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Statistically assisted programme selection – International experiences and potential benefits for Switzerland

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Statistically Assisted Programme Selection – International Experiences and Potential Benefits for Switzerland

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1. INTRODUCTION

Active labour market policies consist of a variety of programmes and schemes intended to support unemployed individuals in getting back to work. Besides traditional passive maintaining by means of unemployment benefits, many resources are put into these active measures that consist of placement services, counselling, training, and employment subsidies. However, many evaluations of active labour market policies have attested little effectiveness. It has been widely recognised that programmes have to be tightly targeted in order to be effective. The need for targeting unemployment services to specific groups that will benefit the most has become an important issue in recent years, especially in order to prevent waste of scarce public resources as well as to avoid macro effects by using labour market programmes on a large scale.

The allotment of unemployed into programmes is undertaken in different ways. Prevalently a caseworker decides about programme participation at his own discretion. In addition to that, different attempts to structure or assist this decision process in order to improve targeting of labour market programmes have been undertaken in several countries. These can be roughly classified into statistical and non-statistical approaches. Non-statistical methods use deterministic target groups defined by fixed characteristics such

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as long-term unemployed, young, or older persons, and give them privileged access to programmes. Others use a caseworker's discretionary structured rating of the employability of persons according to which they assign unemployed to further services. A short overview of these methods in different OECD countries is given in OECD (2002). Statistical methods for targeting unemployment services go one step further (see e.g. OECD, 1998). Australia and the USA started to allocate people to services according to a statistically based score; both systems are still in use. Korea uses a statistical system that produces advisory information for caseworkers. The UK and Canada have tested or considered statistical systems but rejected them for different reasons. Other countries are still in a testing or envisaging stage (e.g. Germany, Denmark, Finland, France, Ireland, Mexico, New Zealand, Sweden).

This study focuses on statistical programme allocation. A review of possible targeting strategies is given in SMITH and PLESCA (2001). The success of applying statistical methods depends crucially on their accuracy and ability to reflect the "real" mode of action of labour market programmes. Programme allocation in the Swiss system is at caseworkers' full discretion. The variety of available measures is huge, and the experience of caseworkers with them is limited as they have a limited number of clients and lack the possibilities to follow-up people once they leave the unemployment insurance system. A statistical system might be capable to assist and therefore improve this process by filling this information gap.

Considering the experiences of several countries as well as theoretical aspects, this paper examines advantages and disadvantages of the existing models and proposes an approach that is suited to the particular circumstances in Switzerland, incorporating the lessons learnt from past experiences in other countries. Besides theoretical properties, a particular emphasis is laid on suitability for potential implementation.

2. INTERNATIONAL EXPERIENCES

Statistical allocation algorithms for labour market programmes have already been tested or implemented in several countries with varied needs. These algorithms can be divided into two broader categories: *targeting* and *profiling* systems. *Targeting* systems deal with a variety of programmes and with hypothetical outcomes after participation in those programmes: for a specific person her or his labour market outcomes after participation in the respective available programmes are predicted, or when not participating in any programme. The programme, which maximises the expected outcome is chosen. If non-participation shows the highest predicted success, then no measure is offered to the person.

Profiling systems, in contrast to targeting systems, compute only one single score for each person and allocate persons into programmes according to the level of this score. The score is supposed to reflect the need of a person for intensive assistance in order to get back to work. This is usually equated with the risk of becoming long-term unem-

ployed when not receiving any assistance. Only people with a high score are allocated to more intensive and costly unemployment services.

2.1. *Conceptual Framework*

Consider an active labour market policy consisting of R different programmes, e.g. counselling, different kinds of vocational training, employment programmes (job-creation schemes) or employment subsidies. In principle, a person i could participate in any of those programmes $r \in \{1, \ldots, R\}$, realising an outcome Y_i^r afterwards. This outcome Y_i^r can represent any variable of interest (or a set of variables) associated with labour market outcomes, e.g. employment (1 for employed and 0 for unemployed) or earnings. After having participated in one of the programmes, a person will realise outcome Y_i^r corresponding to the programme she actually participated in, but hypothetically she could be in any of them. Together with the hypothetical outcome after not having participated in any programme, the $R+1$ potential outcomes $Y_i^0, Y_i^1, Y_i^2, \ldots, Y_i^R$ exist for person i. The statistical methods applied in different countries and presented in the next two sections deal with these hypothetical outcomes in very specific ways.

2.2. *Profiling Systems*

Profiling systems are based on duration or binary outcome models for unemployment. In practice, points are assigned to values of job seeker characteristics. Based on these points, a total score is computed for the risk of becoming long-term unemployed, which should reflect a person's need for more intensive assistance. Then a threshold is defined and people with a higher score than the threshold are assigned to programmes. The two basic stages of a profiling system hence consist of (1) a prediction of a person's need for assistance and (2) an assignment to services according to that prediction. It can be written as

$$S_i = E^*[Y_i^0 | Z = z_i] \tag{1}$$

$$A_i = 1(S_i \geq \underline{S}) \tag{2}$$

The score S is a measure for risk (e.g. duration of unemployment). It is some function based on an expectation of Y_i^0 (the potential outcome after not participating in any programme) derived according to a rule E^* defined by the policy maker who can observe the persons' individual characteristics z_i. Assignment to a programme (A) is made conditional on the value of the score; it takes place only if the score exceeds some threshold $\underline{S}$.

