Performance measurement and determinants of inefficiency of regional employment offices: A non-parametric frontier analysis for Switzerland

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Abstract

In Switzerland, regional employment offices provide placement services to the job-seekers and employers and organize active labor market programs with the objective of lowering the structural unemployment. In this paper, we carry out a quantitative evaluation of the employment offices' performance based on production efficiency measures. We use Data Envelopment Analysis (DEA) technique to estimate the performance of all employment offices and then account for factors in local operating environment that are outside of management control. Our evaluation approach and the ranking of employment offices may easily be interpreted by policymakers and provides guidelines for raising the efficiency of the public employment service. Our findings for Switzerland suggest that efficiency could be improved through better management. Results also indicate that differences in the external operating environment have a significant influence upon the efficiency of employment offices.

Keywords: Public employment service, Technical efficiency measurement, Data envelopment analysis, Labor market conditions.

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1 Introduction

The unemployment problem is most often tackled by either pointing to business cycles conditions or excess of labor market regulation, at least at the macroeconomic level. More recently, employment and training programs or other active labor market measures are being evaluated to gauge their effectiveness in reducing unemployment duration or guaranteeing new jobs with acceptable earnings (Heckman, LaLonde and Smith, 1999).

In this paper, we take another route and look at how the number of jobless people or the mean duration of unemployment can be affected by the "technical" performance of employment offices, which typically aim at finding people jobs and act as a crucial intermediary between firms and job-seekers. We consider employment offices as production units which use inputs to convert them in some form of output, be it exits of unemployment or a lower duration of unemployment spells.

Although this approach is not quite novel, only Cavin and Stafford (1985) and Sheldon (1999) have, to our knowledge, used efficiency analysis to assess the performance of employment offices.

The novelty of our study also lies in the new institutional framework in which employment offices operate in Switzerland. The details of this framework are described more thoroughly in Section 2. Basically, employment offices are now confronted to financial incentives according to their performance in achieving specific targets with respect to the number of hires and the duration of unemployment spells. For this reason, efficiency analysis can provide deeper insights in the job matching process.

The purpose of this paper is to examine the technical efficiency of the Swiss public employment service using a two-stage procedure. In the first stage, Data Envelopment Analysis (DEA) is used to compute technical efficiency for all Regional Employment Offices (REOs hereafter) operating in Switzerland during the period 1998-1999. In the second stage, a regression model is used to analyze the impact of external factors of the operating environment on the variation in technical efficiency scores across employment offices. The results of this study provide a relative ranking of employment offices with respect to their ability to meet pre-defined targets which can be used as guidelines for the offices to become more efficient.

The motivation of this study originates from the enforcement in 2000 of a new agreement between the Swiss federal authorities and cantons relative to the introduction of performance-based budgeting of Regional Employment Offices.[1] This new agreement was struck between the Federal Government and the REOs as Swiss unemployment policy was shifted in 1996 from a passive income maintenance program to active labor market measures aiming at a faster reintegration of the unemployed into the labor market. The performance-based budgeting of REOs is a part of a set of active labor market measures providing the REOs with an incentive to become more efficient in lowering the structural unemployment. Evaluation of employment offices' performance is a necessary condition for the implementation of the budgeting scheme and, more importantly, it helps to discover the best practices in the REO's internal management that could be replicated to improve the overall efficiency of the Swiss public employment system.

[1] See the *Accord ORP/LMMT/Autorité cantonale* (2000).

Although the economics of public employment services is a topical issue, Cavin and Stafford (1985) have noted how little published literature was available on the performance standards of employment services. Since Cavin and Stafford's study, the situation has not changed much.[2] In Switzerland, the evaluation of REOs' performance is currently carried out my means of simple ratio analysis technique (ATAG Ernst and Young, 1999). Another Swiss study by Sheldon (1999a) uses the DEA technique based on the matching approach between unemployed and vacancies. Both ATAG Ernst and Young (1999) and Sheldon's (1999a) studies consider no REO's production factor inputs (such as personnel or capital). Thus, these studies mainly provide benchmarks to compare outcomes achieved among REOs, but are not efficiency studies in Koopman's (1951) sense. We contribute to the understanding of the process of employment service delivery by proposing an alternative model of the economic activity of REOs which also carries the advantage of accounting for the targets of employment offices as specified by the Swiss State Secretariat for Economic Affairs (Seco).

The study unfolds as follows: Section 2 describes some institutional aspects of organization of the Swiss public employment service. Section 3 discusses the model of efficiency measurement. Section 4 describes the data and Section 5 reports the estimation results. In Section 6 we summarize the findings.

2 Organization of public employment service

Like many other European countries, Switzerland has undergone a severe recession in the beginning of the 1990s, with unemployment jumping from below 1% to more than 7% of the labor force. This shock has profoundly affected labor market conditions in a very short period of time as opposed to the previous oil shocks which also had a strong impact on the Swiss economy, but with unemployment spells of much shorter duration. This new state of affairs has led the Swiss Federal government to adjust its unemployment policy. From the second part of the 1990s, an ambitious active labor market policy aiming at faster re-integration of job-seekers into the labor market was launched. Several active labor market programs (ALMP) were organized by the public employment offices since 1996. The public employment service itself has undergone a deep transformation: in 1996, more than 2,000 local employment offices were merged into about 160 Regional Employment Offices. The objective of this reform was to provide more professional and efficient services to job-seekers and employers to lower structural unemployment.

Currently, Swiss public employment services are produced by joint efforts in which federal authorities supply operating funds and the cantons retain administrative control of local operations. The federal funding is related to the canton's size and the REO's performance. The latter is monitored by the federal authorities. It remains up to the cantons to decide whether the REOs' set of activities and organization type are responsive to the needs of the given locality, in order to lower the structural unemployment in the canton. Accordingly, substantial differences were

[2] Torgersen et al. (1996) consider the efficiency of Norwegian employment offices, but mainly to illustrate the use of their technique of ranking of efficient units.

indeed reported in the use of various active labor market programs among cantons and in the administrative organization of the REOs (Curti and Meins, 1999).

Before 1996, the role of public employment offices in Switzerland was limited mainly to the passive income maintenance of the job-seekers receiving the unemployment insurance (UI) benefit. The tasks of the offices were mainly administrative, confined to the calculation of unemployment insurance payments and control activities of effective job search of the registered unemployed. The efficiency of employment offices was evaluated with respect to the resources used and the number of activities performed (e.g., number of cases handled). Since 2000 the REOs are evaluated not with respect to their activities, but with respect to their results in lowering structural unemployment.

As part of the new unemployment policy and in order to control and improve their efficiency, the REOs must report the results of their activities to the Seco. The distinctive feature of the Swiss supervision system is that employment offices are not anymore evaluated with respect to the number of tasks performed but with respect to some pre-specified goals. The Swiss authorities recently implemented a financial framework designed to encourage employment offices to become more efficient. Beginning from 2001, offices achieving the best results are rewarded and from 2003 offices achieving the worst results will be sanctioned.

The goals of the REOs are explicitly given in the *Accord ORP/LMMT/Autorité cantonale* (2000). They are correlated with the number of persons in structural unemployment so that when the REOs improve their results, the structural unemployment should decrease, and *vice versa*. The four goals are aimed at reducing: 1) the mean REO's duration of unemployment; 2) the number of persons entering long-term unemployment (i.e. unemployment spells longer than 1 year); 3) the number of persons losing the entitlement to federal unemployment insurance (UI) benefit (i.e. who are unemployed for more than 2 years); and finally, 4) the number of persons re-entering unemployment in less than four months after having found a job.

Currently, Seco is evaluating the results of employment offices using simple ratio analysis. The four goals of REOs are valued differently by the Seco. The first goal was given the greatest importance with a weight of 0.5. The three remaining goals were given weights of 0.2, 0.2 and 0.1, respectively. However, in this paper, we opt for a method which does not constrain the weighting of REOs' result variables.

3 The model of efficiency measurement

This section begins with a description of the conceptual framework of the economic activity of the REOs. This framework leads us to the specification of a quantitative model to evaluate the technical efficiency of REOs.

