Evaluating dynamic treatment: The Swedish active labour market programmes

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Abstract

This paper assesses the impact of Swedish welfare-to-work programs on labour market performance including wages, labour market status, unemployment duration and future welfare-to-work participation. We develop a structural dynamic model of labour supply which includes detailed institutional features of these policies and allows for selection on observables and unobservables. We estimate the model from a rich administrative panel data set and show that training programs- which accounts for a large proportion of programs- have little effect on future outcomes, whereas job experience programs have a beneficial effect.

1 Introduction

The large increase in unemployment during the seventies and eighties has led a number of OECD countries to introduce or to expand active labor market programs which provides training, subsidised jobs and work placement schemes. These programs allow unemployed individuals to accumulate human capital through formal training or through on the job learning.

The scope of these programs varies from 0.18% in the US to 1.63% of GDP in Sweden (2002 figures). Sweden has pioneered such welfare schemes and is therefore an interesting case to study their impact. Between 2 and 5% of the work force have taken part in one of the several active labor market programs during the nineties.

There is an extensive literature on the evaluation of these programs. For surveys, see Lalonde (1995), There is an extensive body of evidence from micro-econometric studies on the effects of active labour market programs on participants' subsequent labour market outcomes. Evidence from different OECD countries shows that subsidised employment has a greater impact than direct job creation measures or public training (for which negative effects have at times been uncovered). Recent work comparing the effectiveness of the four options of the New Deal for Young People in the UK similarly finds that the employment option performs best compared to full-time education and training, the voluntary sector and the environmental task force (Bonjour et al., 2001; Dorsett, 2004). The finding that the 'work first' approach of the employment programme dominates the human capital approach of the training measure is also in line with the meta-analysis of US welfare-to-work programs by Greenberg et al. (2004). Using similar data as in this paper, Sianesi (2001a,b and 2004) finds that those programmes providing subsidised workplace experience and on-the-job training at an employer are not only cheaper, but considerably more effective for participants' subsequent labour market success than vocational classroom training courses.

The focus of traditional empirical approaches to evaluation (reviewed extensively in Heckman et al., 1999) is mostly on statistical robustness; seeking to identify causal effects without functional-form restrictions, they typically rely on conditional independence assumptions or the availability of instrumental variables. Considering mainly reduced-form models and lacking economic structure, the conventional treatment effect literature is essentially static. Labour market choices are intrinsically dynamic as current decisions affect future outcomes and expected future outcomes affect current decisions.

A second dynamic issue arises when interest lies in the causal effect of a programme on some subsequent outcome conditional on employment. In particular, in order to investigate the effectiveness of the programmes on the quality of the jobs obtained by participants in terms of earnings and of job duration, one would need to adequately model selection not only into the (different) programmes but also into subsequent employment experienced by former participants (cf. Ham and Lalonde, 1996). Empirical microeconometric work to date has in fact focused on the effects of programmes on regular employment or on annual earnings, but has not been able to characterise the treatment effects along their different dimensions of re-employment probabilities, wages and job durations.

Institutional features of the treatment being analysed may give rise to additional sources of dynamic selection causing endogeneity. Labour market policies such as the Swedish one (or those of many European countries) add to the dynamic nature of the unemployed individual's problem in two ways: first, by having a large set of different programmes which continue to operate over time and remain available to the unemployed, who can thus decide not only whether to participate, but also when and in which sequence; and second, by allowing participation in a programme to renew eligibility to unemployment benefits.

To deal with these issues, we develop a dynamic structural model to assess the impact of a complex welfare-to-work system taking into account how it affects working and future programme participation incentives. We model labour supply decisions, programme participation decisions and earnings, taking into account the institutional features, in particular the eligibility to unemployment insurance and its renewal through program participation or work. We allow for selection on unobserved heterogeneity and model explicitly the dynamic selection of forward and optimizing individuals.

We estimate the differential impact of each type of programme or of sequences of programmes, the short- and long-term effects, and the effects on final and on intermediate outcomes. We estimate the mean and the full distribution of treatment effects. In the presence of selection into the programmes based on (unobserved) returns, the average effects uncovered by reduced-form methods may mask important heterogeneity in impacts by types of individuals.

We find that training programmes seem to have no beneficial impact on the treated. On the contrary, they postpone exit from unemployment due to the lock-in effect, whereby treated are deterred from moving into employment while on the programme, and they are used to renew unemployment insurance eligibility. Employment subsidised seem to be more beneficial, particularly to high ability agents. First, they slightly speed up transitions into employment although not enough to recover from the lock-in effect. Second, they seem to have a strong positive impact on wages, significantly beyond what would be predicted by normal job experience. And third, treated agents of high ability enjoy from longer employment spells after treatment.

The next section discusses the Swedish institutional context, the essence of which we try to capture in our dynamic structural model, and describes the data used in our analysis. Section 3 sets up the model. Section 4 analysis the estimated effects of treatment and section 5 discusses the predicted outcomes of alternative policy scenarios. Finally section 6 concludes the paper.

2 Data and Institutional background

2.1 The Swedish labour market policy

Sweden runs one of the world's most generous welfare policies targeted at the unemployed. We briefly describe some of the most important features of Swedish labour market institutions of the late nineties that will set the ground for our model design choices.

The unemployment insurance in Sweden amounts to 80% of the agents salary in the previous job up to a ceiling of about SEK16,500. To first become eligible to 14 months of UI benefits, an agent needs to have accumulated a minimum of 5 months of working experience in the past. After that, eligibility to UI can always be renewed through an additional 5 months on a regular job or in one or more of the many programmes offered to the unemployed.

There are a great number of alternative treatments being offered at any time to unemployed agents. They include subsidised jobs (scheme job subsidies and trainee replacement initiatives), vocational training, work practice schemes and relief work among others. In this paper we distinguish between subsidised jobs and all other programmes in assessing their differential impact on labour market performance. In what follows, the latter will be called training programmes.

2.2 Data Set and Descriptive Statistics

The data set we use is drawn from four different administrative data sets which have been merged for the purpose of the study. The Unemployment Register "Hndel" provides information from August 1991 onwards on unemployment spells, programme participation spells and the subsequent labor market status of those who are deregistered (employment, education, inactivity or lost (attrition)). Information on unemployment compensation comes from the Akstat data base and is available from January 1994 onwards.

We combine information on monthly employment spell and wages from employer reports. This information is available from 1990 onwards. Finally, information on education levels is taken from the "Sysreg" data base which provides the highest education achieved by calendar year, starting in 1990.

The different data sets are merged together using each individual's unique social security number. The data covers the whole working age population in Sweden.

From these data we select the population of Swedish males becoming unemployed during 1996 and follow them up to December 1998. Selection was conditional on the following criteria: being aged between 25 and 30 years of age at their sample inflow; having completed at the most 1-2 years of high school and not upgrading during the observation window (this is true for 95% of the unskilled population at this age group; and not being disabled or self-employed. In each month from inflow to December 1998, the individual's activity is classified in one of the four alternatives, employment, unemployment, subsidised employment or training programme. The criterion we used in case of conflict was to select the state that lasted for longest in the month.

Programme occurrences were only considered if in long spells, lasting for more than 2 months. In such case, treatment spells are split in 4 months periods and considered as sequences of treatment events. The employment state includes part- and full-time employment. If no earnings are observed for an employment spell, it is re-classified as unemployment.[1]

Using the criterion selection described above, our data set contains 14,370 individuals who all start an unemployment spell in 1996. Table 1 provides a brief summary of the data set. Individuals enter the sample with an average of 3.4 years of labor market experience. Prior to 1996 5.4% had gone through a job subsidy program and 47% through a training program. At the start of the sample, all individuals are unemployed, and they are entitled to an average of 10.2 months of unemployment insurance if it is not renewed by working or going into a labor market program. The number of months of unemployment insurance depends on the prior job history of individuals. On average, individuals find a job in 6.1 months. Over the period 1996-1999, they experience 2.1 spells of unemployment (including the first one) and 1.9 spells of employment.