The measure for risk hence is equated with the need for or (at least) with the entitlement to more intensive assistance. Australia (DEETYA, 1998) and the USA (DICKIN-

SON, DECKER and KREUTZER, 1997) both have a long experience with profiling. In both countries, formal systems directly allocate people to unemployment services according to their computed score; there is no discretion of caseworkers. In both cases the probability of long-term unemployment is used as the criterion for being entitled and assigned to assistance. To avoid discrimination in access to public services, both countries omit certain characteristics when computing the profiling score (USA: sex, race, age, disability; Australia: sex, earlier family status).

The Job Seeker Classification Instrument (JSCI) in Australia was implemented in 1998 as a replacement of an earlier profiling instrument, which had been in force since 1993; only persons identified to have a high risk are entitled and referred to intensive assistance such as training programmes and wage subsidies. The Worker Profiling and Reemployment System (WPRS) in the USA was introduced in 1994; it covers reemployment services only, that is counselling, job search assistance, job placement, and similar services; referrals to training are not made on the basis of the profiling score.

Korea and the Netherlands also use profiling scores for dividing unemployed into categories according to their difficulties in the labour market. In Korea, the profiling score reflects the probability of long-term unemployment and is used as an additional information by the caseworker. In the Netherlands, the long-term unemployment risk measures the distance to the labour market and automatically defines the available measures for a person. The UK tested profiling, but decided not to use it as a practical instrument long ago, due to the poor performance of the econometric forecasts of long-term unemployment. Germany carried out a pilot project.

Not all countries disclose information about their econometric models behind the profiling mechanism. For Australia, the scores attributed to a specific characteristic are published but not the underlying model. There is no public information available about the profiling mechanism in Korea. In the USA, every state chooses its own model, most of them a logit model with a dependent variable "exhaustion of benefit entitlement period". In the Netherlands, a duration model with Weibull distribution for duration of unemployment was used originally (DE KONING, 1999), but this was changed recently, see OECD (2002).

2.3. Targeting Systems

While profiling is only a one-dimensional method, targeting is multi-dimensional. It is more sophisticated and accordingly requires more complex econometric methods than the profiling approach. Potential outcomes are estimated for a person for all the $R+1$ available programmes (including non-participation). According to these estimated hypothetical outcomes, persons can be assigned to the programme with the best chances of success. It can be summarised as:

$$S_i^r = E^*\left[Y_i^r | Z = z_i\right] \qquad r = 0, 1, \ldots, R \tag{3}$$

$$r^* = \arg\max_r (S_i^r) \tag{4}$$

S_i^r again defines a score which is supposed to reflect the expectation of the corresponding potential outcomes of a person in the case of participation in programme r. These expectations are built on the basis of a specific rule according to characteristics z_i observable to the policy maker. Two countries pursued the development of such a system: Canada and the United States. Both systems are based on parametric models, estimated by least squares (OLS) or logit regressions.

The Frontline Decision Support System (FDSS) in the USA is described in EBERTS and O'LEARY (2002). It is intended to assist the staff in the recently created one-stop service centres. Besides a systematic job search module, it also consists of a service referral tool that ranks different services according to their estimated effectiveness. This tool is the targeting part of FDSS. The available services consist of three groups: core, intensive, and training. The data used for the estimation of the statistical model consists of wage records from the unemployment insurance (UI) system, programme records from different sources, and local labour market information. Outcomes measured are quarterly earnings and employment. Explanatory variables are education and training, work experience, occupation/industry, age, family structure, military service, disability, local unemployment rates, and employment growth in industry. The first pilot-testing phase started in July 2002 in the state of Georgia.

The estimation procedure consists of two-stages. In the first stage, an "employability score" is estimated by a logit model, on the basis of prior values of exogenous variables; "employability" is given by a dummy for steady employment prior to programme participation. This score is interpreted as a summary of exogenous client characteristics. According to the score, five groups are defined, corresponding to its quintiles. In the second stage, impact estimates of alternative services are conducted for each group separately by OLS, controlling for observables. For each quintile, services are ranked by their effectiveness.

The frontline staff person in a Workforce Investment Act (WIA) one-stop centre enters the ID number of a client. FDSS groups the client into one of the five employability groups. The service referral tool lists different services according to their predicted effectiveness in getting the person back to steady work, which is defined as the percentage of former similar participants having two consecutive quarters with quarterly earnings exceeding $2,500 in the four quarters after seeking services.

Canada developed its Service and Outcome Measurement System (SOMS) from 1994 to 1999 (COLPITTS, 2002). SOMS was designed as a *support* system for service delivery staff. They still had full discretionary power and were not obliged to follow any recommendations of the system.

