USE OF ECONOMETRIC INSTRUMENTS IN DETERMINING THE FINANCIAL RESOURCES NEEDED FOR PROFESSIONAL SKILLS DEVELOPMENT PROJECTS

Dogar Cristian
Universitatea 1 Decembrie 1918
Facultatea de Ştiinţe

Kelemen Andrei
Universtitatea Babes-Bolyai
Facultatea de Ştiinţe Economice şi Gestiunea Afacerilor

The market shows no signs of sustainable recovery after the crisis that hit the world economy in 2007, and therefore public intervention in the area of professional re-conversion is highly desirable. Public spending on training programs needs to be economically justified and closely monitored. We describe an econometric method to evaluate needed costs for training programs for professional skills development, based on a sample of pair values extracted from training projects implemented between 2008 and 2009. We find that, although the unitary value as resulted after applying the econometric model corresponds to the national available amount, by applying other types of indicators, such hour of training, can determine more efficient (less resources needed), cost-effective and effective (increased number of trained individuals for less costs) values in what regards the process of delivering training programs.

1. Introduction

The Lisbon Strategy is put into practice in Romania through the Sectoral Operational Program for Human Resources Development which has as main objective the development of human capital and increasing competitiveness, by linking education and lifelong learning with the labor market and ensuring increased opportunities for future participation on a modern, flexible and inclusive labor market for 1,650,000 people [1]. This objective is planned to be achieved through activities that can be financed after public auctioning under the SOPHRD priority axes (PA) and key areas of intervention (KAI) [2]. The professional skills development of employees is achieved under Priority Axis (PA) no 3 "Increasing adaptability of workers and enterprises", Key Area of Intervention (KAI) 2 "Training and support for enterprises and employees in order to promote adaptability". This KAI has a series of national indicators, as negotiated by the Romanian Government and the European Commission, which set, on a yearly basis, the targets to be achieved and the financial allocation corresponding to the agreed indicators.

Table 1. Result indicators for KAI 3.2 under SOPHRD

Output indicators	Cumulative proposed targets								
	2007	2008	2009	2010	2011	2012	2013	2014	2015 total
Number of persons trained in the filed of work management and organization	-	1600	3300	5400	7800	10600	13500	15000	15000
Number of persons with updated and improved professional competencies	-	30500	62000	102000	148000	198700	252700	280000	280000
Total		32100	65300	107400	155800	209300	266200	295000	**295000**

The indicators in the *Table 1.Result indicators for KAI 3.2 under SOPHRD*, as presented above, refer to employees that have been trained to update, develop and improve their professional competencies. This KAI finances intensive training courses, up to 120 hours/person. Trainings for qualification or re-qualification, which have between 360 and 1080 hours/person, are financed under KAI 2.3 of the SOPHRD [3]. Within the public policy for human resources development, through the implementation of the SOPHRD, by the end of 2015, at least 295,000 employees of active companies in Romania would have been involved in some type of intensive training. For this objective, the Romanian Government, as agreed with the European Commission, has allocated a total sum of 308,550,609 EURO, of which 229,083,655 EURO from the EU, and 40,431,555 EURO from the national budget, as illustrated in *Table 2*.

Table 2. Financial allocation for KAI 3.2 under SOPHRD

| Year | Total | EU contribution (ESF) | Contribuția națională publică | | | | Private contribution |
			State budget	Local budgets	Other public sources	Total	
2007	18.904.046	14.035.325	2.477.130	0	0	2.477.130	2.391.591
2008	29.304.145	21.756.887	3.839.928	0	0	3.839.928	3.707.330
2009	40.172.466	29.826.080	5.264.081	0	0	5.264.081	5.082.305
2010	47.792.232	35.483.382	6.262.552	0	0	6.262.552	6.046.298
2011	52.866.263	39.250.601	6.927.438	0	0	6.927.438	6.688.224
2012	59.164.088	43.926.426	7.752.686	0	0	7.752.686	7.484.976
2013	60.347.369	44.804.954	7.907.740	0	0	7.907.740	7.634.675
Total	**308.550.609**	**229.083.655**	**40.431.555**	0	0	40.431.555	39.035.399

The decision makers have based financial allocation nor on quantitative and/or qualitative analyses, but rather on quantitative estimation of trained employees which need professional updating and development. Using the total financial allocation (308,550,609 EURO) for this KAI and the proposed indicator (295,000 persons) in a simple calculus, one can extract the median cost value for each trained person: 1,045.93 EUR. The financial mechanism put in place to sustain professional skills development programs is provisioned under EC Regulations no 1083/2006, 1605/2002 and 2342/2002. In brief, this mechanism is based on private and public providers of professional skills development training programs which can apply for financing under this particular KAI of the SOPHRD. Under state aid schemes, enterprises can apply directly for financing and organize their own training programs.
As estimated by the authors of the Regional Plans for Labor Force Employment, during the current programming period (2007-2013), approximately 30,000 individuals in the North West Region need to have their professional skills updated and/or developed and/or improved.