Table 1: Descriptive Statistics

Number of individuals in 1996	14370
Average labor market experience in 1996 (years)	3.4
Proportion with previous Job Subsidy in 1996	5.4%
Proportion with previous Training in 1996	47.0%
Average number of months UI eligibility in 1996	10.2
Average time to first employment (months)	6.1
Average number of unemployment spells 1996-1999	2.1
Average number of employment spells 1996-1999	1.9

Figure 1 displays the proportion of individuals in unemployment, employment or either active labor market programs. At the start of the data set, all individuals are unemployed. At the end of the sample, about 10% are unemployed. At any point in time, about 2.2% of individuals are in a training program and 0.6% are in a job subsidy program.

Figure 2 displays the enrolment rate into training or job subsidy programs as a function of the remaining eligibility to unemployment benefits. The enrolment in job subsidy program does not appear to be related to eligibility to UI. On the contrary, the enrolment in training programs is increasing in the remaining eligibility and peaks a few months before the individual looses the right to UI. This indicates that training programs are used to renew eligibility.

We now provide some descriptive statistics on the outcome of those who have participated in one of the

[1]Earnings information is reported by the employer.

Figure 1: Labor Market Status Over Time

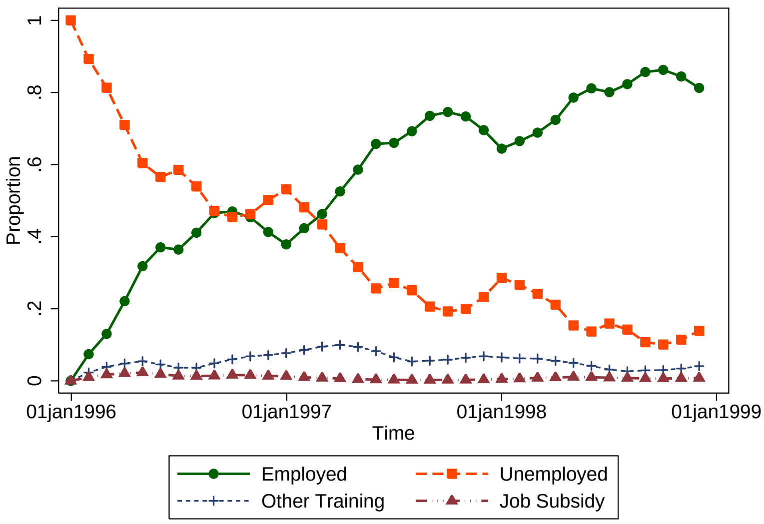
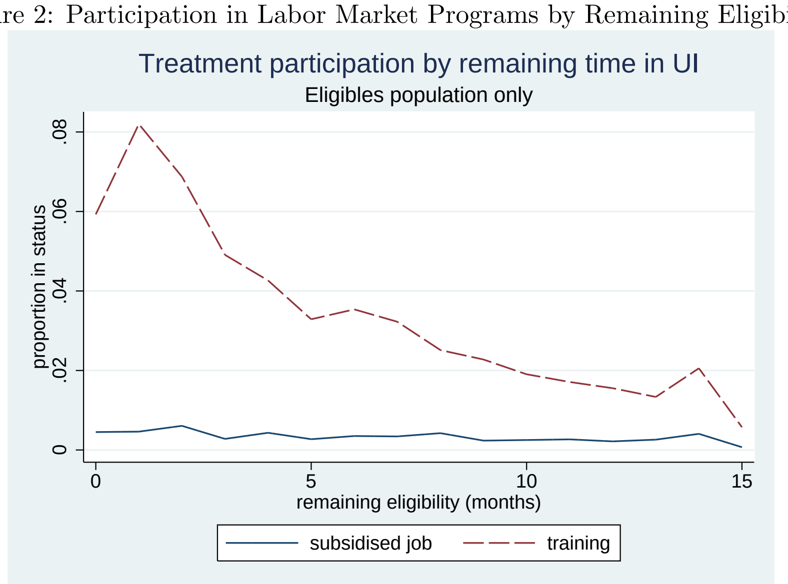


Figure 2: Participation in Labor Market Programs by Remaining Eligibility



programs. We first start with the exit rate from unemployment. Figure 3 displays the proportion of individuals in unemployment as a function of time, comparing individuals who attained a training program or not, or a job subsidy program versus no program participation. The graph is computed by matching individuals by date of inflow and by unemployment duration up to enrolment. In the first four months, due to a lock-in effect, all individuals in training remains not employed. After that period, training program participants appear to stay longer in unemployment, whereas individuals in job subsidy programs are less likely to stay in unemployment.

Figure 3: Unemployment Rate by Treatment Status: Training

Figure 4: Employment Duration by Treatment Status: Training

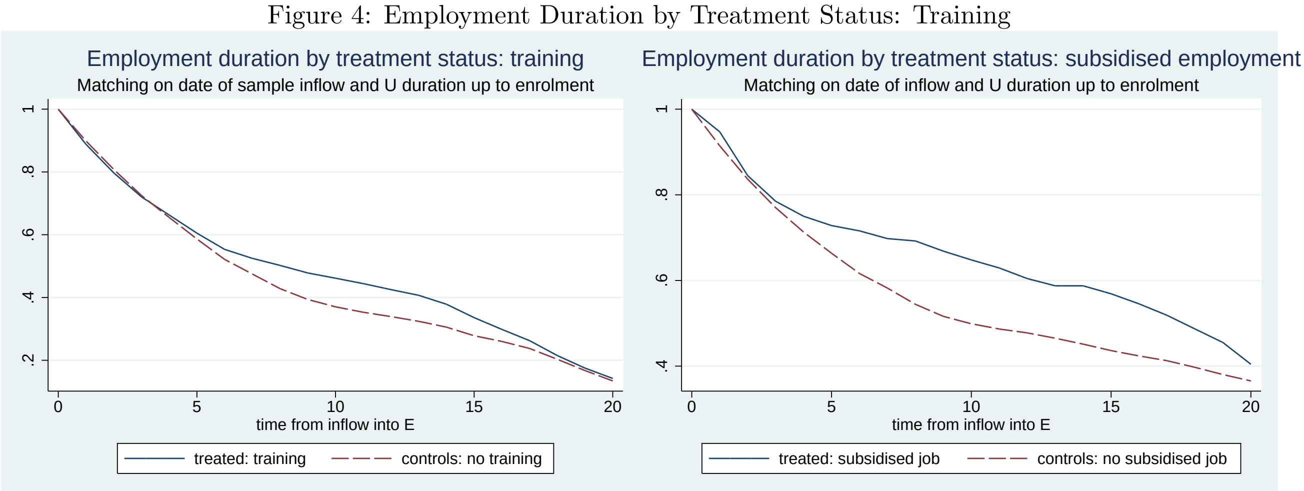


Figure 4 displays the proportion of individuals staying in employment, contrasting those who went through one of the two labor market programs with those who did not. Both programs appear to be beneficial, although the effect of the job subsidy program is more substantial. These results, however, may be plagued with selection bias. Table 2 shows the characteristics at inflow of agents that take and do not take treatment during observational time window by type of treatment. It is clear from these figures that the treated are not a random sample of this population. They have less accumulated experience, particularly if enrolling into training in the future, and thy are more likely to have experienced treatment in the past.

Table 2: Treated versus non-treated within observational time window: characteristics at inflow

	Subsidized job		Training	
	non-treated	treated	non-treated	treated
past experience in months	51.1	49.3	52.3	47.2
% had subsidised jobs in the past	71.9%	85.2%	64.9%	94.1%
% participated in training in the past	6.1%	10.8%	5.7%	8.1%

Notes: Table shows characteristics at inflow of agents that take and do not take treatment during observational time window, between January 96 and December 98, by type of treatment.