Available programmes were National Employment Service, wage subsidies, self-employment assistance, employment programmes, income supplements, and grants for

further education. In total, 22 different programmes were taken into account. The database used for estimating SOMS was composed of 19 different data sources including unemployment insurance, training administration, census data etc. It was completed in 1994 and was called the "Longitudinal Labour Force File". It contained all persons who were unemployed at least once after 1987. Four different outcome variables were defined: unemployment benefits received, earnings, weeks of employment, and probability of employment. As explanatory variables, programme participation, environmental and demographic variables, personal characteristics as well as past outcomes were used. For continuous outcomes a linear model was estimated by OLS, for the binary variable "employment" a logit model was chosen. Explanatory variables also included interaction terms between programme variables and other explanatory variables. They were included stepwise and kept in the model if they were significant at the 20 percent level. The estimates obtained from the linear or logit models were used to predict hypothetical outcomes for each person, each outcome, and each programme available (88 predictions for a person). Through comparison, the optimal programme could be chosen.

In the end, two major problems obstructed the implementation of the system: First, the introduction of the system coincided with a layoff of 5000 service delivery staff. The fear of the remaining staff of being replaced in the long run by the statistical system caused systematic disregard and refusal. Second, the creation of the Longitudinal Labour Force File was considered as a violation of privacy rules in Canada. After a discussion that went on for more than three years, the Privacy Commissioner finally forced the Human Resources Development to delete the SOMS database in May 2002. That was the definite reason for not implementing it. Table 1 summarises the features of these two systems.

Table 1: Comparison of the targeting systems in Canada and the USA

	Services	**Data used**	**Variables used**	**Estimation**	**Procedure**
SOMS (Canada)	22 programmes: National Employment Service, wage subsidies, self employment assistance, employment programmes, income supplements, grants for further education no training programmes	Longitudinal Labour Force File: combination of 19 different data sources of the Human Resources Development Canada: census data, training administration, unemployment insurance	*Explanatory variables*: Individual characteristics, interventions, providers *Outcomes*: unemployment insurance benefits, earnings, weeks of employment, probability of employment	OLS (for benefits, earnings, weeks of unemployment) Logit (for probability of unemployment)	System advisory only; no direct referral
FDSS (USA)	3 groups: *Core*: assessment interviews, resume workshops, labour market information, interviews for referral to other services *Intensive*: individual and group counselling, case management, aptitude and skill proficiency testing, job finding clubs, job search plans, career planning *Training*: basic skills education, on-the-job training, work experience, occupational skills training	UI wage records, programme records from different sources, and local labour market information	*Explanatory variables*: education and training, work experience, occupation/ industry, age, family structure, military service, disability, local unemployment rates, and employment growth in industry *Outcome*: steady employment, earnings	1st step: employability score (logit) 2nd step: OLS validated by matching	1. System first determines services for which a person is eligible (Unemployment Insurance, Welfare to Work, ...) 2. Quintile of employability is computed 3. Available services are ranked according to their effectiveness for the employability quintile and region. Referral to services is not directly done by system.

2.4. Profiling, Targeting, and Optimal Programmes

An optimal treatment $r^*(z)$ can be defined as the one which maximises the expected potential outcome of a person with characteristics z:

$$r^*(z) = \underset{r \in \{0,\ldots,R\}}{\arg\max}\, E[Y^r | Z = z]. \tag{5}$$

If the outcome is a vector of different possible outcomes, they can be weighted according to a utility function:

$$r^*(z) = \underset{r \in \{0,\ldots,R\}}{\arg\max}\ u(E[Y^r|Z = z]). \tag{6}$$

In the previous sections, two different ways of using statistical algorithms for allocating labour market programmes were examined: *profiling* and *targeting*. The quality and appropriateness of any method is defined by its capability to achieve the goals given by some social welfare criterion.

Countries chose the profiling approach mainly to determine which persons should be entitled to more intensive services at all. Those who are expected to be worst off are selected by the mechanism and assigned to programmes. The quality of this method depends first of all on the predictability of long-term unemployment by a statistical model. But furthermore it relies on the crucial assumption of a positive correlation between the effectiveness of programmes and the computed profiling score. And implicitly it is assumed that the programmes offered indeed have a positive effect relative to non-participation. Only these assumptions justify the allocation of the individuals with a high computed risk of becoming long-term unemployed to the intensive programmes.

The outcomes defining "effectiveness" of a programme are the result of a policy debate. An economic efficiency point of view suggests the improvement of future employment chances and reduction of unemployment duration as measures of effectiveness. From a fairness or equity point of view, improvements in the employment chances of the worst off should be given more weight. Experiences in Germany and the USA have shown that the profiling mechanism is not efficient in an economic sense, at least not for the programmes under consideration: in a model project in Germany, no positive effects of case management on the reemployment chances of people identified to be at risk of getting long-term unemployed were found (RUDOLPH and MÜNTNICH, 2001). In the case of Kentucky, BERGER, BLACK and SMITH (2000) find a relatively good predictability of long-term unemployment, but also do not find any evidence for programme effects and profiling scores being correlated.