2. Determining the necessary financing in the North West Region by employing a linear econometric model

Professional skills development is achieved generally at the initiative of the enterprise with the purpose to increase productivity and therefore the profit. Nevertheless, a worker's skills determine that employees's wage and sector of activity and, furthermore, high-wage sectors employ high-skill workers and offer high returns to workers' skills [4].
The level of commitment towards the constant updating of professional skills of employees depends largely on the type of organizational culture, the size, business strategy, type of management and economic environment. Nevertheless, the relation between the professional

abilities of staff and productivity (hence, profit) is very direct and widely accepted. Development of general and/or specific professional skills [5], as they are defined in the Commission Regulation (EC) no. 800/2008 (General block exemption Regulation), cover the entire training area. By reporting to these definitions, external financial support for enterprises becomes a matter of public subventions, which, to be possible, needs to comply with the provisions set out in the above mentioned regulation. The Regulation lays down the limits of aid intensity [6], which, depending on the size and type of enterprise, varies between 25% and 70%.

2.1. Model identification and establishment of variables

As a general rule, training providers base their cost estimation whether on the number of hours of the activity or on the number of individuals to be trained. In each of the situations, their offers are in a linear dependency with the base used in the calculus. When determining the program indicators, decision makers have not taken into account the fact that not all types of training programs need the same, or approximately the same, resource engagements. As indicated in *Table 1*, the result indicator for KAI 3.2 under SOPHRD is the number of trained individuals and not the number of hours. Current Romanian legislation regarding professional skills development indicates that qualification training courses are defined on three levels, level 1 – 360 hours, level 2 – 720 hours, and level 3 – 1080 hours, while intensive training for acquiring new competencies may be varying between 20 – 120 hours [7].

Since an official report on the training needs at national, regional or local levels in relation with the types of employers and number of hours has not been conducted, determining the funding requirements for training cannot be carried out unless a low level of significance is accepted. With the current setup, the public policy regarding training of adults may lead to situations varying among: i) unjustified savings – achievement of proposed indicators by delivering common competencies for a sufficient number of individuals through short-term training, but with the disadvantage of leaving uncovered other types of training needs; ii) inefficient use of resources – training projects with over-estimated budgets which provide short term training programs at the costs of long-term training programs; and iii) lack of resources to cover training needs – fail to achieve indicators due to the lack of resources, regional allocation of funds not being carried out based on estimating the necessary hours of training. The list of encouraged competencies/qualifications has not been made available either, which leads to further confusions in what regards prioritization of public funded interventions.

The only indicator which allows a sufficient allocation of resources at regional level and facilitates proper auditing of the performance of the funds is the **hour of training for encouraged competencies**. An important factor in judiciously using the available funds is represented by the pace of allocating financial resources in relation with the prioritized indicators. Thus, one should first establish the profile of the local economy and, consequently, the related necessary competencies as expected by the enterprises. This would further yield in a territorial prioritization of necessary competencies, based on activities and enterprises.

The needed number of training hours can be determined by the use of an econometric model (with multiple variables) within each of the activity and/or enterprise. In this way one can accurately estimate the necessary hours of training in the tourism sector, for SMEs for professions such as cook, waitress, maid etc. The model may support a single variable in the absence of forecasted additional investments – the increase in number of cooks is not related to the increase in number of waitresses, as the intervention is programmed to solve the deficit of competencies of that particular enterprise (with the accepted hypothesis that its condition does not change as result of new capital injection). One can thus generate different settings with different economic consequences which could be taken into consideration when projecting the impact of the political impact in the territory. The method of global utility can be employed to fundament the decision to finance training programs through public funding for certain types of

enterprises, belonging to an economic sector, over other enterprises, belonging to the same or to another economic sector.

Determining the econometric model and optimizing the decision are reflected in the **effectiveness** of public policies; making available affordable resources for training programs results in **cost-effectiveness**, and **efficient** allocation of resources to obtain desired results completes the framework in which the performance of using public funding for professional skills development programs is analyzed. Such approaches, at this time, are very seldom and most of them respond to two of the above-mentioned criteria.

Organizing public calls, where the main criteria of selection is the lowest offered price, is already a reality through the implementation of Section Grants in the Council Regulation (CE) no 1605/2002 on the Financial Regulation applicable to the general budget of the European Communities. One can respond to the cost-effectiveness criteria of public funding use by the proper employment of such calls for projects.