3.1 Economic activity of Regional Employment Offices

The ultimate goal of employment offices is to match job-seekers with potential employers. The office cannot enforce the matching, but must confine itself to services that facilitate the final contracting by the parties themselves. By choosing the appropriate set of activities, e.g. contacting the employers on the local labor mar-

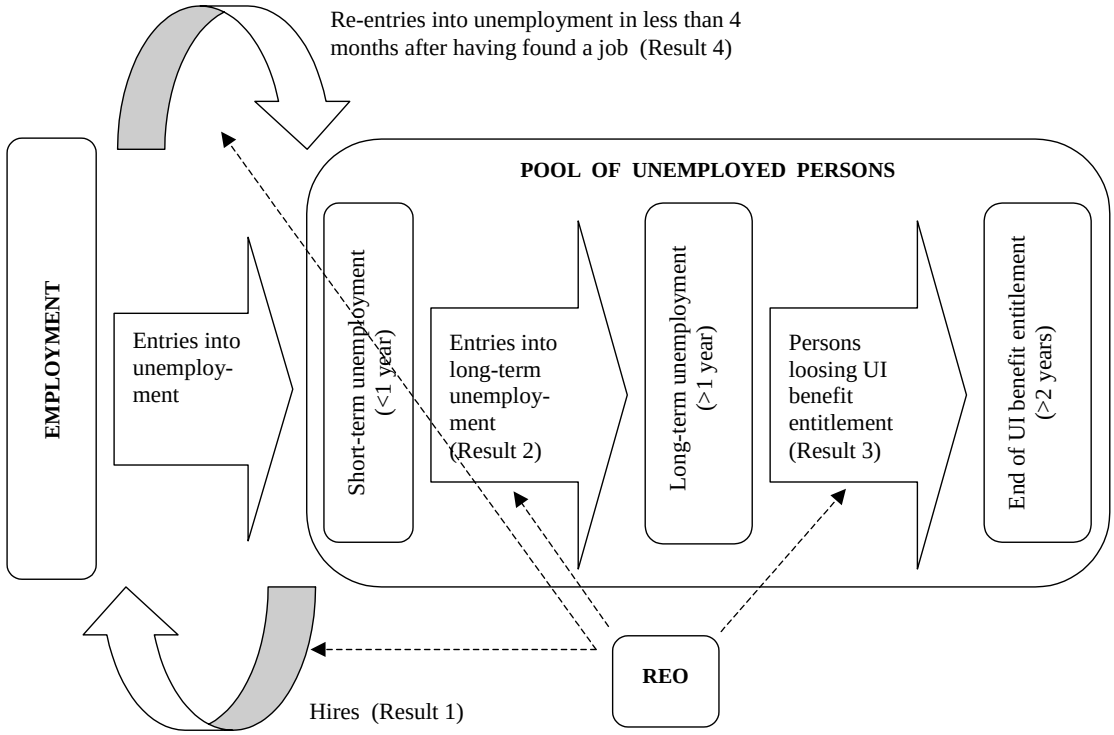

Figure 1: Economic activity of the Regional Employment Office. Transition flows that can be influenced by the REO are indicated by the dashed arrows.

ket, job councelling sessions with job-seekers, organization of the active labor market programs, financial sanctions, they can reduce the duration of unemployment and prevent re-entries into unemployment. The day-to-day activities of a REO are viewed as means to achieve its goals in the matching process.

The economic activity of REOs may be represented with the diagram in Figure 1. The pool of unemployed persons is formed by entries into unemployment mainly from employment. This flow of entries depends on the local economic conditions and may not be controlled by the REO. Therefore, at least in the short run, the number of unemployed in the local labor market is exogenous to the office. The employment office may influence the transition flows within the pool of unemployed persons and some transition flows in and out of unemployment.

The most direct way for a REO to reduce the number of job-seekers and the mean duration of unemployment spells is to increase the number of hires. We take the number of hires as the first result variable of REOs consistent with Seco's objective of reducing the mean duration of unemployment.

At the same time, as the number of hires increases, the offices have to avoid that the most disadvantaged job-seekers stay unemployed for long durations. In order to insure that the REOs do not concentrate their efforts on the job-seekers having the best individual hiring characteristics, Seco is also evaluating the office's performance in minimizing the number of entries into long-term unemployment and the number of unemployed reaching the end of UI benefit entitlement. These two variables are respectively our second and third result variables of the REOs.

Finally, in order to promote a durable labor market reintegration, the REOs have

to minimize the number of job-seekers who re-enter unemployment after a short spell of employment. This variable is our fourth result of the REOs. It may be viewed as an matching quality indicator of the office. To achieve their goal of a better matching between unemployed and vacancies, REOs are endowed with resources that will be discussed below.

3.2 Methodology

By technical efficiency of a production unit, we mean a comparison between observed and optimal values of its outputs and inputs. Koopmans (1951, p. 60) provided a formal definition of technical efficiency: a producer is technically efficient if an increase in any output requires a reduction in at least one other output or an increase in at least one input, and if a reduction in any input requires an increase in at least one other input or a reduction in at least one output. Thus, a technically efficient producer is located on the production frontier while a technically inefficient producer is located below this frontier.

If we are interested in increasing outputs rather than saving inputs, then a radial measure of technical efficiency introduced by Farrell (1957) is defined as the maximum equiproportionate increase in all outputs that could be achieved with the given amount of inputs. This measure gives an idea of the difference between observed and optimal values of outputs, or between observed values of outputs and the efficient production frontier. The goal of efficiency analysis is to estimate the production frontier and to compute the distance between the optimal point on this frontier and the actual values of outputs.

To estimate the production frontier, several possible econometric and mathematical programming techniques are available (Lovell, 1993). We analyze the efficiency of the REOs on the basis of deterministic non-parametric technique named Data Envelopment Analysis (DEA). DEA is a mathematical programming technique initiated by Charnes, Cooper and Rhodes (1978).[3] It has proved particularly useful when evaluating efficiency of public services since it requires no information on the prices of inputs and outputs (that are often unavailable for public goods) and it captures all relevant information in whatever metrics. DEA places no parametric structure on the production frontier which is a valuable feature since little information is available on the REOs' "production technology".

DEA estimates a multivariate production frontier by forming a piecewise-constant envelope of the cloud of data points in the inputs/outputs space. Therefore, the efficiency of a producer is measured relative to the efficiency of all the other producers. The assumption of variable returns to scale allows the cloud of data points to be enveloped as tightly as possible. Suppose we have n REOs, each of them consuming p inputs and producing q outputs. The output increasing efficiency measure E_O for the office O equals the inverse of the optimum value of the linear programming

[3]See the reviews of the methodology in Seiford and Thrall (1990) and Ali and Seiford (1993).

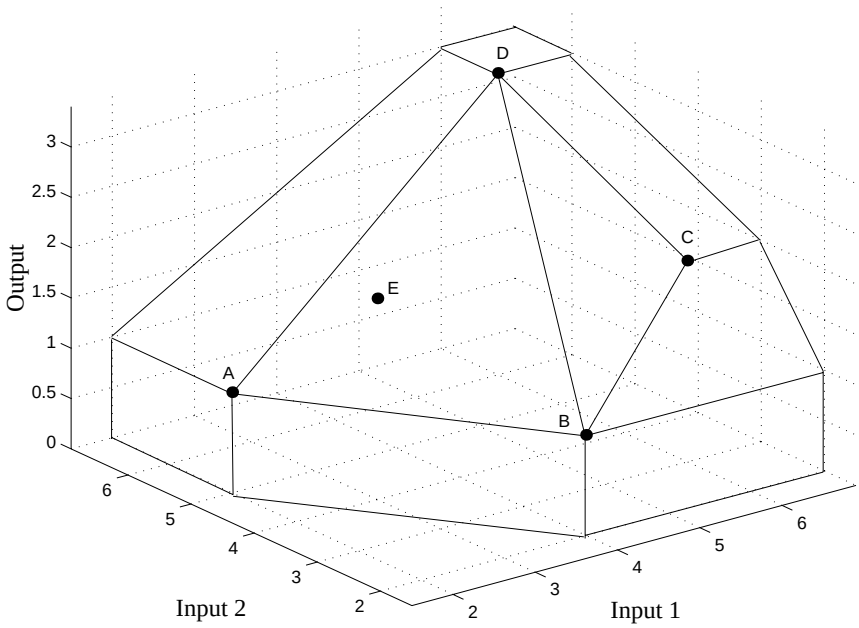

Figure 2: DEA-VRS envelope. Offices A, B, C and D are efficient. Office E (lying below the envelope) is not efficient: it could increase output given its use of inputs.

problem below, i.e., $E_O = \lambda_O^{-1}$

$$\begin{aligned} \max_{\{\lambda_O,\gamma\}} \ & \lambda_O \\ \text{subject to} \ & \\ \lambda_O y_O - Y'\gamma &\leq 0 \\ -x_O + X'\gamma &\leq 0 \\ i_n'\gamma &= 1 \\ \gamma, \lambda_O &\geq 0, \end{aligned} \tag{1}$$

where $X : (n \times p)$ matrix of the n observed input vectors, $Y : (n \times q)$ matrix of the n observed output vectors, $\gamma = (\gamma_1, \ldots, \gamma_n)'$ is a $(n \times 1)$ vector and i_n is a $(n \times 1)$ vector of 1's. $x_O : (p \times 1)$ and $y_O : (q \times 1)$ denote the vectors of inputs and outputs for the office O respectively. The program should be solved n times.