We now turn to wages in employment. Table 3 displays the coefficients of a regression of log wage on labor market experience indicators and an indicator for having participated in either a job subsidy or a training program. The regression include only those who had never participated in any active labor market program. Those who went through a job subsidy program have a wage which is 11% higher than those who did not go through such a program. Those who went through a training program have a wage which is 6% *lower*. This indicates that either individuals loose skills during this program, or -more likely- that the program is not taken up randomly; individuals with lower productivity are more likely to be offered and to choose this type of program.

Table 4 displays the results of a regression in first difference of log wages on an indicator of a spell of unemployment and indicators for participation in either labor market programs. By using first differences, we remove fixed differences in productivity at individual level. While individuals experiencing unemployment see a 2% decrease in their wage, the effect of both labor market programs are positive, 8% for job subsidy programs and 5.5% for training programs. This indicates that either the programs do benefit participants or that selection into employment is important enough to generate these results. Indeed, program participation does not only provide training, but also renews the unemployment insurance eligibility. Hence at the end of a program, individuals can choose between a further unemployment spell at 80% of the previous wage, or to accept a new job if one is offered. Program participation increases therefore the reservation wage and those who accept a job only do it if the wage is large enough.

Comparing the results of Tables 3 and 4 indicates that it is important to take into account unobserved heterogeneity linked to labor productivity. However, as discussed, it is difficult to disentangle the training

Table 3: Determinants of Log Wage. Cross-sectional Results

	Coefficient	sd. err.
Job subsidy	.1106786	.0111352
Training	-.0628562	.0070715
Experience= 1 year	.1954244	.0095001
Experience= 2 years	.3055844	.0143551
Experience= 3 years	.2618404	.014001
Experience= 4 years	.2518599	.0091672
Experience= 5 years	.2793837	.0077093
Experience= 6 years	.2875579	.0072929
Experience= 7 years	.3441186	.0078404
Experience= 8 years	.3853782	.0116428
constant	9.312134	.0061716

Notes: Regression on 127718 observations. Conditional on no program participation prior to first observation.

Table 4: Determinants of Log Wage, First Difference Results

	Coefficient	sd. err.
Unemployed	-.0238061	.0054501
Job subsidy	.0798278	.0438869
Training	.0556019	.0206896
constant	.0005388	.0011653

Notes: Regression on 93748 observations. Conditional on no program participation prior to first observation.

component of active labor markets with selection on unobservables and the changes in the reservation wage introduced through the particular institutional feature of these programs. This is why we develop a model of forward looking agents in the next section.

3 The model

We follow a structural approach in modeling individual labour market decisions and outcomes. The model is designed to evaluate the impact of the main institutional features that characterise the Swedish labour market of the late nineties on a range of important outcomes in an integrated way. By altering the rewards to each activity, such rules will affect individual's labour market profiles, productivity and life-time income. Examples of important institutional aspects we will consider are the offer of treatment places, the eligibility rules to treatment, the possibility of renewing eligibility to UI through programme participation and the lock-in effect of programmes. Examples of individual-level outcomes we will consider include unemployment duration, re-employment probabilities and job attachment, productivity and income. The structural nature of the model will allow us to characterise the whole distribution of effects and to perform full cost-benefit analysis taking into account the full set of programme effects.

We consider the problem of low-skilled workers at an early stage, but not the beginning, of their working ages. We model labour supply and programme participation as the result of the optimising behaviour of forward looking agents within the institutional background that characterises the Swedish labour market of the late nineties. We follow the choice-theoretic framework set out in Eckstein and Wolpin (1989) to study the labour market decisions of young unskilled workers.

In our model, a time period stands for one calendar month and we consider infinitely lived agents. In each time period, the agent chooses activity to maximise the expected discounted present value of utility. Possible activities are employment, unemployment and programme participation. We discriminate between two types of labour market programmes, depending on whether the treatment is mainly a job experience or not. From now onwards, the former will be known as a subsidised job and the latter as a training programme.

Let $K = \{E, U, J, T\}$ be the set of mutually exclusive labour market alternatives, respectively employment, unemployment, subsidised employment and training programme. The choice of activity at any time t follows the maximision of the expected value of total current and future rewards. Maximisation is based on the set of information observable by the individual (but possibly not by the econometrician) at the time of making a decision, Ω_{it}. It includes information about working experience (e), remaining number of months of entitlement to UI benefits (u where u is below a cap $\overline{u} = 14$ months), accumulated working or treatment periods since last exhausted UI eligibility (m where m is below a cap $\overline{m} = 5$), number of spells in subsidised employment and training programmes (p^J and p^T, respectively), number of spells in subsidised employment and training programmes already completed at the start of current out-of-work spell if applicable (s^J and s^T, respectively), exogenous variables (x) including seasonal effects and region of residence, two-factor unobserved heterogeneity

(π, θ) and transitory productivity (ξ) and taste shocks $(\epsilon^E, \epsilon^J, \epsilon^T)$.[2]

The dummy variables d_t^k are the choice variables in the agent's problem, representing labour market decision at each point in time. $d_t^k = 1$ means that alternative k has been selected in period t, $d_t^k = 0$ otherwise, and $\sum_{k \in K} d_t^k = 1$ at any period t.

At a point in time τ, the problem of agent i is to select the optimal sequence of feasible activities over the future, $\{d_{it}\}_{t=\tau,...} \left\{d_{it}^E, d_{it}^U, d_{it}^J, d_{it}^T\right\}_{t=\tau,...}$, conditional on the contemporaneous information set, $\Omega_{i\tau}$,

$$\max_{\{d_{it}\}_{t=\tau,...}} E_\tau \left[\sum_{t=\tau}^{\infty} \sum_k \beta^{t-\tau} d_{it}^k R_{it}^k \left(\Omega_{it}\right) \middle| \Omega_{i\tau} \right]$$

where β is the discount rate and R^k represent the per period reward or utility function when labour market option k is selected.

This maximisation problem is subject to a number of restrictions, including the motion of the state variables and the feasibility of the different labour market options in each period. We now describe the per-period reward functions and the restrictions to the maximisation problem.

3.1 Per period reward functions

Contemporaneous utility is assumed to be linear in contemporaneous income. Income is modeled as a dynamic process that depends on accumulated labour market experience. Working and programme participation affect future job earnings and income while out of work since this is linked to the market wage.

The market log wage for an agent of type π with e periods of working experience and (p^J, p^T) treatments is,

$$\ln w(e, p^J, p^T, \pi) \quad = \quad \alpha_0 + \alpha_1 \ln(e+1) + \alpha_2 \mathbf{1}(p^J \geq 1) + \alpha_3 \mathbf{1}(p^J \geq 2) + \alpha_4 \mathbf{1}(p^T \geq 1) + \alpha_5 \mathbf{1}(p^T \geq 2) + \pi$$

where $\mathbf{1}(A)$ is the characteristic function, being one if A is true and zero otherwise, and the α's are the coefficients of the model.

The period utility from unemployment depends on the eligibility status to UI. An eligible agent $(u > 0)$ is entitled to a proportion α of the market wage for a worker of similar characteristics up to a ceiling, $\overline{B}$. An

[2] The s variables are introduced to ensure that income while out of work is not affected by programme participation during spells of unemployment. Hence, s^T is equal to p^T if the agent has not undergone any training since being unemployed. If one training spell has occurred since unemployment began, p^T is updated but not s^T as current unemployment benefits, based on the previous wage, are not changed.

ineligible agent ($u = 0$) is entitled to a flat social security rate, b. The reward function for agent i at time t is

$$\begin{aligned} R^U(\Omega_{it}) &= \begin{cases} \min\left\{\alpha w\left(e_{it}, s_{it}^J, s_{it}^T, \pi_i^W\right), \overline{B}\right\} & \text{if } u_{it} > 0 \\ b & \text{if } u_{it} = 0 \end{cases} \\ &= \begin{cases} UI_{it} & \text{if } u_{it} > 0 \\ b & \text{if } u_{it} = 0 \end{cases} \end{aligned}$$

where $s^{J/T}$ measure the number of programme treatments the agent had accumulated at the beginning of the current out-of-work spell and UI_{it} is the unemployment insurance the agent receives if entitled.