In order to achieve the efficiency criteria we proposed to determine the necessary financing for future training in the Region North-West of Romania, by employing a linear econometric model and by using data collected in the previous programming period (pre-accession period).

The professional skills development programs during the years 2006 and 2009 and in the case of employees, have been carried out through financial allocations made available within the Phare Economic and Social Cohesion – Human Resources Development funding lines. In the North-West Region a number of 31 projects have been approved and implemented with the following pairs of values (as reflected in *Table 3. Phare pairs, 2005-2006)*: budget value (endogenous value) and number of trained individuals (exogenous variable).

2.2 Estimation of the econometric model

We estimate the existence of a linear dependency between the project budget and the number of trained individuals, as illustrated by the following formula:

Table 3. Phare pairs, 2005-2006

No.	Budget	Indicator
1	60,445	60
2	83,140	40
3	90,763	110
4	29,796	44
5	78,460	66
6	43,760	62
7	48,950	62
8	72,435	51
9	60,200	44
10	67,400	87
11	58,910	42
12	48,425	56
13	78,255	104
14	20,852	100
15	86,255	143
16	63,855	133
17	58,761	148
18	85,710	144
19	77,025	35
20	82,887	300
21	44,590	51
22	105,130	76
23	33,900	25
24	110,494	60
25	53,870	46
26	101,085	480
27	79,180	20
28	77,440	56
29	56,256	39
30	69,420	225
31	71,865	56

$y_i = a + bx_i + \varepsilon_i, i = \overline{1, n}$, where Y is the endogenous value (project budget), X is the exogenous variable (number of trained individuals) and ε is the random residual variable, which includes the effects on Y of other factors than X, but less significant than X. Taking into consideration the pairs in *Table 3. Phare pairs, 2005-2006* we can estimate the model coefficients. Thus $\hat{\bar{y}} = 67726,26$, and $\hat{\bar{x}} = 95,65$ and $\hat{a} = 59711.87$, respectively $\hat{b} = 83.79$. The linear model of budget dependency on indicators for a project becomes: **Ymed(X)** = 59711.87 + 83.79 **X.**

One can observe that in the considered model the project budget is made of a fix part and of a variable one, the later directly proportional with the number of trained individuals. One way to make the training costs more efficient is to impose lower limits for the number of trained

individuals per project, determining thus, eventually, a decrease in the number of financed projects, which, at its turn, leads to reducing the costs which are not directly related to training costs.

Besides the punctual estimation as shown by the values obtained on the pairs of data, $\hat{a}$ and $\hat{b}$, for the unknown parameters a and b, one can construct confidence intervals such as

$$P\left(\hat{b} - t_{\alpha/2, n-2}\sqrt{\hat{V}(\hat{b})} \leq b \leq \hat{b} + t_{\alpha/2, n-2}\sqrt{\hat{V}(\hat{b})}\right) = 1-\alpha,$$ where $\alpha \leq 5\%$, is the significance

threshold, $t_{\alpha/2, n-2}$, is a table value from the Table of the Student's T Distribution with n-2 degrees of freedom, corresponding to the probability, $\alpha/2$, and $\hat{V}(\hat{b})$ is

$$\hat{V}(\hat{b}) = \frac{\hat{s}^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2},$$ $\hat{s}^2$ being the punctual estimator of the unknown variance of the residual

variable, σ^2, given by the formula, $\hat{s}^2 = \dfrac{\sum_{i=1}^{n}\hat{\varepsilon}_i^2}{n-2} = \dfrac{\sum_{i=1}^{n}(y_i - \hat{a} - \hat{b}x_i)^2}{n-2} = 13316560.8$.

Based on the values in the sample, after calculating the residuals and the values for $\hat{s}^2$, we obtain for the variance of $\hat{b}$ the estimated value **1578.919**, and for the variance of $\hat{a}$ the estimated value **0,029898.** For $\alpha/2 = 0,025$ and 29 degrees of freedom we find, in the Table of the Student's T Distribution, the constant 2,045. Thus we can determine the numerical limits of the confidence interval both for a and for b. From here it results that P(2,53 < b < 165.05) = 95% and P(59711,52 < a < 59712,22) = 95%

2.3 Model validation

The model is validated both through the test T of significance for coefficient b and through the test F for the linear correlation coefficient. Based on the result obtained on the sample, we can calculate the particular value T calc = 2,108761. As *Tcalc* does not belong to the interval [-2,045, 2,045], we dismiss the null hypothesis and accept the alternative hypothesis. Consequently, $b \neq 0$, which means that X stays in the model as factor of major linear influence, for Y, the significance threshold being 5%. Based on the data obtained on the sample, we can calculate a particular value (2), *Fcalc* = 4,4468. As 4,4468 does not belong to the interval [0, 4,18], we dismiss the null hypothesis and accept the alternative hypothesis. Consequently, $R_{01} \neq 0$, which means that Y is explained in an acceptable manner by a linear model based on *X,* the significance threshold being 5%.