The targeting method though does not rely on assumptions of this kind. It estimates not only employment chances for non-participation but also for participation in the different programmes. Insofar these tools have a much larger potential to improve efficiency of the policy as a whole (SMITH, 2003). The FDSS system in the USA can be seen as still very closely related to the profiling idea in the sense that groups are defined on the basis of their "employability"; within groups the same effectiveness of programmes is assumed. Canada's SOMS, on the other hand, purely dealt with hypothetical outcomes after programmes and was completely detached from the idea of any connection between programme impacts and employability measure. Practicability of the pure targeting approach, as uniquely used in Canada so far, depends on the accuracy of the estimation and prediction of the hypothetical outcomes on an individual basis. By paying enough attention to the underlying data and estimation strategy this approach is the most promising of all.

3. POTENTIALS OF A STATISTICAL SYSTEM IN SWITZERLAND

With the second revision of the unemployment insurance act in 1996, active labour market policy gained in importance in Switzerland. The *activation principle* was introduced, which made benefit entitlement beyond a certain period dependent on willingness and readiness to participate in labour market programmes. A variety of programmes were developed, and the total expenditures for active labour market policy increased rapidly. In 1999, the Swiss State Secretariat for Economic Affairs (seco) engaged several research groups for the evaluation of the effectiveness of the new programmes (see e.g. LALIVE, VAN OURS and ZWEIMÜLLER, 2002; GERFIN and LECHNER, 2002). The results show a mixed picture: certain programmes are found to be effective (subsidised interim jobs, see also GERFIN, LECHNER and STEIGER, 2002), others are found to be harmful.

This ineffectiveness could be due to poor-quality programmes, but it could also be the result of an inefficient allocation of people into programmes. LECHNER and SMITH (2003) gave the first evidence in this regard, showing that the caseworkers in charge of this allocation were not able to perform very well in 1998, the period under consideration. Reasons for this finding could be manifold: caseworkers would need advise or experience with the effectiveness of programmes for certain people. But they lack this, for the reason of the limited number of past job seekers with similar characteristics and because of their inability to follow-up after deregistration from placement office. Hence a caseworker has to build expectations about impacts of programmes on a very uncertain and notional basis. In addition, the whole system was changed completely in 1996. The newly created regional employment centres and the activation principle were unfamiliar to the caseworkers. Furthermore, the broad variety of programmes available in Switzerland makes it difficult to select the optimal strategy for a specific person, even though instructions for caseworkers might have improved in the meantime.

A statistical system to assist caseworkers in allocating people into labour market programmes thus could be potentially fruitful for Switzerland. As argued above, a targeting system seems to be a reasonable way. Practical reasons and circumstances in Switzerland support this view: the low unemployment rate in Switzerland allows to spend more resources in active labour market policy per person than in other countries suffering from high unemployment rates. In principle, every unemployed person is entitled to participate in courses or other programmes if needed to improve their employability. This entitlement and subsequent allotment has to be judged on a case by case basis: a computer course might enhance reemployment chances for a secretary who worked with a type writer in his last job, but it might be useless for a construction worker. A profiling score usually regulates access to general groups of services only. Whereas a targeting system allows to select appropriate measures directly.

3.1. Active Labour Market Policy in Switzerland

A person who becomes unemployed in Switzerland has to register at the corresponding regional placement office. The caseworker in charge might consider activation schemes for her after some time. His decision has legal power in the sense that if the unemployed refuses participation in a programme, sanctions can be imposed. The toolbox of active labour market programmes at the caseworker's disposal consists of training programmes and different kinds of wage subsidies. The general classification of active labour market programmes defines 43 different types, of which many are training programmes. Training can be grouped into basic, personality, language, computer, and vocational training courses. The main wage subsidy schemes cover primarily temporary work, in the form of (1) interim jobs within the regular labour market or (2) fixed duration employment programmes in a sheltered labour market. The latter can be further subdivided into (a) workplaces with a regular public or non-profit employer and (b) collective workplaces in facilities created particularly for this purpose.

3.2. Data

Data from the unemployment insurance (information systems for placement/labour market statistics and payments) combined with social security records are used in this study to estimate hypothetical outcomes and to simulate a reallocation of persons into programmes. The data set covers a subpopulation of unemployed on December 31, 1997 (79'273 individuals). Socio-economic variables and information about programme participation are taken from the information system for placement and labour market statistics and the payment system. Outcome variables on income and employment as well as the complete earnings and employment history in 1988–1997 were extracted from social security data. The focus of the study is the time between January 1998 and December 1999. For every person a "first programme" after January 1, 1998 is defined. All persons with evidence for earlier programme participation are excluded from the sample. Persons without any programme are defined as "nonparticipants" and assigned a hypothetical programme start date; those who already were employed at this hypothetical date are excluded from the sample (this procedure follows LECHNER, 2001). The sample was restricted to individuals aged 25 to 55 and entitled to unemployment benefits, and according to some further sample selection rules (described in Appendix A). The final sample for this study consists of 28'130 persons.

