with rejected applicants as a control group for all methods. In addition, we compared supported applicants with non-applicants in the case of the PSM method (using difference-in-difference).

## 1.1 Propensity Score Matching Method

The PSM method is based on the comparison of firms with a similar propensity score, which is a one-dimensional variable, which determines the probability of being supported. Under some conditions, see Rosenbaum and Rubin, 1983, such a comparison is equivalent to the comparison based on a full set of observable characteristics. .Formally, the method works as follow: first, the probability to which group a particular firm belongs (whether to the group of supported applicants or non-applicants) is estimated and this generates the propensity score. Then, indicators of supported applicants and non-applicants with the similar values of a propensity score are compared.

Selection of observations with similar propensity score value can be done in several ways, for the purpose of this paper, we have chosen the most commonly used the nearest neighbour matching. In this approach each supported applicant is compared with non-applicant that has the closest propensity score. The result of estimation is the average of comparisons over all supported applicants.

To estimate the propensity score, we consider a set of probit models which contained a selection from the following variables as explanatory variables:

- The firm size (number of employees - full-time equivalents);
- A Legal form (dummy variables for each type);
- The NACE (in the form of dummy variables for each NACE);
- Regions (in the form of dummy variables for each region);
- The interaction of the firm size with above mentioned characteristics (multiple of the firm size with above mentioned characteristics);
- A Change in fixed assets of the firms (calculated as the percentage difference between 2010 and 2008).
- Support from other public sources (Public support according to data of the CZSO and the HREOP)

We used a modified Akaike's information criterion for choosing the best final model. This criterion is the standard choice for statistical model selection, see (Burnham and Anderson, 2002). Results from the best model were used to estimate the propensity score. Confidence intervals were computed using the bootstrap (Davison, Hinkley, 1997).

### 1.2 Instrumental variable Method

The IV method requires the presence of an instrumental variable, which have to satisfy two following conditions:

- It has to be a significant predictor of the probability that the firm receives the support;
- It is not related to the observed indicator (sales) otherwise than through receiving the support.

We used an identification of appraisal experts as the instrument. Appraisal experts score project applications and according to the resulting score value the application is accepted or not. It is necessary that an appraisal expert relates to the acceptance of a project (different

appraisal experts are variously "strict"), but not to the final results of support. The second condition cannot be statistically verified. It has to be accepted as an assumption. In this case, the assumption is pretty reasonable because appraisal experts do not come into contact with the rated firms otherwise than through the assessment process and therefore the situation of firms is not related to the appraisal experts who sign a declaration of impartiality and independence.

The IV method can be applied in several ways. We chose the two-stage least squares (2SLS) as a suitable approach. The standard deviations of estimated parameters are estimated by non-parametric bootstrap.

The 2SLS approach is based on a formulation of two structural equations. The first equation explains the probability of receiving the support based on the characteristics of appraisal experts and the characteristics of firms where appropriate. The second structural equation explains the observed indicators (sales) by whether the firm has received the support and with a help of other characteristics of firms (NACE, region).

Given that the second equation does not contain a variable directly derived from the appraisal experts, it is possible to use estimates from the first equation (the estimated value of the probability of receiving the support) as an instrument for the support itself. In this case, the first stage of the method should contain all relevant variables, not only the variable that is excluded from the second stage (the first stage should even include characteristics of firms, not only identifiers of appraisal experts).

At first, we estimated a discrete choice model, where the probability of acceptance a project proposal was explained by a variable "sum of experts' personal biases" (SEPB) and observed characteristic of the firm (including NACE, a region, a legal form, a size). The variable SEPB is a combination of personal bias of appraisal experts and is calculated as follows:

- To calculate the average number of points for all projects from all assessments (XN);
- Then to compute the average score for each appraisal expert (XH);
- The difference XH - XN is called "experts personal bias" (EPB);
- To sum EPBs of all appraisal experts for each project to give the variable SEPB.

This is the first stage estimation. To estimate the probability of acceptance of the project we chose a linear probability model. From tests, it is obvious that the SEPB variable significantly influence probability of the project acceptance. As the necessary requirement is satisfied, it can be used as an instrument.

### 1.3 Regression Discontinuity design Method

To apply the RDD method to estimate the impact of ESF support on sales of firms it is necessary to know the process of application selection very well. In HREOP there is each project application rated by independent appraisal experts who are chosen randomly. The project application is assessed by two appraisal experts who assess the quality of the project application. Each appraisal expert scores the project application from 0 to 100 points according to specified criteria. If the project gets more than 65 points from both experts, it is supported. If the project gets less than 65 points from both experts, it is rejected. If the project application gets less than 65 points from one appraisal expert and more than 65 points from second one, the third appraisal expert has to assess the project application and according his/her given score the application is supported or not. There is possibility that the cut-of-point can be higher than 65 points because of lack of allocated money. But it is not case of selected calls of proposals. This simple selection process of applications allowed us to use the 65 points as a cut-of-point to be used in RDD.

RDD estimates the average effect of support across the cut-of-point for receiving support by differences in expected (mean) value of indicators of projects that fall just above and below this cut-of-point. The expected (mean) value can be estimated in several ways. Due to the robustness of the results, we used the following three different econometric methods:

- Non-parametric regression (we used the Watson-Nadaraya's estimator (Nadaraya, 1964; Li, Racine, 2007), while the length of the smoothing window is set by cross validation);
- Polynomial regression (we tested different degrees of polynomials and we used a simple least squares method to estimate the coefficients of the polynomial);
- Robust polynomial regression (we used robust regression to estimate the coefficients of the polynomial, which is less inclinable to outlier observations unlike the simple least squares method).