The efficiency measure (or score) E is equal to 1 if the producer is fully efficient and is smaller than 1 otherwise. It may be given the following interpretation: a score of 0.8 means that given the amount of the inputs consumed, the production unit produces only 80% of its maximum output level. Therefore, to be efficient with respect to at least one output, it has to increase its actual outputs' levels by a factor of $1/0.8 = 1.25$, i.e., by 25%, keeping inputs constant.

The solution value $\gamma = (\gamma_1, \ldots, \gamma_n)'$ indicates whether office i $(i = 1, \ldots, n)$ serves as a peer for office O. The offices that are peers define where the part of the frontier relevant to O is and hence define efficient production for O. The efficient production for O is the linear combination of its peers where the weights in this linear combination are the elements of vector γ. For example, if $\gamma_i = 0$, then office

i is not a peer for O. However, if $\gamma_i > 0$, say $\gamma_i = 0.6$, then office i is a peer office with 60% weight placed on deriving the target efficient output and input level for office O. An efficient office has no peers. The number of times it is a peer for other offices gives the number of dominated offices.

The DEA piecewise-constant envelope is illustrated in Figure 2. We assume that five hypothetical offices use two inputs to produce a single output. Offices A, B, C and D are fully efficient—indeed, their output level cannot be increased without increasing the input consumption. Office E is inefficient, because it could produce more output with its current consumption of inputs.

3.3 Empirical strategy

We now turn to the issue of applying the DEA technique to the data from Regional Employment Offices. As depicted in Figure 1, the efficiency of REOs is to be measured with respect to their results in achieving a large number of transitions from unemployment to employment; a small number of transitions into long-term unemployment; a small number of people reaching the end of UI benefit entitlement and a small number of re-entries into unemployment. Therefore, the REOs have to manage four transition flows: one of them is to be maximized and the other three are to be minimized.

The DEA method requires definition of the inputs and outputs so that the inputs are to be conserved and the outputs are to be increased. In the REO setting, we cannot consider the raw results 2-4 as outputs. To be efficient, a REO has to decrease these variables rather than to increase them. Instead of developing either the reciprocals or proxies for the results 2-4 (which leads to possible non-linear transformations of the original data), we enter them in the DEA linear program as inputs rather than as outputs.

The proposed DEA program comprises one output to be maximized which is the number of transitions from unemployment to employment and five inputs. There are two types of inputs. The inputs of the first type are the result variables of REOs that are to be minimized—i.e., the number of transitions into long-term unemployment, the number of unemployed losing federal UI benefit entitlement and the number of re-entries into unemployment. The inputs of the second type are the "resources" of the REOs.

The public services provided by REOs are produced by labor and capital. Labor is the dominant cost component in placement service production. However, the labor input is not homogeneous. Employees working in REOs may be specialized in administrative tasks, computer support, tasks relative to active labor market programs or in job councelling involving the direct contact with the job-seekers. Furthermore, some of the job counselors are given specialized training possibly with a formal diploma (*brevet fédéral*). Finally, the job tenure of the counselors should be an important determinant of the knowledge of the local labor market conditions and should therefore influence the results of their activities.

It was only possible to get data on the number of REOs job counselors for the period analyzed. No information on the formal diploma was available. However, it may be argued that the job counselling is the main activity of REOs. The job counselors offer to job seekers vacant jobs available on the local job market, decide

Table 1: Result and resource variables of employment offices and DEA's inputs and outputs.

	Variable	Its type	Should be:	Enters DEA as:
1	Number of hires	Result	Maximized	Output
2	Number of entries into long-term unemployment	Result	Minimized	Input
3	Number of unemployed loosing UI benefit entitlement	Result	Minimized	Input
4	Number of re-entries into unemployment in 4 months after having found a job	Result	Minimized	Input
5	Number of REO's job counselors	Resource	Minimized	Input
6	Number of registered job-seekers with UI benefit entitlement	Resource	Minimized	Input

on the participation of the unemployed in the labor market programs and may apply sanctions (e.g., unemployment insurance benefit cuts) if the job seekers do not comply with the demands of the office. As job counselling is the central activity of the offices, the other tasks performed at the office are mainly intended to give to the job counselors the possibility to work in an efficient way. Assuming that the job counselors were given equal work conditions, the number of job counselors is then a reasonable proxy for the labor input of REOs. While more detailed information on the specific training of job counselors and the other staff employed at REOs would be quite valuable, we perform our analysis with the number of job counselors as a proxy for the REO's labor input.

For simplicity, capital in the form of office space and computer terminals is assumed to be proportional to labor input and, due to common standards, varies very little across offices. Strict complementarity of labor and capital on the input side is therefore a reasonable assumption. Consequently, efficiency in the use of labor is the main factor for productivity differences among offices and the capital input is not taken into account in this study.

In order to account for the fact that the number of unemployed per job counselor varies substantially among offices (cf. Section 4), we include the number of unemployed with UI benefit entitlement registered at the REO as the last input of REOs. Including this input into the DEA program also saves us from identifying as efficient REOs that saw a large number of unemployed find a job simply because of the larger size of the REO. The result and resource variables of employment offices and DEA program's inputs and outputs are summarized in Table 1.

Finally, we chose to apply the output increasing efficiency measure because of the importance given by the Seco to the number of hires. In addition, the number of registered unemployed and the number of job counselors (which enter the DEA on the input side) are not under the control of the office (at least in the short run). In the REOs context, the office's managers have more control over the DEA's output which is the number of exits from unemployment than over the DEA's inputs which include the number of registered unemployed and the number of job counselors. Therefore, the output increasing efficiency measure is more appropriate than the

input decreasing measure.

The proposed model of efficiency measurement has some drawbacks. They stem from the fact that both "resources" and results of the offices appear on the input side of the DEA program. First, since the result variables are introduced both as inputs and as outputs, no conclusion can be made relative to the scale efficiency of REOs. Therefore, no recommendation can be made on the optimal size of the offices.

The second point may be illustrated with the hypothetical case depicted in Figure 2. Let us suppose that the offices have one output to maximize (e.g., number of hires) and use only two inputs. Input 1 is the number of unemployed and input 2 is the number job counselors. DEA gives the same efficiency score of 1 to the offices A and B which have the same "output level". However, a simple computation shows that the exit rate from unemployment *per job counselor* is larger for the office A than for the office B. Hence, offices A and B should not be assigned equal efficiency scores. However, note that all offices producing the same level of output as A or B, but not lying on the DEA envelope will be assigned efficiency scores smaller than 1. Since these less efficient offices also have the rates of exit from unemployment *per counselor* that are smaller than those of A and B, the problem is not severe enough to compromise the model.

After computing the efficiency scores for all offices, we analyze how the efficiency of REOs is influenced by the exogenous operating conditions beyond the control of the office. The results of our estimations are presented in Section 5.

4 Data

Our data pertain to 156 Regional Employment Offices that operated during the period beginning in April, 1998 and ending in March, 1999 (i.e., 12 months). Most of the data were provided by Seco which uses them for supervision purposes. The data consist of monthly averages which allows to get rid of the cyclical fluctuations. We also completed our data set with some variables characterizing the heterogeneity of the labor markets among different cantons. These data consist of cantonal variables and originate from different official sources.