The current reward of employment for individual i at time t can now be expressed as,

$$R^E(\Omega_{it}) = w\left(e_{it}, p_{it}^J, p_{it}^T, \pi_i\right)\exp(\xi_{it}) + \gamma_1 \mathbf{1}(p^J \geq 1) + \gamma_2 \mathbf{1}(p^T \geq 1) + g^E(\theta_i) + \epsilon_{it}^E$$

where attachment to employment is allowed to depend on programme participation and the individual-specific taste from employment. In the above expression, ξ is the transitory productivity shock, assumed to follow an AR(1) process, ϵ^E is the transitory taste shock, and the two shocks are allowed to be contemporaneously correlated. g^E is a transformation of the taste types θ and the γ's are the coefficients of the model.

The subsidised job programmes offer the opportunity to try a normal job while earning the common wage in the economy. We consider only long spells in these programmes, lasting for at least $\overline{m}$ months, and the longer spells are split in subsequent spells of exactly $\overline{m}$ months. This ensures that eligibility to UI benefits is renewed for as long as the employment condition is met. The reward function for the whole $\overline{m}$-months period on a subsidised job is,

$$R^J(\Omega_{it}) = \frac{1-\beta^{\overline{m}}}{1-\beta} w(e_{it}, p_{it}^J, p_{it}^T, \pi_i)\exp(\xi_{it}) + g^J(\theta_i) + \epsilon_{it}^J$$

where t is the first period on the programme, ϵ^J and θ_i are the transitory and permanent taste shocks and g^J is a transformation of the taste type. Again, the two transitory shocks, (ξ, ϵ^J) are allowed to co-vary.

Finally, the contemporaneous returns to training programmes depend on whether the minimum working experience requirement has been fulfilled in the past. Again, we only consider long spells, lasting for at least $\overline{m}$ months, and the longer spells are split in subsequent spells of exactly $\overline{m}$ months. The per-period income is either the UI benefit of the social security flat rate subsidy, depending on whether e is larger or smaller than $\overline{m}$. The reward function for the whole $\overline{m}$ periods is,

$$R^T(\Omega_{it}) = \begin{cases} \frac{1-\beta^{\overline{m}}}{1-\beta} UI_{it} + \nu\mathbf{1}\left(d_{it-1}^T = 1\right) + g^T(\theta) + \epsilon_{it}^T & \text{if } e_{it} \geq \overline{m} \\ \frac{1-\beta^{\overline{m}}}{1-\beta} b + \nu\mathbf{1}\left(d_{it-1}^T = 1\right) + g^T(\theta) + \epsilon_{it}^T & \text{if } e_{it} < \overline{m} \end{cases}$$

where ϵ_{it}^T and π^T are the transitory and permanent taste components, g^T is a transformation of the taste type θ and ν measures the effect of having been on a training programme on the probability of a new training spell.

3.2 Transitions

The feasible set of activities in any period is restricted by the present activity and the arrival of offers for alternative activities. We follow the patterns observed in data, excluding direct transitions from employment into the programmes and direct transitions from subsidised jobs onto training programmes. We then add to the maximum value considerations in choosing activity, the requirement of receiving an offer. In particular, transitions into regular and subsidised employment are made conditional on receiving the respective offer during the present period. We assume the time intervals to be sufficiently small to ensure that at most one offer arrives in each period, let it be a regular or a subsidised job. The offer arrival rates are allowed to vary with the individual's characteristics. They are modeled as a logit function of past programme participation, present labour market status, exogenous covariates and unobserved heterogeneity,

$$\delta^k_{it+1} = f^k\left(I^k(\Omega_{it+1})\right)$$

where k is either E or J, f is the logistic function and

$$I^k(\Omega_{it+1}) = \eta^k_0 + \eta^k_1 \mathbf{1}\left(d^J_{it} = 1\right) + \eta^k_2 \mathbf{1}\left(d^T_{it} = 1\right) + \eta^k_3 \mathbf{1}\left(p^J_{it+1} = 1\right) + \eta^k_4 \mathbf{1}\left(p^T_{it+1} = 1\right) + x_{it+1}\lambda^k + h^k(\theta_i)$$

η and λ are the option-specific parameters of the model and h is the option-specific transformation of the individual unobserved heterogeneity related to tastes.

3.3 Dynamics of the information set

The rules governing the dynamics of the state variables depend on present activity. We now describe them in more detail.

Working experience is accumulated on the job only. We allow for subsidised jobs to differentially affect individual outcomes. The motion of e is described by,

$$e_{it+1} = \begin{cases} e_{it} + 1 & \text{if } d^E_{it} = 1 \\ e_{it} & \text{otherwise} \end{cases} \tag{1}$$

and e is zero at the start of the working life.

Eligibility to UI is determined by the variable u, which measures the remaining months of UI entitlement. u is limited by a maximum number of entitlement periods, $\overline{u}$, and is "used" while the agent is unemployed: for each period in unemployment, the agent loses entitlement to one period of UI benefits. The associated variable m defines the eligibility requirement. To first gain eligibility to the full $\overline{u}$ months of insured unemployment the agent must complete $\overline{m}$ months of working experience. After that, full eligibility is regained by either completing a further $\overline{m}$ periods on a job or by participating in programmes for the same length of time. Since we are only considering long programme spells, lasting at least for $\overline{m}$ months, programme enrolment will always lead to full eligibility after the initial working requirement is fulfilled.

Both m and u are zero at the start of the working life. The motion of m and u can now be described as,

$$m_{it+1} = \begin{cases} m_{it} & \text{if } d_{it}^U = 1 \text{ and } m_{it} < \overline{m} \\ 0 & \text{if } d_{it}^U = 1 \text{ and } m_{it} = \overline{m} \\ \min\{m_{it}+1, \overline{m}\} & \text{if } d_{it}^E = 1 \\ \overline{m} & \text{if } d_{it}^J = 1 \text{ or } d_{it}^T = 1 \end{cases} \quad (2)$$

and,

$$u_{it+1} = \begin{cases} 0 & \text{if } e_{it+1} < \overline{m} \\ \max\{u_{it}-1, 0\} & \text{if } d_{it}^U = 1 \\ u_{it} & \text{if } d_{it}^E = 1 \text{ and } m_{it+1} < \overline{m} \\ \overline{u} & \text{if } d_{it}^E = 1 \text{ and } m_{it+1} = \overline{m} \\ \overline{u} & \text{if } d_{it}^J = 1 \text{ or } d_{it}^T = 1 \end{cases} \quad (3)$$

Programme experience is accumulated through programme participation. We consider programme spells lasting for exactly $\overline{m}$ and split longer spells in sequences of treatments. In the model we separate the impact of the first two treatment spells of each category. Thus, the motion of p^k, for $k = J, T$ is

$$p_{it+1}^k = \begin{cases} p_{it}^k & \text{if } d_{it}^k = 0 \\ \min\left\{p_{it}^k + 1, 2\right\} & \text{if } d_{it}^k = 1 \end{cases} \quad (4)$$

and the motion for the accumulated treatment experience at the start of the out-of-work spell is,

$$s_{it+1}^k = \begin{cases} p_{it}^k & \text{if } d_{it}^E = 1 \\ s_{it}^k & \text{if } d_{it}^E = 0 \end{cases} \quad (5)$$

Finally, the productivity shock follows is serially correlated,

$$\xi_{it+1} = \rho \xi_{it} + \mu_{it} \quad (6)$$

where μ is an iid innovation and the transitory taste shocks, $(\epsilon^E, \epsilon^J, \epsilon^T)$ are serially uncorrelated.