8 categories of programmes are defined: personality courses, language courses, basic computer courses, advanced vocational training, other courses, employment programmes at single workplace, collective employment programmes, subsidised interim jobs. The final data set covers all kind of information about job seekers and programmes. A small selection of variables is listed in Table 2.[1]

1. Comprehensive descriptive statistics can be found in an appendix available on the Internet.

Table 2: Selected descriptive statistics

	No programme	Personality course	Language course	Basic computer course	Further vocational training	Other courses	Employment programme at single workplace	Employment programme at collective workplace	Subsidised interim job
Number of persons	8520	1217	2518	2218	1434	469	2087	2087	7580
Female	0.43	0.46	0.55	0.51	0.35	0.29	0.38	0.41	0.42
Age	37.68	39.05	36.72	38.78	37.63	39.02	38.52	38.40	37.70
Qualification									
Skilled	0.58	0.62	0.32	0.76	0.62	0.68	0.53	0.41	0.56
Semiskilled	0.17	0.13	0.19	0.12	0.16	0.15	0.18	0.17	0.18
Unskilled	0.25	0.25	0.49	0.12	0.21	0.17	0.29	0.41	0.26
Work permit									
Yearly	0.15	0.12	0.36	0.06	0.15	0.08	0.17	0.21	0.15
Permanent	0.30	0.26	0.39	0.19	0.25	0.28	0.27	0.31	0.30
Swiss citizen	0.56	0.63	0.25	0.76	0.60	0.65	0.56	0.48	0.55
Employability									
No information	0.06	0.04	0.04	0.05	0.05	0.04	0.06	0.04	0.07
No further help necessary	0.02	0.03	0.02	0.03	0.02	0.01	0.01	0.01	0.03
Easy	0.15	0.15	0.10	0.19	0.17	0.17	0.14	0.09	0.17
Medium	0.57	0.58	0.57	0.61	0.59	0.60	0.58	0.57	0.60
Difficult	0.17	0.18	0.25	0.12	0.15	0.15	0.17	0.24	0.12
Special case	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.05	0.01
Prior unemployment duration[a)]	153.85	149.89	146.22	131.09	148.87	156.25	155.24	157.78	131.50
Monthly earnings in last job, CHF	3918	3940	3575	4175	4350	4560	3812	3473	4168
Month of programme start[b)]	2.86[c)]	4.05	3.81	3.94	4.57	5.71	6.09	6.11	4.76
Duration of unemployment at start	224.77	256.37	245.40	234.17	271.06	312.42	323.09	326.16	259.42

Notes: a) Duration of unemployment on 31st December 1997, b) 1 = January 1998, c) simulated date.

3.3. *Identification of Hypothetical Outcomes*

Crucial for the targeting approach is the estimation of the hypothetical outcomes on an individual basis: $E[Y^0|Z=z], E[Y^1|Z=z], \ldots, E[Y^R|Z=z]$. As described in the previous subsection, the available data is very informative on many individual characteristics. It contains most objective labour market relevant variables as well as caseworkers' subjective valuation of employability and therefore builds an almost unique basis for estimation. The data is about former participants in Swiss programmes who were allotted to the programmes mainly by caseworkers.

Caseworkers also seek to build expectations of the effectiveness of different programmes on the basis of their individual characteristics and allocate persons accordingly. Hence, the composition of participants in different programmes is not random, but varies significantly. That means that selection bias has to be dealt with. People actually found in a programme have different potential outcomes than those participating in other programmes: $E[Y^r] \neq E[Y^r|D=r]$, with D denoting the participation in a programme and $D \in \{0, \ldots, R\}$. Only the outcomes $E[Y^r|D=r]$ can be estimated from the data directly; the parameters of interest $E[Y^r]$ are not identified. Identification requires the conditional independence assumption (CIA) to hold:

$$Y^r \coprod D|X \qquad r \in \{0, 1, \ldots, R\}. \tag{7}$$

That is, identification is possible by conditioning on all characteristics X that jointly influence the programme participation decision and the potential outcome. X variables do not need to coincide with Z characteristics. Z is information upon which the expectations about the potential outcome shall be based. Hence, if these X characteristics are not already fully included in the Z characteristics, it is necessary to condition on both of them to obtain an estimate of potential outcomes:

$$E[Y_t^r|Z=z, X=x] = E[Y_t^r|Z=z, X=x, D=r]. \tag{8}$$

By integrating out X, the potential outcomes of a person with characteristics Z can be determined:

$$\begin{aligned} E[Y_t^r|Z=z] &= \int E[Y_t^r|Z=z, X=x] \cdot dF_{X|Z=z}(x) \\ &= \int E[Y_t^r|Z=z, X=x, D=r] \cdot dF_{X|Z=z}(x). \end{aligned} \tag{9}$$

Since X is multidimensional, this problem can be very demanding. It has been shown by Rosenbaum and Rubin (1983), Imbens (2000) and Lechner (2001) that in order to address selection bias it is sufficient to condition on propensity scores (given X)

$$p^r(x) = P(D=r|X=x). \tag{10}$$

This allows a significant reduction of the dimension, and the potential outcomes can be identified as follows:

$$\begin{aligned} E[Y_t^r|Z=z] &= \int E[Y_t^r|Z=z, p^r(X)=\rho] \cdot dF_{p^r(X)|Z=z}(\rho) \\ &= \int E[Y_t^r|Z=z, p^r(X)=\rho, D=r] \cdot dF_{p^r(X)|Z=z}(\rho). \end{aligned} \tag{11}$$