Some of the REOs were aggregated for different reasons such as a close complementarity of their activities or re-organization.[4] While rendering more difficult the interpretation of the results, aggregation has the advantage of making them comparable to those obtained in the ATAG Ernst and Young (1999) study. Aggregation reduces the number of offices to 137. Five additional offices were deleted from our data set due to missing values in the result or resource variables, thus reducing the number of observations to 132.

The variables used in this study may be separated in four distinct groups. The first group comprises the four variables measuring the REOs' results (see Section 3). The second group is the "resources" of REOs—i.e., the number of job counselors and the number of registered UI benefit recipients. The next group of variables are

[4]See ATAG, Ernst and Young (1999) for a more detailed description of the reasons of aggregation.

the REOs' activities. These include the number of days when UI benefits were cut off, the number of counselling sessions, the number of unemployed in intermediate earnings programs[5]and the number of active labor market programs organized by the office.[6]

Finally, the last group of variables describes the office's operating environment, i.e. the exogenous variables that influence the results of the office but cannot be influenced by the office itself (at least in the short term). This group is formed of the variables relative to the office (e.g., number of woman registered at the office) and of the variables relative to the canton (e.g., the unemployment rate in canton). Table A1 in Appendix reports the descriptive statistics for all available variables. The choice of cantonal variables are dictated by labor market considerations.

More information about the relations among these variables are obtained by performing the Principal Component Analysis (PCA) (see e.g. Saporta, 1990). The projections of the original variables on the factorial plans obtained with PCA are reported in Figure 5 in the Appendix. To compute these projections, we normalized all the variables except those relative to cantons by the number of UI benefit recipients registered in the REO in order to avoid the high correlation between the variables. However, the data set is still collinear.

To interpret Figure 5, note that if the angle between two variables projected on the factorial plan is close to 0, these variables have a strong positive correlation. If the angle is close to 90 degrees, there is no correlation and if the angle is close to 180 degrees there is a strong negative correlation. Variables projected near the center of the unit circle are badly represented on the factorial plan—therefore, care should be exercised in the interpretation of the relations of these variables with the others.

Limiting our analysis to the first three factorial axes allows to explain 52.07% of total variance in the data. The first, second and third axes explain 24.97%, 15.19% and 11.91% of total variance respectively. With so many variables, no clear interpretation can be given to the factors. However, some interesting relations do appear among the variables.

The PCA shows that the REOs that achieve a large number of hires (result 1) usually have a large number of re-entries into unemployment (result 4) and large numbers of entries into long-duration unemployment (result 2) and at the end of UI benefit entitlement (result 3). There is some evidence for a trade-off between the number of hires and the quality of the job found, on the one hand, and between the number of hires and the number of job seekers experimenting long durations of unemployment, on the other hand.

A high fraction of woman in REO is positively correlated with the fraction of job-seekers experimenting long unemployment spells (variable "woman" is projected near the results 2 and 3). It is negatively correlated with the number of hires. How-

[5]It consists of a wage subsidy for temporary jobs in the regular labor market that would otherwise not be taken up by the unemployed.

[6]The most frequently used ALMP are the courses to improve basic skills (aiming at improving the effectiveness of individual job search and self-esteem), language courses (mostly offered to non-Swiss unemployed), computer courses (basic word processing and spreadsheet usage), employment programs and subsidized jobs. These four programs represent approximately 85% of the total ALMP supply. The remaining 15% are the programs for young unemployed ("motivation semester"), incentives to independent activity, etc.

ever, women appear to re-enter unemployment less frequently than men. This may be due to their higher propensity to leave the labor market. As it could be expected, the higher unemployment rate in the canton where the REO is located is negatively correlated with the number of transitions to employment. The affiliation of job-seekers to economic sectors subject to cyclical variations of activity is positively correlated to the number of hires (result 1) as well as to the number of re-entries into unemployment (result 4). The following section gives more conclusive results on the relation among the performance of REOs and the exogenous variables.

5 Assessing the performance of Regional Employment Offices

In this section, the model of performance measurement introduced in Section 3 is applied to the Regional Employment Offices data described in Section 4. We first report the evidence of considerable variation in performance among REOs. We then examine the portion of measured inefficiency that is associated with some environmental factors beyond the control of employment offices.

5.1 Results on efficiency

The DEA problem presented in Section 3 was solved with the EMS software of H. Scheel (2000). The mean efficiency score is 0.8459. The standard deviation is 0.0906. The minimum efficiency is 0.5725 and the number of efficient offices is 15 (i.e., 11.36% of 132 aggregated or not aggregated offices analyzed). The efficiency distribution is illustrated in Figure 3 where offices are ranked from the lowest to the highest efficiency.

In order to assess the empirical validity of our model, we check that the DEA efficiency scores E are related to the REO's result and resource variables in a way consistent with the representation of the REO's economic activity given in Section 3.1.

Tobit[7] log-log regression results in Table 2 show that, other things equal, the DEA score increases with the number of hires and decreases with five other variables composing it (these variables were summarized in Table 1). Despite some collinearity problems, the pseudo R-square is high and all coefficients bear the expected sign and are statistically significant.

Among the 15 efficient REOs there are no offices that are efficient by default. An office would be efficient by default if, given the level of inputs it uses, there is no other office which uses similar levels of inputs but produces a lower output. This is basically a finite sample problem. For example, an office whose size is substantially larger or smaller than the size of all other offices will be identified as efficient by DEA. While being ascribed an efficiency score of 1, such an office could possibly improve its results. Therefore, care should be exercised in interpreting the efficiency scores for the REOs that dominate no other or few other offices.

[7] As the dependent variable is restricted to values between zero and one, Tobit regression is appropriate—see Section 5.3 below.

Table 2: Tobit log-log regression of efficiency score E on its components.

Variable	Coef.		St. Dev.
ln (nb of hires)	0.9841	***	0.0539
ln (nb of entries in long-term unemployment)	-0.0837	*	0.0425
ln (nb of persons reaching the end of UIB entitlement)	-0.0687	**	0.0331
ln (nb of re-entries into unemployment less than 4 months after having found a job)	-0.3951	***	0.0219
ln (nb of REO's job counselors)	-0.0921	***	0.0142
ln (nb of REO's registered unemployed entitled to UIB)	-0.2330	**	0.0898
Constant	-1.7764	***	0.3003
Ancillary parameter	0.0483	***	0.0032
n	132		
Pseudo R^2	0.8271		
Log$L$	-180.1897		
LR $\chi^2(6)$	232.9117		

*/**/***: Statistically significant at the 10/5/1 percent level.

However, the efficient offices with ID's 13, 24 and 45 dominate only 1, 2 and 3 other offices, respectively. Since these efficient offices were compared to very few other offices, their performance should be further checked on the case study basis because their efficiency score of 1 may reflect mainly the small sample problem rather than true efficiency. Other efficient offices dominate more than 5 other offices each. Finally, note that 3 of 15 efficient REOs are the aggregated offices. As it was mentioned in Section 4, aggregation of offices renders the interpretation of results more difficult.

In addition to the relative ranking of REOs, the DEA technique provides some specific guidance to the means for improving the performance of a particular REO. For example, the REO with the ID 3 was given the efficiency score of 0.8384. This score indicates that to be fully efficient, this office should increase the number of hires (result 1) by a factor of $1/0.8384 = 1.1928$ (i.e. a 19.28% increase), keeping constant the number of registered UI benefit recipients, offices' job counselors, entries into long-term unemployment (result 2), number of persons losing UI benefit entitlement (result 3) and the re-entries into unemployment (result 4).

To establish the efficiency score $E = 0.8384$, the office 3 was compared to the efficient offices with ID's 43, 47, 58 and 60 (its peers) that were given weights of 0.18, 0.01, 0.74 and 0.07, respectively. It may be that the performance of the REO 3 could be improved by examining these similar, but more efficient, offices carefully to discover what they are doing differently.