3.4 Value function representation of the problem

We now present the model in its value function representation conditional on present activity as this formulation helps visualising the dynamic nature of the decision process and the available options at each stage.

An agent i at time t with information Ω_{it} derives the current utility from being unemployed of $R^U(\Omega_{it})$ and faces the possibility of moving into regular or subsidised employment in the next period conditional on receiving an offer or otherwise select according to his/her preferences between unemployment or a training spell. The value of choosing unemployment today can then be written as,

$$
\begin{aligned}
V^U(\Omega_{it}) \quad = \quad & R^U(\Omega_{it}) + \\
& \beta\delta^E\left(\Omega_{it}, d_{it}^U = 1\right) E_t\left[\max\left\{V^U(\Omega_{it+1}), V^E(\Omega_{it+1})\right\}\middle|\,\Omega_{it}, d_{it}^U = 1\right] + \\
& \beta\delta^J\left(\Omega_{it}, d_{it}^U = 1\right) E_t\left[\max\left\{V^U(\Omega_{it+1}), V^J(\Omega_{it+1})\right\}\middle|\,\Omega_{it}, d_{it}^U = 1\right] + \\
& \beta\left[1 - \delta^E\left(\Omega_{it}, d_{it}^U = 1\right) - \delta^J\left(\Omega_{it}, d_{it}^U = 1\right)\right] E_t\left[\max\left\{V^U(\Omega_{it+1}), V^T(\Omega_{it+1})\right\}\middle|\,\Omega_{it}, d_{it}^U = 1\right]
\end{aligned}
$$

where the evaluation of this function takes into account the laws of motion (1)-(6).[3] The expressions in lines 2-4 detail the continuation value of the employment option. Line 2 states that with probability δ^E tomorrow's choice will be between moving into employment or remaining unemployed. Line 3 states that with probability δ^J tomorrow's choice will be between a subsidised job spell and unemployment. Line 4 states that, the training option will be always possible if no option arrives.

The same agent will derive the current utility $R^E(\Omega_{it})$ from the employment option and faces the possibility of remaining employed tomorrow. Following the data patterns, direct transitions into programmes from employment are excluded. The value of the employment status can then be written as,

$$
V^E(\Omega_{it}) \quad = \quad R^E(\Omega_{it}) + \beta E_t\left[\max\left\{V^U(\Omega_{it+1}), V^E(\Omega_{it+1})\right\}\middle|\,\Omega_{it}, d_t^E = 1\right]
$$

where again the evaluation of this function takes into account the laws of motion (1)-(6). The option of unemployment is always available tomorrow and the decision will only hinge on optimality considerations.

The current utility while on a subsidised job, $R^J(\Omega_{it})$, accounts for the duration of the spell ($\overline{m}$ periods). Conditional on receiving an offer, the agent will be deciding in $\overline{m}$ periods time whether to move into employment or a new subsidised employment spell.[4] The value of a subsidised job treatment is,

$$
\begin{aligned}
V^J(\Omega_{it}) \quad = \quad & R^J(\Omega_{it}) + \\
& \beta^{\overline{m}}\delta^E\left(\Omega_{it}, d_{it}^J = 1\right) E_t\left[\max\left\{V^U(\Omega_{it+1}), V^E(\Omega_{it+1})\right\}\middle|\,\Omega_{it}, d_{it}^J = 1\right] + \\
& \beta^{\overline{m}}\delta^J\left(\Omega_{it}, d_{it}^J = 1\right) E_t\left[\max\left\{V^U(\Omega_{it+1}), V^J(\Omega_{it+1})\right\}\middle|\,\Omega_{it}, d_{it}^J = 1\right] + \\
& \beta^{\overline{m}}\left[1 - \delta^E\left(\Omega_{it}, d_{it}^J = 1\right) - \delta^J\left(\Omega_{it}, d_{it}^J = 1\right)\right] E_t\left[V^U(\Omega_{it+1})\middle|\,\Omega_{it}, d_{it}^J = 1\right]
\end{aligned}
$$

[3]The offer rates, δ^E and δ^J have been expressed as functions of Ω_{it} and d_{it} since these set the arguments of these functions deterministically conditional on the laws of motion.

[4]Direct transitions into training programmes from subsidised jobs have been excluded as they are not observed on the data.

where the evaluation takes into account the laws of motion (1)-(6). Again, the option of unemployment is always possible and is, in this case, the only alternative with probability $1-\delta^E-\delta^J$.

The value of training resembles the value of a subsidised job. The current utility, $R^T(\Omega_{it})$, accounts for the duration of the spell ($\overline{m}$ periods), although in this case all types of transitions are possible tomorrow. The value of training is,

$$\begin{aligned}
V^T(\Omega_{it}) \quad = \quad & R^T(\Omega_{it}) + \\
& \beta^{\overline{m}}\delta^E\left(\Omega_{it}, d_{it}^T=1\right) E_t\left[\max\left\{V^U(\Omega_{it+1}), V^E(\Omega_{it+1})\right\}\middle|\, \Omega_{it}, d_{it}^T=1\right] + \\
& \beta^{\overline{m}}\delta^J\left(\Omega_{it}, d_{it}^T=1\right) E_t\left[\max\left\{V^U(\Omega_{it+1}), V^J(\Omega_{it+1})\right\}\middle|\, \Omega_{it}, d_{it}^T=1\right] + \\
& \beta^{\overline{m}}\left[1-\delta^E\left(\Omega_{it}, d_{it}^T=1\right)-\delta^J\left(\Omega_{it}, d_{it}^T=1\right)\right] E_t\left[\max\left\{V^U(\Omega_{it+1}), V^T(\Omega_{it+1})\right\}\middle|\, \Omega_{it}, d_{it}^T=1\right]
\end{aligned}$$

where the evaluation takes into account the laws of motion (1)-(6).

3.5 Estimation Method

The full structural model is estimated by maximum likelihood using a nested optimisation algorithm where the inner routine solves the structural problem of the worker conditional on the model parameters and the outer routine maximises the likelihood function (see Rust, 1994, for a description of these sort of algorithms). To ensure stationarity, experience is assumed to have no impact on earnings after 20 years of work.

Unobserved heterogeneity is assumed to follow a discrete distribution. We allowed for 6 different unobserved types, resulting from a combination of 3 ability (or productivity) types and 2 preference types. Unobserved heterogeneity affects decisions through a number of dimensions, including wages, returns to experience and returns to treatment, employment and treatment offer rates and job attachment.

Working experience and past treatment at inflow is a result of individual observable and unobservable characteristics and is expected to be related with the unobserved heterogeneity. To deal with this problem, we model the distribution of unobserved heterogeneity as a function of the initial conditions. The full likelihood function can be found in appendix B.

Estimation was based on a random sub-sample of 20% of the individuals in the administrative data that start an unemployment spell during 1996. This amounted to a total of 2,849 individuals and 70,388 observations monthly observations.

4 Estimation Results

4.1 Fit of the model

In this section we show some evidence on the fit of the model along with a discussion of the directly observable patterns of the data. In assessing the fit of the model we use the distribution on initial conditions observable in our sample and simulated the individual decisions throughout the observable period using simulated draws from the estimated joint distribution of shocks. We then compare the patterns created by the simulated data with what is observed in the real data.