3.4. Estimation, Optimal Programme Choice, and Reallocation Simulation

In a first step, the estimation of the potential outcomes is conducted for every person in the data set and every possible programme. For this purpose a three-stage estimation procedure is chosen, which is described in Appendix B. As X variables all possible information that jointly influences caseworkers' allocation decisions as well as outcomes have to be included. This suggests the use of all information available such that the conditional independence assumption can be assumed to hold. The following *X variables* are used for addressing selection bias: age, gender, number of dependent persons, marital status, mother tongue, type of work permit, searching for part time work, information about regional placement offices, indicator for social norms, caseworker's rating about employability, qualification, position in last job, earnings in last job, unemployment duration, participation in short programmes in 1997, information about unemployment and employment history 1988–1997, information about earnings history 1988–1997, industry and occupation of last job and of desired job, region. Z variables in turn can be a subset of that information also. In practice the limit for Z variables is the information directly accessible in the information system of a regional placement office. The following *Z variables* are used as prediction characteristics: age, sex, civil status, mother tongue, type of work permit, nationality, qualification, position in last job, earnings in last job, unemployment duration at start of programme, number of unemployment spells 1996/97, region, occupation of last job, industry of last job.

The employment and earnings outcomes used are measured at 3 different points in time: 7, 12, and 17 months after programme start.

After having computed these potential outcomes, people are hypothetically reallocated according to them. In this way an allocation on the basis of a statistical targeting tool is simulated. Initially, for every person the "best programme" has to be designated. In order to avoid weighting of different outcomes by applying an arbitrary utility function over outcomes, 3 different simulations are chosen, with the relevant target variables: "employed" 7, 12 and 17 months after programme start, respectively. To determine the optimal programme, one could simply choose the maximum of all estimated values. However, this procedure would not take into account the statistical uncertainty associated with the estimates and therefore overestimate the gains. In addition to that it would not account for resource constraints in the supply of programmes.

To account for the uncertainty of the estimated outcomes, a multiple comparison with the best procedure according to HORRACE and SCHMIDT (2000) is chosen. It first picks out the best-predicted outcome and then defines a set of programmes that lead to an outcome not significantly worse than the best one.[2] All programmes in this set are not statistically distinguishable from the optimal programme.

To address resource constraints, an attempt is made to keep the original numbers of participants in the different programmes more or less constant. The reallocation is in the following way: In a first step, persons for whom a unique best programme was found were reallocated to the corresponding programme. The remaining persons are reallocated to one of the programmes in their sets of best programmes such that the final composition of numbers of participants in every group is approximately the same as the original one. The allocation of participants according to their potential outcomes in the end turns out to be different than the original one, see Table 3 columns 2a–c, depending on the underlying time horizon of 7, 12, or 17 months, respectively.

Employment programmes are generally the longest of all programmes, they have a duration of up to 6 months. Due to reduced search efforts while the programme is still going on – the lock-in effect – we thus expect possible positive impacts of the programme to be later in the unemployment spell. This indeed is reflected in the different allocation schemes. When defining the relevant target variable as 7 months after programme start, an employment programme has hardly a chance to be the most effective programme, and only a small number of persons is allotted to them. On the other hand, with respect to "employment after 17 months", even more persons are allotted to employment programmes than in the original allocation. In fact, the same pattern is found for all kinds of training programmes. However, the opposite effect can be found for subsidised interim jobs, whose positive short-term effects appear to be reduced in the longer run: with respect to employment after 7 months, subsidised interim jobs would be recommended for 34 % of all persons, while this figure shrinks to 27 % with respect to employment after 17 months.

By computing the mean of the hypothetical outcomes corresponding to the programme the person is reallocated to, the total outcome after reallocation is estimated. The results are given in Table 4 columns 2a–c. As a benchmark the outcomes with the actual programme allocation (column 1) as well as with a random allocation (column 3), where the original proportions of the number of participants in the various programmes are maintained, are given in Table 4.[3]

12 months after programme start, 49.8 % of persons are re-employed in the sample according to the actual allocation. A purely random allocation would have led to 49.5 %. With statistical targeting according to employment 12 months after programme start, the simulated employment rate is 57.7 %. Hence the employment rate could have

2. A significance level of 50 % is chosen for this purpose.
3. Other specifications and allocation regimes have also been examined.