Finally, we computed the coefficient of correlation between the efficiency score and the size of REO as measured by the number of its registered UI benefit recipients. There is a positive correlation between these two variables, suggesting that REOs would gain in efficiency if they were of larger size. However, some caution is required in interpreting this statistical correlation. A graphical analysis not reported here show that this relation is not linear, meaning that there also exists a large number of small REOs that are very efficient. More importantly, several offices among the

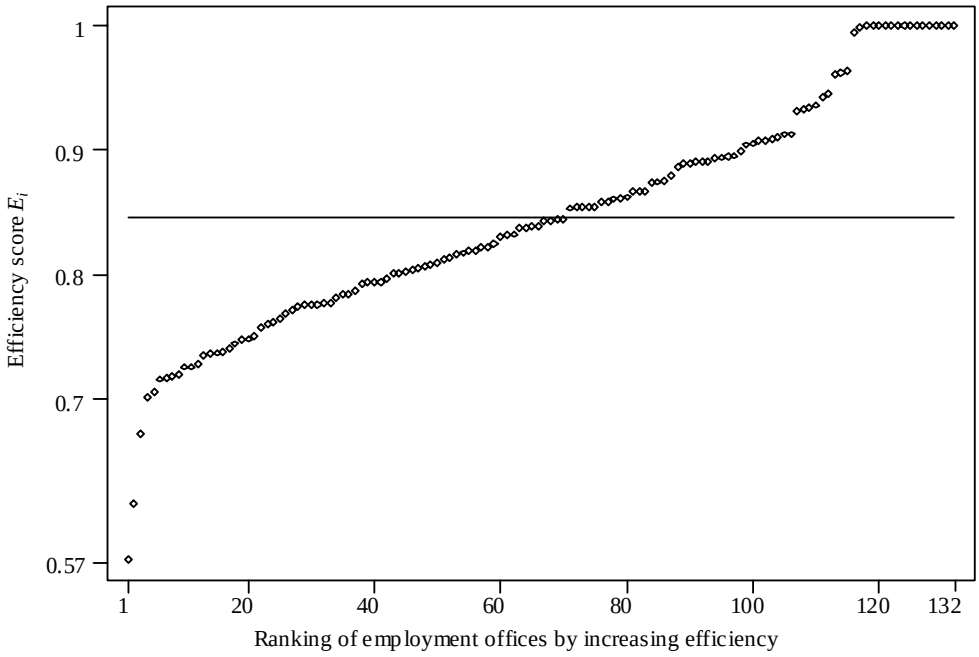

Figure 3: Output-oriented DEA-VRS efficiency scores (E); mean efficiency score $E_{\text{mean}} = 0.8459$ (horizontal line).

largest ones are the aggregated units, and we ignore whether they may be directly compared to the non-aggregated ones.

5.2 Determinants of inefficiency

We now ascribe the variations of efficiency scores across employment offices to the exogenous variables beyond the control of the offices. Our objective is twofold. First, we attempt to identify the exogenous factors that may explain a part of the variation of efficiency scores. Next, an efficiency score taking into account the influence of exogenous factors is proposed. The need for this new score stems from the fact that substantial regional differences in an office's operating environment render a direct comparison of the previously reported efficiency scores difficult. A new "corrected" score allows a *ceteris paribus* comparison of efficiency of employment offices operating under different external conditions, e.g. in different cantons and/or facing heterogeneous populations of job-seekers.

The usual approach to analyze the effect of the operating environment on efficiency is to regress the efficiency scores on the exogenous variables:

$$E_i = X_i'\beta + \epsilon_i, \quad i = 1, \ldots, n, \tag{2}$$

where X_i is the vector of exogenous variables associated to employment office i and to the canton where it is located (see Table A1 in the Appendix) and ϵ_i is a normally distributed error term. In order to prevent size effects, all the variables relative to REOs have been divided by the number of registered UI benefit recipients.

We go a step further and interpret the above equation as a decomposition of the efficiency score in a part explained by the operating environment, $X_i'\beta$, and a part explained by the managerial performance, ϵ_i. More precisely, the estimated residual

Table 3: Determinants of inefficiency

	OLS			Tobit		
Variable	Coef.		St. Dev.	Coef.		St. Dev.
Permit B	0.5567	***	0.2061	0.4801	**	0.1919
Permit C	-0.3574	***	0.1233	-0.2783	**	0.1162
Women	-0.7029	***	0.2204	-0.6573	***	0.2081
Part recipients	0.1252	**	0.0539	0.0993	*	0.0510
Women cant	1.9212	***	0.6950	1.9943	***	0.6468
Part-time cant	-1.5517	***	0.3269	-1.1369	***	0.3157
Constant	0.6226	**	0.2492	0.4901	**	0.2306
Ansillary parameter				0.0844	***	0.0057
n	129[a]			132		
R^2	0.3793					
Adjusted R^2	0.3488					
$F(6, 122)$ statistic	12.4327					
Pseudo R^2				0.2877		
Log$L$				-108.5912		
LR $\chi^2(6)$				48.5312		

*/**/***: Statistically significant at the 10/5/1 percent level.
a: REOs with ID's 27, 45 and 112 excluded from analysis as outliers.

$\hat{\epsilon_i}$ is the deviation from the mean managerial performance that would be observed in a given environment X_i. If $\hat{\epsilon_i} > 0$ ($\hat{\epsilon_i} < 0$), the REO's managerial efficiency is higher (lower) than the mean efficiency that would be observed in the environment X_i, and if $\hat{\epsilon_i} = 0$, the efficiency is equal to the mean efficiency in the given environment. The ranking of employment offices from the lowest to the highest estimated residual $\hat{\epsilon_i}$ gives the idea of their relative performance and it takes into account, *ceteris paribus*, the heterogeneity in their operating environment.

As the dependent variable is restricted to values between zero and one, equation (2) is usually estimated by means of a Tobit regression. While being satisfactory for the explanatory purposes, Tobit regression is inappropriate for the prediction purposes. Indeed, as many authors have reported, the estimated residual $\hat{\epsilon_i}$ obtained from a Tobit model is a biased estimate of the true residual ϵ_i.[8] It is possible to overcome the problem of truncation of the dependent variable E_i by applying a ranking procedure of efficient units (i.e., employment offices with unit efficiency scores) initially proposed by Andersen and Petersen (1993). They note that the efficiency scores for efficient firms equal one, only the inefficient units can be ranked on the basis of the DEA scores. Andersen and Petersen (1993) rank the efficient units by measuring the distance from the efficient unit to a frontier, based on a set of observations which excludes the efficient unit in question (see also Lovell et al., 1994, for an application). In their method, the most efficient unit is the one that can proportionally reduce outputs relatively the most without becoming inefficient.[9] In the Andersen-Petersen DEA model, inefficient observations are assigned the same

[8]See e.g. Greene (1997), p. 963.

[9]Wilson (1995) observes that the Andersen-Petersen measure is also suitable for detecting outliers in DEA.

efficiency score as in the DEA of Section 3.2, i.e. $E_{APi} = E_i$, where E_{APi} denotes the Andersen-Petersen score. These scores conserve their standard interpretation. For efficient observation, the Andersen-Petersen efficiency scores may be equal or larger than one. The interpretation of scores larger than one is still the same as for the standard Farrell measure: the office with a score e.g. $E_{APi} = 1.2$ may decrease its output vector proportionally up to a factor of $1/1.2 = 0.8333$ and remain efficient, but it will be dominated by other offices if the proportional decrease in the output vector exceeds 0.8333. As noted by Wilson (1995, p. 33), it is possible that E_{APi} cannot be computed for some observations under variable returns to scale technology. For these units (that are three in our sample), we arbitrarily set the Andersen-Petersen score E_{APi} to one.

Since the scores E_{APi} are no more truncated to one, we may now estimate equation (2) by OLS where we substitute E_i by E_{APi}. To guarantee a small variance in the prediction of regression residuals $\hat{\epsilon_i}$ and to remedy the collinearity problem present in the data we reduce the number of explanatory variables by backward deletion to obtain a parsimonious model with statistically significant covariates and the highest R-square. The resulting model is reported in the first three columns of Table 3. The last two columns of the same table show, for the purpose of comparison, the coefficients for the equation (2) estimated by maximum likelihood Tobit technique with the dependent variable truncated at one.