Table 5: Fit of the Model: Labour Market Status

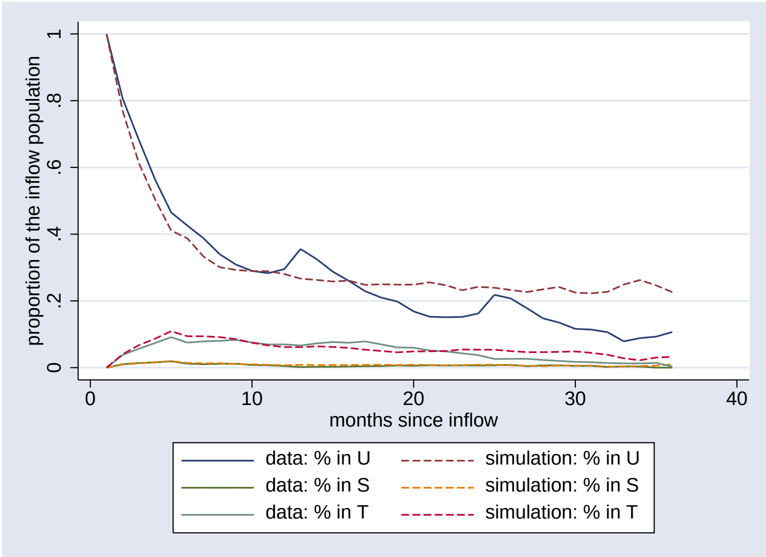
	Data	Model
Unemployment	0.327	0.327
Employment	0.608 0.606	
Subsidised job	0.008	0.009
Other treatment	0.057	0.058

Table 5 shows the proportion of observations falling in each state and, as expected, the simulations reproduce observable data very closely. This is done in more detail in Figure **??**, which presents the proportion of individuals in each state over time from the moment of sample inflow. The doted lines represent the simulated data and the full lines are the real data. The simulated data seems to reproduce the average evolution of labour market status quite closely but it fails to capture the seasonal patters (the current version of the estimates does not allow for seasonal variation; this will be cared for in the near future).

A particularly important feature is the pattern of transitions between different states. Table 6 presents the model and real transition rates. Overall, the simulated patterns are very closed to the observed ones.

Another determinant component of the model is the wage rate. Tables 7 and 8 show how close the model reproduces the data. Table 7 shows that the distribution of the wage rates among workers is very close in the two datasets. Table 8 then assesses the correlation between wage rates among the employed and different individual characteristics. In this case, although qualitatively the results are similar, real data vary more strongly with individual characteristics in the real data than in simulated data.

Figure 5: Fit of the model: labour market status over time



4.2 Estimated parameters

The model is fully described (at this stage) by a total of 42 parameters and all the estimates are presented in appendix A. The following are some of the most meaningful parameters when discussed in isolate.

Table 9 shows the distribution of unobserved heterogeneity over the population. We consider a two factor model with (potentially) correlated ability and taste types. Ability directly affects productivity at work while tastes affect search ability and employment attachment. In what follows, and given the nature of our estimates, we call type 1 and 2 individuals with respect to taste as "high taste for employment" and "low taste for employment", respectively. Over 85% of our sample is concentrated in the high-ability group, particularly among the high-taste-for-employment agents where this proportion raises to 91%.

The estimation results pertaining the determinants of the (log) wage are presented in Table 10. In the last column of this table we compare the impact of additional 4 months of working experience on the wage rate of an agent with 40 months of working experience (the average at the sample inflow) to the impact of the different treatments. Subsidized jobs show a 2 to 3% increase in wages, suggesting the returns from this type of treatment cannot be reduced to experience on the job. Agents with a job subsidy spell seem to be able to secure better jobs. Training programmes, however, seem to have no impact on earnings or a small negative effect.

In contrast with the results in Table 8, estimates of the log wage equation within the model accounting

Table 6: Fit of Model: Transition

	U	E	S	T
Real Data:				
unemployment (U)	0.771	0.186	0.005	0.038
employment (E)	0.059	0.942	0.000	0.000
job subsidy (S)	0.578	0.319	0.104	0.000
other treatment (T)	0.570	0.159	0.013	0.258
Simulated Data:				
unemployment (U)	0.765	0.185	0.006	0.045
employment (E)	0.073	0.927	0.000	0.000
job subsidy (S)	0.581	0.331	0.088	0.000
other treatment (T)	0.607	0.158	0.008	0.227

for the full selection process show much smaller effects of working experience and both types of treatment on the wage rates. This supports the view that enrollment into treatment and employment is not random and is related with unobserved productivity levels. Treatment effects on wages under the structural selection specification are also smaller than those presented in Table 4, where only heterogeneous productivity levels are accounted for. This is further evidence supporting the impact of treatment on the selection mechanism: under the Swedish system, programme participation renews eligibility to UI, raising the reservation wage for the treated and consequently delaying entrance into employment.

Regular and subsidised job offer rates seem to be strongly affected by the previous activity in the labour market but not so much by the treatment status (see Table 11). In particular, the odds of gaining a regular or a subsidised job offer increase very significantly for agents in subsidised employment in the previous period. In all other cases, subsidised jobs seem to be rarely available.

Table 12 shows unobserved preferences for different activities. Type 1 individuals show a strong taste for work while type 2 agents seem to have strong preferences towards unemployment.

4.3 Average treatment on the treated effects

Using our model estimates, we can now simulate the impact of treatment on individual outcomes. To do so, we use the distribution of initial conditions found in the sample and draw a sequence of shocks from the estimated

Table 7: Fit of the Model: Distribution of Log Wages

	Data	Model
Mean	9.56	9.49
St. deviation	0.75	0.83
Percentile:		
1	6.03	6.15
5	8.31	8.14
25	9.51	9.15
50	9.71	9.61
75	9.88	10.01
95	10.22	10.55
99	10.60	10.92

Table 8: Fit of the Model: Wage Equations

	Data		Model	
	Coefficient	Std. Error	Coefficient	Std. Error
log(experience)	0.114	0.004	0.0621	0.0043
Past Job Subsidy	0.100	0.012	0.0618	0.0142
Past Training	-0.022	0.007	-0.0058	0.0081
Constant	9.095	0.016	9.2700	0.0177

joint probability to simulate the life-cycle activity pattern of these agents. We then observe individuals joining their first treatment spell within the first two years in the sample while still on their first unemployment spell and these are the treated. This group is therefore similar to the treated group used to plot the impact of treatment on the duration of unemployment and subsequent employment spells as displayed in figures 3 and 4. In producing the treatment effects we compare treated agents with their exact counterfactual: the control group is obtained by simulating the life choices of the treated agents were they forbidden to participate in that first treatment they enrol into. We then simulate their choices over the next 3 years and compute the effects by comparing treatments and controls. In measuring these effects, all sorts of impacts are accounted for, including

Table 9: Unobserved heterogeneity: composition

	Heter. in preferences	
	type 1	type 2
Ability		
low	1.1%	1.8%
medium	4.0%	7.1%
high	49.7%	36.4%

Table 10: Estimates: Log Wage Equation

	Coefficient	% Effect on Earnings
ln(experience)	0.0442	0.44% (*)
Past subsidised jobs: 1	0.0202	2.02%
Past subsidised jobs: 2+	0.0163	3.65%
Past Training programmes: 1	-0.0064	-0.64%
Past Training programmes: 2+	-0.0076	-1.40%
Fixed effect: type 2	2.2947	
Fixed effect: type 3	3.4217	
constant	6.1245	
Proportion group 2	0.1109	
Proportion group 3	0.8611	

(*) impact of 4 months of work for an agent with 40 months of experience, the sample average experience for first time participants into treatment at the time of enrolment.

working incentives, earnings, job attachment, arrival of offers and benefit collection.

Table 13 displays the impact on income and activity over the next 3 years by unobserved heterogeneity. The first 4 rows show the proportion of participants in each treatment by unobserved heterogeneity as well as the sample size used to produce the displayed effects. Participation into training is more affected by unobserved heterogeneity as, in particular, training is more readily available. Agents with a preference for employment

Table 11: Estimates: Offer Rates

	Jobs	Subsidized Jobs
Non-treated	0.19	0.02
Treated: Job Subsidy	0.17	0.01
Treated: Past Training	0.19	0.02
Previous Activity: Job Subsidy	0.33	0.28
Previous Activity: Training	0.16	0.03

Table 12: Unobserved heterogeneity in tastes

	Heter. in preferences	
	type 1	type 2
Job attachment	320.8	136.2
Taste for job subsidy	.	0.81
Taste for training	57.8	-309.4

also extract more utility from training and they are more likely to enrol in this type treatment. Productivity levels, however, do not seem to strongly affect selection into training.