The first two approaches are standard in the econometric literature, for example Lee and Lemieux (2010). The third approach was chosen because the polynomial regression model estimated by the least squares method can be very sensitive to atypical observations. Standard errors of estimation and p-values were estimated by using the bootstrap.

## 1.4 Data

The counterfactual impact evaluation is a method demanding the quality and quantity of data. Selection of processed analyses is based on the availability of data outside the ESF monitoring system Monit7 + and its real explanatory power. The analysis used data from the Monit7 +, combined with data from the Czech Statistical Office (CZSO).

The Support area 1.1 of the HREOP consists of 12 calls of proposals for grant projects and 10 calls of proposals for individual projects of public administration. For the analysis presented in the paper were selected 4 very similar calls of proposals for grant projects (calls 23, 35, 39 and 60). All projects focused on the training of employees and the development of the educational systems in firms.

We managed to get from the CZSO a data sample of 31 604 firms, of which 2630 were applicants for the ESF assistance in the calls of proposals in question. The data sample enabled us to test the impact of the ESF assistance among the supported applicants and compare them to i) non-applicants; and ii) to the rejected applicants. We divided firms into groups according to their size (small – up to 50 employees, medium – 50 to 250 employees and large firms). The numbers of firms included in each group are shown in the following table.

**Tab. 1: Firms by size (according to the variables of number of employed persons)**

| The number of applicants (not applications) | Rejected applicants | Supported applicants | Non-applicants | Total |
|---|---|---|---|---|
| Small firms (under 50 employees) | 639 | 746 | 22 015 | 23 400 |
| Medium firms (50-250 employees) | 391 | 445 | 5 869 | 6 705 |
| Large firms (over 250 employees) | 153 | 256 | 1 090 | 1 499 |
| Total | 1 183 | 1 447 | 28 974 | 31 604 |

Source: CZSO and Monit7 +, own calculations

Many of the rejected firms applied once again for the support and in the end, they received it. These firms switched from rejected applicants to supported applicants over time. The research team worked with that fact as well as with the fact that 18 companies in the sample received grant support for two project applications.

Supported firms received a total ESF contribution of 1 049 580 196 CZK. Small firms received 534 066 414 CZK, medium firms received 324 412 243 CZK and large firms received 191 101 538 CZK.

# 3 Results

Through the analysis of subsidies, it is possible to identify the following effects of the support from the ESF on sales in firms. The following table presents results for all applied methods and for all size groups of firms as well as for all firms together.

**Tab. 2: Results for all methods (Induced CZK of sales - average for a firm)**

| | **Small firms** | | **Medium firms** | | **Large firms** | | **All firms together** | |
|---|---|---|---|---|---|---|---|---|
| Method | Estimate | P-value | Estimate | P-value | Estimate | P-value | Estimate | P-value |
| **PSM** (Supported:Rejected) | 41 775 | 0,23 | 18 476 | 0,13 | 34 081 | 0,40 | 26 990 | 0,30 |
| **PSM** (Supported:non-applicants) [1] | 181 763 | 0,00 | 287 188 | 0,00 | 437 061 | 0,00 | -6 085 | 0,45 |
| **RDD** (Supported:Rejected) | 71 731 | 0,15 | -63 398 | 0,25 | 100 054 | 0,30 | 10 619 | 0,47 |
| **IV** (Supported:Rejected) | -79 726 | 0,21 | -193 417 | 0,32 | -2 132 968 | 0,00 | -456 471 | 0,01 |

Source: CZSO and Monit7 +, own calculations

The estimated impact of ESF on sales varies according applied methods and the size of firms. For the full set of firms the results are negative (using the IV method), or estimates are not significant. When we analyze the impact of ESF support for particular size groups of companies there is a positive impact based on the PSM method, approximately 181 000 CZK for small firms, and 287 000 CZK for medium firms. The same method then gives the result even of 437 000 CZK for the large firms. In contrast, for large firms IV method estimates a negative impact (a decrease of almost 2 133 000 CZK). There are no significant estimates for RDD method.

From the comparison of the results, we can conclude that sales grew for supported firms compared to non-applicants. When comparing supported firms and rejected applicants we cannot demonstrate this.

The increase in sales is not based on the results in a 1:1 ratio with the amount of contribution from the HREOP. For small firms, sales increased by 1 CZK for approximately every 4 CZK of support, while estimates show a decrease of approximately 1 CZK per each 0.35 CZK of

[1] Although for all three size groups of firms separately the results are statistically significant and positive results for the entire data set are not significant and also negative. This may explain the Simpson's paradox, see for example Blyth (1972).

HREOP support for large firms[2]. For mid-sized firms estimates issue increase by 1 CZK for approximately 2.50 CZK of the ESF contribution.

## Conclusion

The obtained results do not lead to a clear conclusion. When we applied the PSM method and compared supported applicants to non-applicants, the estimated impact of the ESF assistance was positive for small, medium and large firms. But using the same method with the comparison of supported applicants to rejected applicants do not provided any significant results. Nor the RDD method did not bring any significant results. On the other hand according the IV method the obtained results estimated the negative impact of the ESF assistance on the sales for large firms and for the full set of firms.

It was not possible to manage the test of the sustainability of increased sales at this time. Most of the projects received payments both in 2009 and 2010. So the results show the effects on sales in firms during the realization of supported projects and it is possible that the impact of intervention on sales will disappear or decrease because of the aspect of project administration (resp. revenue from the ESF assistance).

The research team will continue to monitor the situation in terms of impacts of the EU Structural Funds on firms in the Czech Republic and we believe that obtained data during coming years will bring clearer results.

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