Four variables relative to employment offices and two variables relative to cantons where these offices are located explain 34.88% of the variance in the dependent variable, according to OLS regression. The interpretation of the factors affecting the efficiency of employment offices is not straightforward, especially if we recall that our initial data set was characterized by important collinearity. While no collinearity persists in the model in Table 3, we highlight the meaning of the reported relations between explanatory variables and efficiency scores by mentioning how these variables are related to other variables that are not in the model, but nevertheless affect efficiency.

The fractions of foreign workers with yearly B and permanent C work permits among the job seekers registered at the employment office affect efficiency in opposite directions. From a detailed analysis of relations among the explanatory variables not reported here for reasons of space, we know that both groups of foreign workers have lower skill levels than the Swiss.[10] However, the foreign work force is concentrated in different economic sectors, according to the type of work permit. Foreigners with yearly work permits often work in economic sectors that are subject to cyclical fluctuations of activity, while the opposite is true for the established foreigners. Workers in cyclical sectors experience the shortest unemployment spells (see Section 4). Therefore, the lower education seems to be more than compensated by employment in economic activities with high turnover for the foreigners with yearly work permits, thus improving the efficiency of the employment offices where an important number of such job-seekers is registered. In the case of established foreigners, the lower education component seems to dominate the effect on efficiency. Hence, the proportions of foreigners registered in a REO account for at least two

[10] This is a well known feature of the Swiss labor market. It is due to the past immigration policy when the work permits were delivered mainly for unskilled or low skilled jobs.

effects: the effect of job-seeker's education on REO's efficiency and the effect of economic sector where they work. Next, the existence of some discriminating behavior in the Swiss labor market may aggravate the difficulty of reinserting foreign workers.[11]

The employment offices with a high fraction of women among the registered job seekers were found to be less efficient. From Section 4, we know that women have longer unemployment durations than men. At the same time, they re-enter unemployment after a short employment spell less frequently than men. This result is hard to explain: it could be argued that either the employment office's dedication into the placement process is weaker for women, or women's motivation to re-integrate employment is less than that of male job-seekers, or both.

The employment office's efficiency improves as the share of registered job-seekers not entitled to federal unemployment insurance benefit increases. Hence, job-seekers without entitlement to UI benefits[12] have, on average, better labor market characteristics or a stronger motivation than unemployed entitled to UI benefit.

We now turn to the cantonal variables characterizing the local labor market where the employment office operates. A higher fraction of women employed in the canton shows the opposite effect to what we found for the fraction of women registered at the office. Cantons with more women in the labor force may have greater labor market flexibility.

Finally, a higher fraction of part-time workers in the labor force of canton has a negative impact on the efficiency of employment offices located in this canton. This result is not entirely new: in an analysis of micro-economic duration data, Sheldon (1999b) found that the unemployed searching for a part-time job are at higher risk of long-term unemployment.

It could be questioned whether the operating environment has the same impact on the efficiency of employment offices located in the lower and upper tails of the efficiency distribution. A straightforward way to answer this question is to split the sample of employment offices by e.g. the mean efficiency point and to run an OLS regression on each of the two sub-samples. However, this procedure implies an important loss of degrees of freedom. Therefore, we prefer to run the 0.25 and the 0.75 quantile regressions on the whole sample. Results are reported in Table 4.

Notice the difference in the quality of fit (as evaluated by the pseudo R-square) between the two regressions. Accordingly, while five out of six explanatory variables remain statistically significant in the 0.75 quantile regressions, only two variables conserve significance at the 5% level in the 0.25 quantile regression. Hence, the impact of operating environment is of more importance for the highly efficient offices than for the low efficient ones. This result is quite sensible: the highly efficient REOs may already have reaped nearly all the productivity gains from improving their managerial efficiency. The efforts of further improvement could be limited by the operating environment, which highlights why the exogenous variables are of

[11] See de Coulon (1999) and Flückiger and Ramirez (2000).

[12] The reasons for not being entitled to UI benefits can be various: people who register as unemployed but were not working before (e.g., having just finished their education or re-entering the labor force after a period of inactivity, or returning from abroad) typically have not paid any UI contribution and do not receive UI benefit. Also, UI is not compulsory for some self-employed. People quitting their job have to wait a certain period of time before being entitled to benefits.

Table 4: Quantile regressions of efficiency score E_{APi}

	0.25 quantile			0.75 quantile		
Variable	Coef.		St. Dev.	Coef.		St. Dev.
Permit B	0.7017	**	0.3010	0.4363	***	0.1595
Permit C	-0.2971	*	0.1727	-0.3742	***	0.1067
Women	-0.6310	**	0.2604	-0.8714	***	0.1919
Part recipients	0.1355	*	0.0710	0.1621	***	0.0447
Women cant	1.4004		0.9357	0.6948		0.5718
Part-time cant	-0.6482	*	0.3835	-1.1519	***	0.3137
Constant	0.0470		0.3557	1.1166	***	0.1862
n	129^a			129^a		
Pseudo R^2	0.1134			0.2850		

*/**/***: Statistically significant at the 10/5/1 percent level.
a: REOs with ID's 27, 45 and 112 excluded from analysis as outliers.

such importance. On the other hand, it could be that the low efficiency offices may accomplish important productivity gains without hitting yet the limits imposed by external factors. Hence, these factors play a less important role.

5.3 Efficiency scores corrected for the operating environment

We now proceed by computing a new efficiency score that takes into account the effect of exogenous variables. This corrected score noted as E_{Ci} equals the estimated residual $\hat{\epsilon}_i$ of the OLS regression model in Table 3. As compared to the DEA scores E_i, the corrected scores E_{Ci} have zero mean. While taking into account the operating environment, the standard DEA interpretation is lost. No more peers may be identified nor the interpretation of the score as the percentage of the maximum output level is conserved. However, the useful feature of the corrected score is to allow a ranking of employment offices from the lowest to the highest efficiency, accounting for the differences in the exogenous conditions beyond the control of employment offices. Hence, a direct comparison of the efficiency of employment offices servicing different segments of Swiss labor market becomes easier.

The distribution of corrected efficiency scores is illustrated in Figure 4. In order to facilitate the comparison between the relative ranking of REOs obtained with the ordinary DEA scores E_i, the employment offices in Figure 4 are sorted in the same order than in Figure 3. The increasing trend given by the DEA scores E_i is still conserved. Also, REOs that are above the horizontal line have better ranks according to E_i than those below the horizontal line representing the mean corrected score E_{Ci}. Thus, correction for the exogenous environment did not induce dramatic changes in the relative efficiency ranking of employment offices. This conclusion is further confirmed by the correlation coefficient of 0.92 (0.79 if three outliers are dropped out) between the ordinary DEA and corrected efficiency scores. Also the rank correlation coefficient of Spearman and the Kendall's τ are positive and significant (0.80 and 0.62, respectively). This finding means that even after taking into account the exogenous variables, the inefficient offices still have about the same peers than those

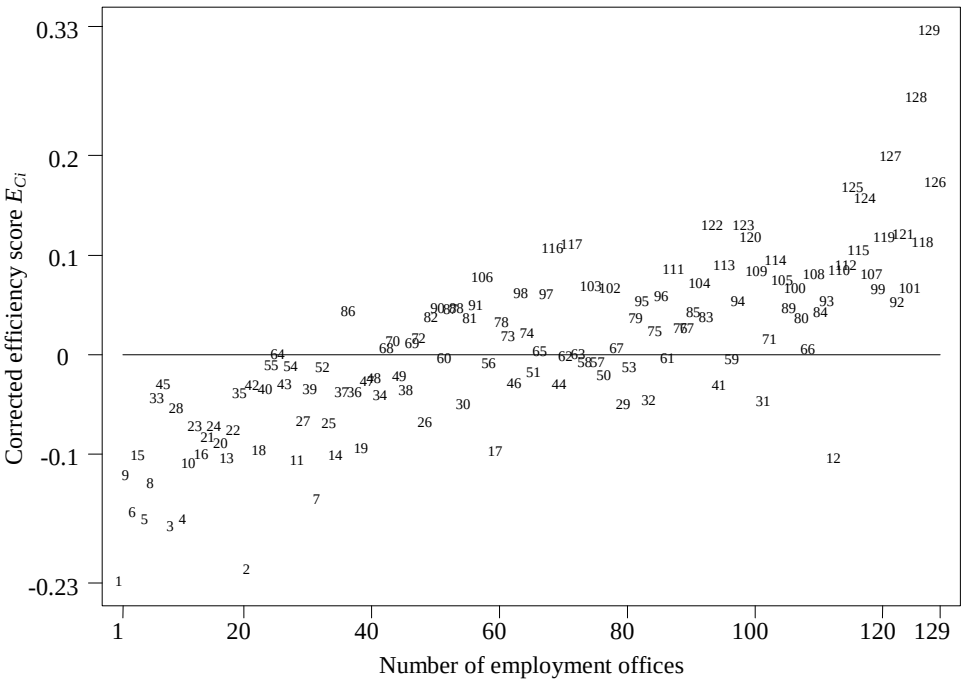

Figure 4: Efficiency scores (E_{Ci}) corrected for the operating environment. Plotting symbols: rank according to the increasing order of corrected score E_{Ci}. Outliers with ID's 27, 45 and 112 with corrected scores (E_{Ci}) of 0.6256, 0.6820 and 1.0897, respectively, are not shown on the graph.

identified by the DEA.