Subsidized jobs seem to have a strong positive effect on income while decreasing modestly the time in employment after treatment. In contrast, training has a more pronounced negative impact on the odds of employment and a small negative effect on income. Figure 6 plots the impact of treatment on future income of eligible agents by remaining months of eligibility to UI at the time of enrolment into treatment. The returns to both types of treatment are decreasing in months of eligibility, but the pattern is particularly strong in the case of training. Close to benefit exhaustion, training has a significant positive effect by renewing eligibility. As the eligibility period increases, however, the effect becomes negative by decreasing time in employment.

The effects of training on income and time out of employment are particularly strong among agents that show higher preference for training. They are also more likely to repeat training in the future in the event of being treated, which suggests training is more frequently used to renew eligibility in this group.

To better understand these results, figures 7 and 8 display the remaining time in unemployment for treated and controls while figures 9 and 10 display the duration of the first employment spell after treatment. These

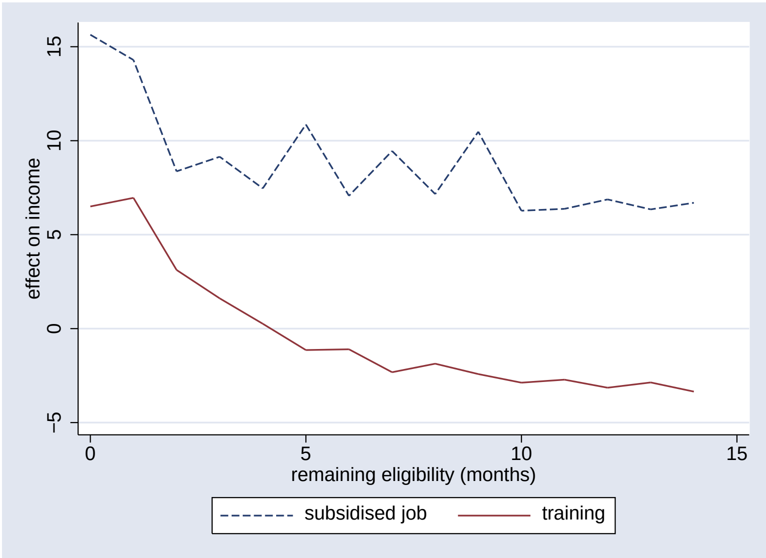
Table 13: Impact of treatment on the treated over the next 3 years: Income and activity within the 3 years of treatment enrolment

	low taste for E		high taste for E		
	low prod.	high prod.	low prod.	high prod.	all
Subsidized job					
% in treatment group	2.5%	2.4%	1.9%	2.5%	2.5%
No observations (treated)	187	762	81	1073	2,103
Training					
% in treatment group	14.9%	15.9%	18.6%	18.2%	17.1%
No observations (treated)	1,117	4,943	803	7,762	14,625
Impact on income					
job subsidy	+11.2%	+9.4%	+6.3%	+7.6%	+8.5%
training	-0.1%	-0.9%	-4.7%	-3.5%	-2.4%
Impact on time in employment after treatment					
job subsidy	-2.8%	-3.5%	-7.2%	-4.0%	-3.8%
training	-5.0%	-5.7%	-10.6%	-9.9%	-8.2%
Impact on time in subsidised employment after treatment					
job subsidy	+1.4%	+0.9%	+1.4%	+0.7%	+0.9%
training	0.0%	+0.1%	+0.1%	+0.1%	+0.1%
Impact on time in training after treatment					
job subsidy	-0.7%	-0.3%	+0.2%	-0.7%	-0.5%
training	+1.9%	+1.6%	+4.7%	+3.8%	+3.0%

are similar graphs to the ones presented before using matched treatment and control groups (figures 3 and 4) but display somehow different patterns, suggesting selection plays an important rule in leading individuals into training and determining its effects. First, subsidised employment does not prolong time out of work as markedly as training but it does not seem to raise flows into employment as sharply as suggested in figure 3. On average, treated taking subsidised jobs experience an unemployment spell 2.3 months longer than had they not been treated. The similar figure to training is 3.8 months.

Second, high-ability and high-taste-for-employment agents in subsidised employment do seem to obtain

Figure 6: Impact of treatment on the treated by remaining eligibility time (time in UI): income over the following 3 years



better jobs when eventually moving into employment than if non-treated, and the difference in job-retention seems to widen over time. After 2 years, agents with high preference for working are 9% more likely to remain in the same job if treated by a subsidised job programme. Similarly, subsidised jobs increases the proportion remaining in the same job after 2 years by 6.2% among high ability agents. In contrast, the same figures for the low-taste-for-employment and low-ability groups are 1.2% and 0.5% respectively. The raise in time out of employment identified above as a consequence of subsidised employment seems to be a consequence of the lock-in effect and is partially compensated within the 3 years by increased job attachment and outflows into employment.

However, contrary to what is suggested in figure 4, training does not seem to affect job attachment for any group. Indeed, two years after flowing into employment, treated agents are 0.5% less likely to remain in the same job as compared with non-treated. The large negative effect of training on employment rates is driven by the lock-in effect and increased treatment participation in the future.

5 Ex-ante evaluation exercise

In this final section we experiment with different policy scenarios. We use the initial distribution of observable characteristics from the data and simulate the labor market behavior of these individuals for five years from

Figure 7: Impact of treatment on the treated by productivity type: time to employment

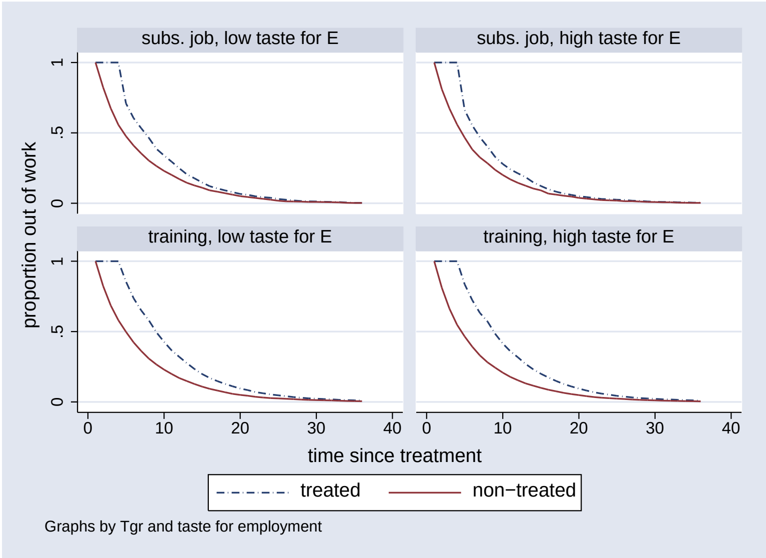
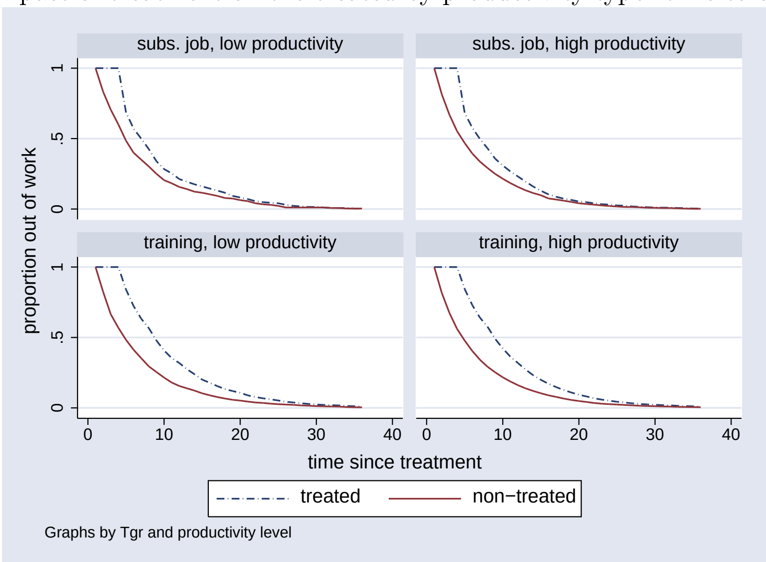


Figure 8: Impact of treatment on the treated by productivity type: time to employment



inflow. In all cases we compute the additional cost per capita of providing treatment as compared to a baseline where only UI benefits are available. Our estimates of the costs of unemployment include the income paid to individuals while out of work and the cost of programmes as reported in Carling and Richardson (2001). We then simulate the effect of the different scenarios on labor market outcomes under two alternative assumptions.