2.4 Estimates based on the model

In the hypothesis that all 30,000 individuals would be trained under one project, by a single training provider, the allocated budget could be determined by using the described linear model, as it follows: average budget for 30,000 individuals to be trained = 59711.87 + 83.79 X 30000 = **2.573.411,87 EUR.** But the model has been constructed for an average indicator of approximately 100 individuals trained per project, which means that between 2009 and 2015, providers of professional skills development programs will have trained 30,000 individuals in approximately 300 projects. This way we will have: average budget for 30,000 individuals to be trained = 300(59711.87 + 83.79 X 100) = **20.427.261 EUR.**

Confidence interval for the forecast: $\hat{V} = \hat{s}^2 \left[1 + \dfrac{1}{n} + \dfrac{\left(x_{n+h} - \hat{\bar{x}} \right)^2}{\sum\limits_{i=1}^{n} \left(x_i - \hat{\bar{x}} \right)^2} \right]$

In the hypothesis of 100 individuals to be trained, the result is: 426159890.1 and the confidence interval for the forecast will become:

$$P\left(\hat{y}_{n+h} - t_{\alpha/2,n-2} \sqrt{\hat{V}} \leq y_{n+h} \leq \hat{y}_{n+h} + t_{\alpha/2,n-2} \sqrt{\hat{V}} \right) = 1 - \alpha$$

P(68090.87-42216.24 < Y < 68090.87 + 42216.24) = 95%; P(25874.63 < Y < 110307.11) = 95%. We observe that in order to train 30,000 individuals, within 300 projects, with a probability of 95%, the necessary financial resource will amount to 33,092,133 EUR. Based on the tested econometric model, the necessary financing for the North-West Region for training 30,000 individuals is **33,092,133 EUR.**

3. Conclusions

The sample taken into consideration for testing the econometric model is based on recent data, extracted from projects that have been implemented between 2008 and 2009, and therefore we can confidently consider that it offers an accurate image of project based training programs financed through public funding. The unitary value as resulted after applying the econometric model corresponds to the national available amount, 1103 EUR/trained individual vs. 1045.93 EUR/trained individual. Nevertheless, the ambiguity of the result indicators as they are set by the public policy implementer, generates difficulties in assuring an efficient public policy implementation framework, and, as a consequence, affecting the general performance of public funding usage. The model described here in is based on a number of trained individuals, within certain contractual provisions where the volume (result indicators) is assumed by the contract beneficiary. Applying other types of indicators, such hour of training, can normalize the information and determine more efficient (less resources needed), cost-effective and effective (increased number of trained individuals for less costs) values in what regards the process of delivering training programs. This will eventually lead to an increased impact of the public policy. Since the market shows no signs of sustainable recovery after the crisis that hit the world economy in 2007[8], public intervention in the area of professional re-conversion is highly desirable, and therefore public spending on training programs needs to be economically justified.

References
[1] Government of Romania. *Sectoral Operational Programme Human Resources Development 2007-1013,* pg. 58
[2] Government of Romania. *Framework Document for the Implementation of SOP HRD,* pg 4
[3] Government of Romania. *Framework Document for the Implementation of SOP HRD,* pg 74
[4] Gibbons, Robert and all. *Comparative Advantage, Learning, and Sectoral Wage Determination,* Journal of Labor Economics, 2005
[5] European Commission. *Commission Regulation (EC) no. 800/2008 (General block exemption Regulation) declaring certain categories of aid compatible with the common market in application of Articles 87 and 88 of the Treaty,* Section 8, art. 38, paragraphs 1 and 2
[6] European Commission. *Commission Regulation (EC) no. 800/2008 (General block exemption Regulation) declaring certain categories of aid compatible with the common market in application of Articles 87 and 88 of the Treaty,* Section 8, art. 39, paragraphs 1 and *2*
[7] Government of Romania, Ministry of Labor, Family and Equal Opportunities and Ministry of Education. *Order no 353/5.202/2003 for the approval of the Methodology to authorize providers of adult training programs*, art. 7, paragraph 1, letter a, b and c.

[8] Shierholz, Heidi. *Labor market closes 2009 with no sign of robust jobs recovery*, 2010, Washington, D.C.: Economic Policy Institute.