Finally, let us consider the question of how the activities of employment offices that comprises both disciplining measures and supportive actions influence their corrected efficiency scores. Table 5 presents the results from running an OLS regression of corrected efficiency scores E_{Ci} on the four REO's activity variables available to us. None of the coefficients is statistically significant, nor is the regression as a whole (see the Fisher's F-test). The following interpretation may be offered to this finding: employment offices operate under very different exogenous conditions. As mentioned in Section 2, substantial differences were reported in the use of supportive actions and disciplining measures among different REOs. We may conjecture that in order to organize their activities in the way they judge the most adequate to the local labor market conditions, REOs have selected very specific sets of activities that would be inappropriate in other operating environments. Thus, it is possible that there exists no systematic relationship between the efficiency and the use of a particular activity that would be common to all offices.

We can further conjecture that all employment offices' activities are at their optimal level, so that both an increase or a decrease in their use would deteriorate the efficiency. In such situation, the relations between the explanatory and the dependent variables should exhibit a quadratic pattern allowing for a maximum. We test this hypothesis by regressing the corrected scores on the squared values of activity variables. Since the regression's coefficients remain insignificant, the hypothesis is rejected.

Table 5: Effect of activity variables on the corrected efficiency score E_{Ci}, OLS regression.

Variable	Coef.		St. Dev.
UIB cut	0.0722		0.0573
Sessions	-0.1506		0.1236
Int earnings	-0.0985		0.1343
ALMP	-0.2958		0.1802
Constant	0.1371	**	0.0585
n	132		
R^2	0.0455		
Adjusted R^2	0.0154		
$F(6, 122)$ statistic	1.5123		

*/**/***: Statistically significant at the 10/5/1 percent level.

6 Conclusions

The Swiss authorities are implementing performance-based budgeting for public employment service to lower structural unemployment. Performance measurement of Regional Employment Offices is necessary to reap the full rewards of performance-based budgeting. Efficiency measures encourage employment offices to improve their performance because this information makes them more accountable to the authorities.

To estimate the relative technical efficiency of Regional Employment Offices in Switzerland between April 1998 and March 1999, we used non-parametric Data Envelopment Analysis technique. We found mean inefficiency on the order of 15% of best observed performance, which gives the idea of the magnitude of possible improvement as to the number of hires, and we established a relative ranking of employment offices from the lowest to the highest efficiency.

We then ascribed the variations in efficiency scores to the external operating environment beyond the control of REOs and to the variables describing the REOs' activities. Some socioeconomic characteristics of the local labor market explain nearly one third of the variation in performances of employment offices. Also, a new ranking of employment offices taking into account differences in their operating environment was obtained.

Our evaluation approach and the ranking of Regional Employment Offices may easily be interpreted by policymakers and managers of REOs and provides guidelines for raising the efficiency of public employment service. For each inefficient employment office, a set of similar, but more efficient offices was found. The performance of inefficient offices could be improved by discovering what these similar, but more efficient offices are doing differently.

Raising the efficiency of employment offices can lead to substantial gains in the fight against unemployment. Simple calculations show that, if all REOs were efficient, unemployment duration could be lowered by 15 percent.

The final remark concerns the possibility of substitution among inputs. Since the DEA inputs may either be the result or resource variables, an office may be

identified as efficient either because it minimizes e.g. the number of entries into long-term unemployment or because it achieves the same performance as to the output to maximize with a smaller number of job counselors.[13] From the political point of view, it may be more important to provide the REOs with the incentive to minimize the number of long-term unemployed rather than to minimize the number of job counselors. Hence, it may be interesting to further extend this research by using non-radial (directional) efficiency measures. These new efficiency measures will allow us to take into account the preferences and value judgements of policymakers in Switzerland. We plan to further investigate this issue in the future.

References

[1] Accord ORP/LMMT/autorité cantonale (2000). Seco, Berne.

[2] Ali, A.I. and L.M. Seiford (1993). "The mathematical programming approach to efficiency analysis", in The Measurement of Productive Efficiency: Techniques and Applications, eds.: H. Fried, C. A. K. Lovell and S. S. Schmidt, chap. 3, Oxford Academic Press.

[3] Andersen, P., and N. C. Petersen (1993). "A procedure for ranking efficient units in Data Envelopment Analysis", *Management Science* 39, pp. 1261-1264.

[4] ATAG Ernst and Young (1999). "Calcul des résultats des ORP compte tenu des facteurs d'influence exogènes", *Rapport Final*, version à l'intention du Seco et des directeurs des offices cantonaux.

[5] Cavin, E. and F. Stafford (1985). "Efficient provision of employment service outputs: A production frontier analysis", *Journal of Human Resources* 20, pp. 484-503.

[6] Charnes, A., W.W. Cooper and E. Rhodes (1978). "Measuring the efficiency of decision making units", *European Journal of Operational Research* 2, pp. 429-444.

[7] de Coulon, A. (1999). "Four essays on the labor market assimilation of immigrants in Switzerland". Ph.D. Thesis No. 494, Department of Economics, University of Geneva.

[8] Curti, M. and E. Meins (1999). "Politique suisse du marché du travail: différences résultant de sa mise en application au niveau du service le l'emploi", *La Vie économique—Revue de politique économique* 2/99, pp. 64-70.

[9] Farrell, M.J. (1957). "The measurement of productive efficiency", *Journal of the Royal Statistical Society*, Series A, General, 120(3), pp. 253-281.

[13] See Figure 2—input 1 is say the number of entries in long-term unemployment and input 2 is the number of job counselors: office A is as efficient as B.

[10] Flückiger, Y. and J. Ramirez (2000). "Analyse des salaires entre les hommes et les femmes sur la base de la LSE 1994 et 1996", Report No. 10, *Observatoire universitaire de l'emploi*, University of Geneva.

[11] Greene, W.H. (1997). "Econometric analysis", Third edition, Prentice-Hall International, Inc.

[12] Heckman, J.J., R.J. LaLonde and J.A. Smith (1999). "The economics and econometrics of active labor market programs", in: Ashenfelter, O.C. and D. Card (eds.), Handbook of Labor Economics, Vol. 3A, Elsevier Science B.V., Amsterdam.

[13] Koopmans, T.C. (1951). "An analysis of production as an efficient combination of activities", in T.C. Koopmans, ed., *Activity Analysis of Production and Allocation*, Cowles Commission for Research in Economics, Monograph No. 13. New-York: John Wiley and Sons, Inc.

[14] Lovell, C.A.K. (1993). "Production frontiers and productive efficiency", in The Measurement of Productive Efficiency: Techniques and Applications, eds.: H. Fried, C.A.K. Lovell and S.S. Schmidt, chap. 1, Oxford Academic Press.

[15] Lovell, C.A.K., L.C. Walters, and L.L. Wood (1993). "Stratified models of education production using DEA and regression analysis", in Data Envelopment Analysis: Theory, Methods and Applications, eds.: A. Charnes, W.W. Cooper, A.Y. Lewin and L.M. Seiford, New York: Quorom Books.