Table 3: Simulated reallocation into programmes: composition of participants

	(1)	Allocation by potential outcome			(3)
	Actual allocation	(2a)	(2b)	(2c)	Random allocation
Composition of participants (%)					
Nonparticipation	30.3	41.5	29.1	22.7	30.3
Personality course	4.3	1.9	2.3	2.6	4.3
Language course	9.0	4.7	7.5	10.9	9.0
Basic computer course	7.9	4.6	6.5	8.0	7.9
Further vocational training	5.1	4.6	5.5	7.3	5.1
Other courses	1.7	2.0	4.3	4.4	1.7
Employment programme single workplace	7.4	3.7	5.6	8.4	7.4
Employment programme collective	7.4	3.4	4.3	8.7	7.4
Subsidised interim jobs	26.9	33.5	34.8	26.9	26.9
Total	100	100	100	100	100

Notes: Simulation of potential outcomes for all 28'130 persons. *(1) Actual allocation*: composition of participants in programmes actually found in the data. *(2a–c) Allocation by potential outcome*: optimal programme is determined by multiple comparison procedure for the computed potential outcome (2a) "employment after 7 months", (2b) "employment after 12 months", and (2c) "employment after 17 months"; significance level 50 %; persons are allocated to unique best programme if available, remaining persons are assigned such as to keep original composition constant. *(3) Random allocation*: People are reallocated randomly, keeping the original composition constant.

been 8 percentage points higher after one year. Choosing shorter or longer term effects as the relevant target variable, the gains after 7 and 17 months would have been 8 and 5.5 percentage points, respectively.

Mean earnings show a similar picture: earnings gains due to statistical targeting are 230/220/190 CHF monthly per person, when targeted towards employment after 7/12/17 months, respectively. Earnings for those who find employment (last 3 rows) are similar for all allocation regimes. Hence, while targeting towards employment increases the employment rate, it does not lead to a deterioration in earnings among those who find a job, as might have been expected if unemployed where pushed towards lower-paying jobs.

In the last row of Table 4, rough estimates of the average per-person costs for active labour market programmes are given. These estimates should be interpreted with care, as they are calculated from total expenses per programme category, taking length of programme participation and other determinants as fixed. Nevertheless, the figures indicate that statistical targeting does not lead to an extraordinary increase in total costs and may even reduce them, due to targeting expensive programmes only to those who significantly benefit from them.

Table 4: Outcomes after simulated reallocation

	(1)	Allocation by potential outcome			(3)
	Actual allocation	(2a)	(2b)	(2c)	Random allocation
Outcomes					
Employed after 7 months (%)	38.9	**46.6**	43.0	40.0	38.3
Employed after 12 months (%)	49.8	55.1	**57.7**	53.0	49.5
Employed after 17 months (%)	62.4	65.2	66.4	**67.9**	61.9
Earnings after 7 months (CHF)	1'280	1'510	1'410	1'310	1'250
Earnings after 12 months (CHF)	1'580	1'730	1'800	1'680	1'560
Earnings after 17 months (CHF)	1'960	2'060	2'110	2'150	1'950
Earnings after 7 months if employed	3'290	3'240	3'280	3'280	3'260
Earnings after 12 months if employed	3'170	3'140	3'120	3'170	3'150
Earnings after 17 months if employed	3'140	3'160	3'180	3'170	3'150
Per capita costs for active labour market programmes	1'500	828	1'160	1'770	1'500

Note: See note below Table 3.

4. CONCLUSIONS

Two different ways to allocate people into labour market programmes on the basis of statistical methods are presented: targeting and profiling mechanisms. From international experiences together with theoretical considerations it is concluded that targeting is the superior way to do. The variety of available active labour market programmes and the generally unrestricted access to them are practical reasons why a profiling system would not be appropriate for Switzerland. A targeting system could much better assist caseworkers in finding a good strategy for an unemployed person. However, for existing targeting systems too little empirical evidence about their effectiveness in practice is available. The Achilles heel of the Canadian SOMS was the lacking carefulness in implementation, concerning refusal by staff as well as privacy. The FDSS in the USA, which started its test phase in 2002, is too recent to draw any conclusions. The theoretical ability of a targeting system crucially depends on the capability of a statistical method to estimate hypothetical outcomes after programme participation accurately. Therefore the econometric method has to be handled carefully, and data requirements are high.

The potentials of a targeting system for Switzerland are simulated in this paper. By using data about unemployed in 1998/99, hypothetical outcomes after different programmes are estimated. A reallocation of persons into programme is simulated according to these predicted outcomes, while keeping resource constraints constant. It is found that one year from programme start, the reemployment rate could have been 57.5 percent instead of 49.8. It can be concluded that statistically assisted programme allocation is potentially fruitful for Switzerland.

APPENDIX A: SAMPLE SELECTION

Table A1: Sample selection

	Remaining observations
Total sample	**79'273**
Start of programme not before 2nd January 1998	73'294
Age between 25 and 55, no disability No participation in significant programme (> 2 weeks) in 1997	44'697
No homeworkers, trainees, students No persons who already had exhausted benefits on 1st January 1998 or which were not actually unemployed	43'282
Only Swiss and foreigners with at least yearly permit (B, C permit)	42'341
Only persons with earnings in last job > 1000 CHF	41'567
No part time unemployed	38'271
No persons without employment in 1988–97 No persons having entered social security system in December 1997 only	37'604
No participants in other programmes not covered by this study (job introduction allowances, training allowances, commuter allowances, ...)	37'334
No canton of Ticino After dropping nonparticipants who are not unemployed at randomised programme start date	**28'130**