Figure 9: Impact of treatment on the treated by preferences towards employment: duration of employment spell

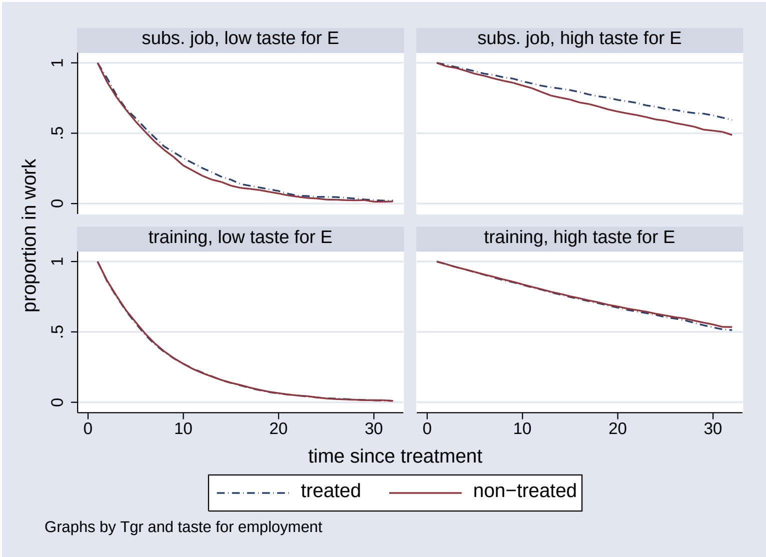
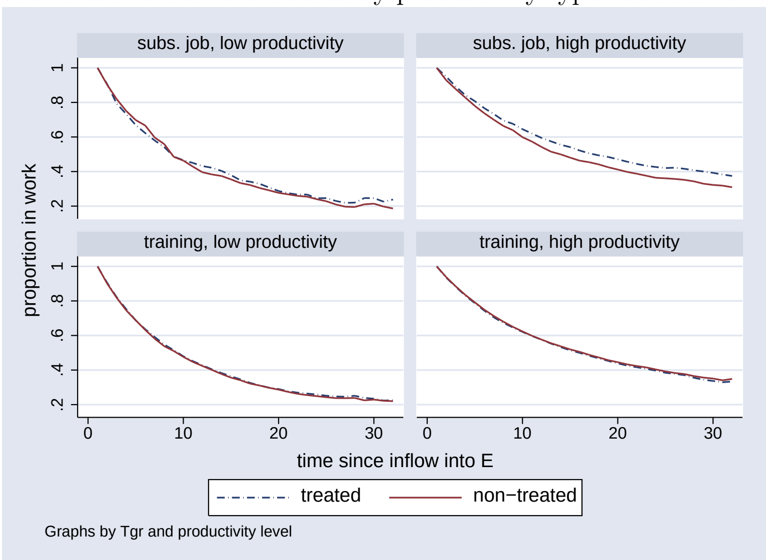


Figure 10: Impact of treatment on the treated by productivity type: duration of employment spell



First, the required funding to cover the additional costs of alternative policies is not supported by this group. And second, the additional cost is supported by this group within the 5 years period.

Table 14 shows the results in four alternative policy scenarios, including the baseline when no programme

Table 14: Effects on 5 years income and time out-of-work

	mean income*	time in U	time in J	time in T	additional cost	tax change
Baseline: no programmes	892.8	0.298	-	-	-	-
S and T: unfunded	894.2	0.283	0.008	0.053	31.42	-
S and T: funded	860.8	0.285	0.008	0.055	-	3.71%
Only J: unfunded	897.7	0.296	0.008	-	4.89	-
Only J: funded	889.9	0.297	0.008	-	-	0.56%
Only T: unfunded	890.4	0.284	-	0.054	27.93	-
Only T: funded	860.4	0.285	-	0.055	-	3.32%

* Values in 1000s SEK. Additional cost is per capita and is relative to baseline (cost of UI only).

is available. The second and third rows on the table show that introducing subsidised jobs and training programmes increases pronouncedly the time out-of-work and thus the cost of the welfare state. While individual's income increases marginally when the programmes are introduced, this is no longer true when they bear the cost of the additional treatments. In this case, tax rates would increase by a significant 3.7% and the attractiveness of employment would decrease even further.

Most of the responsibility for the increase in costs and time out-of-work can be assigned to the training programmes. Rows 4 to 7 show the simulated results for two alternative policy scenarios where only one of the programmes is made available. The case where only training programmes are available is almost undistinguishable from when both treatments are introduced. The small effect of the subsidised job programmes is probably a consequence of the low availability of this option.

Table 15 shows some similar simulated results for alternative policy scenarios. Policy 1 reproduces the case where both programmes are available but excludes the possibility of renewing UI eligibility through programme participation; in this case, only regular employment can lead to regain access to fully subsidised unemployment. It shows that this feature of the policy design seems to account for most of its additional cost. Without the possibility of renewing UI benefits, the training programmes become less desirable and the time out of work decreases significantly.

Policy 2 adds sanctions to policy 1: agents refusing to take up a subsidised job offered to them lose eligibility to benefits and need to regain it through working. As a result, time in unemployment decreases and the average

Table 15: Effects on 5 years income and time out-of-work

	mean income*	time in U	time in J	time in T	additional cost	tax change
Baseline: no programmes	892.8	0.298	-	-	-	-
Policy 1: unfunded	883.5	0.288	0.008	0.028	6.97	-
Policy 1: funded	876.2	0.288	0.008	0.028	-	0.83%
Policy 2: unfunded	876.6	0.280	0.009	0.028	-0.69	-
Policy 2: funded	877.4	0.280	0.009	0.028	-	-0.08%
Policy 3: unfunded	865.8	0.275	0.046	0.025	-17.74	-
Policy 3: funded	885.6	0.275	0.047	0.025	-	-2.24%
Policy 4: unfunded	872.5	0.290	0.047	-	-25.50	-
Policy 4: funded	900.1	0.289	0.047	-	-	-3.12%

* Values in 1000s SEK. Additional cost is per capita and is relative to baseline (cost of UI only).

cost of unemployment also decreases. However, responses to this change are very limited by the availability of subsidised jobs. Nevertheless, the drop in costs is sufficiently large to render this policy just as expensive as the baseline case.

Policy 3 adds to policy 2 an increased offer of subsidised jobs. We assume the offer rate for this treatment increases uniformly by 10%. Such change leads to a substantial increase in the time used in this option and to substantial savings in the cost of the welfare intervention as compared to the baseline of no programmes. Agents now stay less in unemployment while increasing their time in subsidised, on average a less expensive option to the public sector. If the surplus of this policy is then returned to the group, average income over the next 5 years will almost recover to the baseline level.

Policy 4 excludes training programmes from policy 3. The result is to decrease time out of employment and to further diminish the cost of the welfare policy. The substantial savings lead to substantial redistribution of surplus that allows the average income over the 5 years to overtake the baseline average income for this population.

6 Conclusion [to be written]

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