[16] Saporta, G. (1990). "Probabilités, analyse des données et statistique", Editions Technip.

[17] Scheel, H. (2000). "EMS: Efficiency Measurement System user's manual", *mimeo*, Operations Research und Wirtschaftsinformatik, University of Dortmund (available from `http://www.wiso.uni-dortmund.de/lsfg/or/scheel/ems/`).

[18] Seiford, L.M. and R.M. Thrall (1990). "Recent developments in DEA: The mathematical programming approach to frontier analysis", *Journal of Econometrics* 46(1/2) (October/November), pp. 7-38.

[19] Sheldon, G. (1999a). "The efficiency of public employment services: A non-parametric matching function analysis for Switzerland", *mimeo*, Labor Market and Industrial Organization Research Unit (FAI), Uiversity of Basle.

[20] Sheldon, G. (1999b). "Die Langzeitarbeitslosigkeit in der Schweiz: Diagnose und Therapie", Bern.

[21] Torgersen, A., F. Forsund and S. Kittelsen (1996). "Slack-adjusted efficiency measures and ranking of efficient units", *Journal of Productivity Analysis* 7, pp. 379-398.

[22] Wilson, P. W. (1995). "Detecting influential observations in Data Envelopment Analysis", *Journal of Productivity Analysis* 6, pp. 27-45.

Appendix

Table A1: Descriptive statistics for Regional Employment Offices (monthly averages of variables for the period April, 1998—March, 1999)

Variable and description	Mean	St. Dev.	Min.	Max.
REO's result variables				
Result 1 Nb of exits from unemployment	150.70	121.36	15.92	897.33
Result 2 Nb of entries in long unemployment	26.05	28.29	1.33	254.00
Result 3 Nb of entries at the end of UI benefit entitlement	26.35	24.40	2.08	152.42
Result 4 Nb of re-entries into unemployment in 4 month after having found a job	12.16	11.24	0.75	83.25
REO's activity variables				
UIB cut Nb of days when UI benefits were cut off	332.94	272.14	8.33	1348.75
Sessions Nb of counselling sessions	238.19	244.95	11.83	2047.83
Int earnings Nb of unemployed in intermediate earnings program	286.18	232.83	2.58	1610.50
ALMP Nb of active labor market programs organised by REO	260.37	191.07	7.50	994.67
REO's resource variables				
Recipients Nb of UI benefit recipients	1048.07	1027.70	74.00	8945.25
Counsellors Nb of job counsellors	15.45	12.97	0.42	95.17
Exogeneous variables				
– *Relative to REO*				
High position Nb of UI benefit recipients who had a high position in last job	602.61	725.90	36.67	6742.75
Swiss Nb of Swiss UI benefit recipients	573.88	539.18	42.33	4752.50
Permit B Nb of foreign UI benefit recipients with yearly residence permit	133.40	127.99	6.92	952.17
Permit C Nb of established foreign UI benefit recipients	310.11	343.81	11.17	2943.33
Permit A Nb of foreign UI benefit recipients with saisonal residence permit	29.68	46.23	0	297.58
Permit O Nb of foreign UI benefit recipients with other residence permit	1.01	1.53	0	12.58
Cyclical Nb of UI benefit recipients who worked in the economic sectors subject to cyclical fluctuations	250.96	231.84	22.67	1398.58
Invalid Nb of UI benefit recipients with invalidity rent	28.36	26.08	0.92	200.25
Women Number of woman	482.83	512.97	24.08	4732.75
Part recipients Ratio nb of job-seekers/nb of UI benefit recipients	1513.49	1530.13	90.58	13623.67
– *Relative to canton*				
U-rate cant Unemployment rate in 1998	3.73	1.20	0.82	6.34
Tertiary cant Fraction of job-seekers working in service sector	0.69	0.07	0.55	0.83
Women cant Fraction of woman in labor force	0.41	0.01	0.38	0.43
Part-time cant Fraction of part-time workers	0.26	0.03	0.18	0.30
Foreign cant Fraction of foreign workers	0.24	0.08	0.13	0.46
Cross-border cant Fraction of cross-border commuters	0.03	0.05	0	0.19
Vacancy cant Ratio nb of vacancies/nb of registered unemployed	0.11	0.07	0.05	0.32

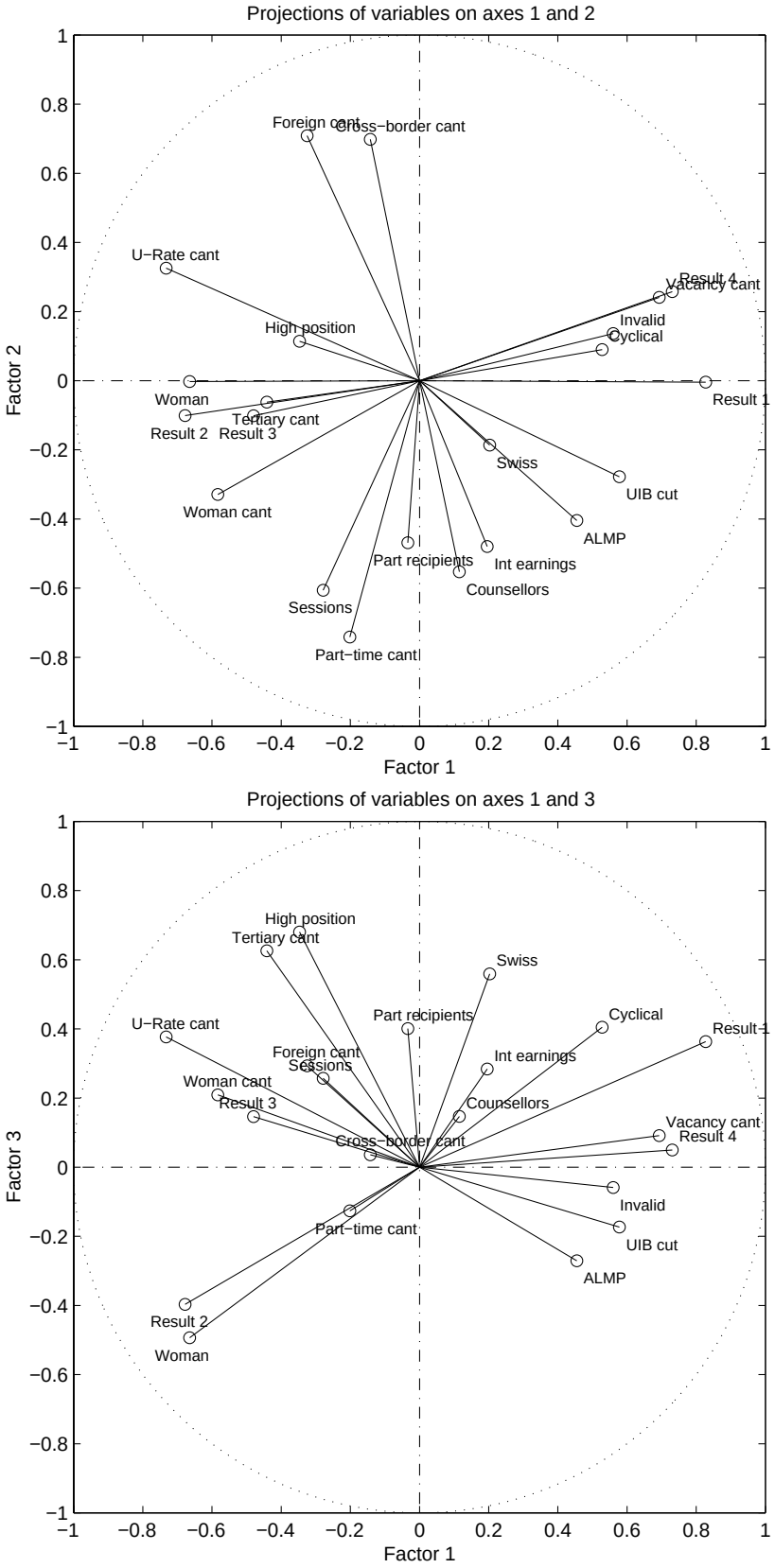

Figure 5: Principal Component Analysis: projections of the analyzed variables on the factorial axes 1 and 2 (top panel) and 1 and 3 (bottom panel).