APPENDIX B: ESTIMATION

(1) *Propensity scores:* The probabilities of participating in a programme are estimated by probit for every programme and for nonparticipation:[4]

$$p^r(x) = P(D = r|X = x) = \Phi(xa^r). \tag{B1}$$

On the basis of the estimated coefficients $\hat{\alpha}^r$, the probabilities $\hat{p}_j^r$ are computed for every person and every programme:

$$\hat{p}_j^r = \Phi(X_j\hat{\alpha}^r), \qquad j = 1, \ldots, N; \qquad r = 0, \ldots, R. \tag{B2}$$

(2) *Programme outcomes:* They are estimated as a function of characteristics Z and all participation probabilities:

$$E[Y_t^r|Z = z, p^0(X) = \rho^0, \ldots, p^R(X) = \rho^R, D = r] \doteq \varphi(z, \rho^0, \ldots, \rho^R; \beta^r). \tag{B3}$$

For binary outcomes like employment a probit model is used. For continuous outcomes a different approach has to be chosen: since earnings are 0 if a person is unemployed and greater than 0 if employed, only people with positive values are selected for estimation.[5] The logarithm of their outcome is regressed on variables Z and all computed probabilities. Coefficients for the outcome "employment after 12 months" are listed in a separate appendix that is available on the internet.[6]

Based on the estimates $\hat{\beta}^r$ for every person and every programme, expected outcomes conditional on the Z characteristics and the probabilities are computed:

$$\tilde{Y}_{j,t}^r = \hat{E}[Y_t^r|Z_j, p^0(X_j), \ldots, p^R(X_j)] = \varphi(Z_j, p^0(X_j), \ldots, p^R(X_j); \hat{\beta}^r). \tag{B4}$$

(3) *Outcome predictions:* The above computed conditional expectations were based on Z as well as on X. Since X are not available to the caseworker directly or are not intended to be used by the system, a prediction of an outcome has to be based on available Z characteristics only. For this purpose we control for the distribution of X conditional on Z and integrate them out:

$$E[Y_t^r|Z = z] = \int E[Y_t^r|Z = z, p^r(X) = \rho, D = r] \cdot dF_{p^r(X)|Z=z}(\rho). \tag{B5}$$

4. We use $R + 1$ univariate probit models with dependent variable 1 $(D = r)$.
5. People with zero earnings are not employed and therefore covered in the employment equation already.
6. www.siaw.unisg.ch/lechner.

The density $dF_{p^r(X)|Z=z}$ would have to be computed from the data. Here a simple approximation is chosen by regressing the above computed conditional expectations $\tilde{Y}^r_{j,t}$ on Z by OLS:

$$E[Y^r_i|Z=z] = \zeta(z;\hat{\gamma}). \tag{B6}$$

Inserting the Z characteristics of any person into one of the $R+1$ resulting functions $\zeta(z;\hat{\gamma})$, we can compute her hypothetical outcome for any of the available programmes as well as for nonparticipation.

As *outcomes* for each employment and earnings, 3 different points of time are focused on: 7, 12, and 17 months after programme start. Coefficients for the outcome "employed after 12 months" are listed in the separate appendix available on the internet.

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SUMMARY

The need for better targeting of active labour market programmes is evident from the many evaluation studies that find insignificant or even negative effects. A statistical system could contribute to a more precise targeting of labour market programmes to those individuals who are likely to benefit from them. Such a system could assist caseworkers in selecting adequate programmes on an individual basis. In this paper, international experiences with these systems are surveyed and a potential approach for Switzerland is developed. The simulated outcomes indicate that a statistical selection system could have contributed to a substantial re-employment increase.

ZUSAMMENFASSUNG

Ein gezielterer Einsatz der aktiven arbeitsmarktlichen Massnahmen erscheint aufgrund der insignifikanten bzw. negativen Resultate vieler Evaluationsstudien notwendig. Ein statistisches System könnte dazu beitragen, aktive arbeitsmarktliche Massnahmen gezielter für jene Personen einzusetzen, die tatsächlich von diesen profitieren können. Ein solches System könnte die Personalberater bei der Auswahl geeigneter Massnahmen für eine bestimmte arbeitslose Person auf individueller Ebene unterstützen. In diesem Papier werden die internationalen Erfahrungen mit solchen Systemen beleuchtet und ein potentieller Ansatz wird für die Schweiz entwickelt. Die Simulationsergebnisse deuten an, dass ein solches statistisches System zu einer deutlich höheren Wiederbeschäftigungsquote hätte beitragen können.

RÉSUMÉ

La nécessité de mieux cibler les mesures de la politique active du travail est évidente après les études qui trouvent que les effets de nombreux programmes sont insignifiants voire négatifs. Un système statistique pourrait contribuer à un ciblage plus précis des programmes du marché du travail sur les individus qui en profiteront probablement le plus. Un tel système pourrait assister les conseillers en personnel lors du choix de programmes sur une base individuelle. Dans cet article, nous procédons d'abord à une revue de littérature internationale des expériences avec ces systèmes puis nous développons une approche potentielle pour la Suisse. Les résultats simulés indiquent qu'un système de sélection statistique aurait pu contribuer à augmenter substantiellement le réembauchage.

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