The effect of participation in subsidised employment on labour market transitions *

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Preliminary version

Abstract

This paper provides estimates of the impact of participation in subsidised employment for young long-term unemployed workers. I apply a multivariate duration model with correlated unobserved heterogeneity to control for selective programme-participation. The estimates for the effect of participation in subsidised employment are derived by the means of simulation for different duration outcomes.

I find that participation in subsidised employment a) significantly shortens the duration until regular employment. b) has a significantly positive effect on the duration of the first employment spell. c) has no significant effects on the second unemployment spell, after participation.

The simulations suggest that subsidised employment has larger effects on unemployed people with unfavourable labour market characteristics.

Keywords: labour market policy, subsidised employment, repeated MMPH
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1 Introduction

This paper provides estimates for the effect of participation in subsidised employment on different duration outcomes for young long-term unemployed school-leavers in Belgium.[1] I apply a multivariate mixed proportional hazard model (MMPH) to estimate transition rates between three distinct states: unemployment, subsidised employment and regular (non-subsidised) employment. The estimates of the effect on the labour market transitions of the participants are derived by the means of simulation. The derived effects are allowed to vary with the characteristics of the individuals as well as over time.
I find the following effects: Participation in subsidised employment a) accelerates significantly the transitions to regular (non subsidised) employment. b) has a significant positive effect on the duration of the first employment spell. c) has no significant effects on the duration in the second unemployment spell, after participation. Moreover, the simulations suggest that subsidised employment has larger effects on unemployed people with unfavourable labour market characteristics.

Economic theory provides different explanations why participation in subsidised employment may have an effect on the investigated duration outcomes. Amongst others, two of the most frequently mentioned explanations are human capital accumulation and signalling.[2] A detailed discussion of the relationship between economic theory and the results are provided in section 6, separately for the different simulation outcomes.

There is comprehensive literature on the effects of participation in subsidised employment on labour market outcomes. A main distinction can be drawn with respect to the recipient of the employment subsidies. Most of the North-American employment subsidy programmes provide subsidies to the workers whereas most European programmes are targeted at employers. For example Card and Hyslop (2005) investigate the effect of the presence of employment

[1] Long-term unemployment is defined as unemployed for at least 12 months.

[2] Richardson (1997) provides arguments on human capital accumulation during employment. See McCormick (1990) or Ma and Weiss (1993) for signalling in the context of employment.

subsidies on welfare participation using data of the Canadian Self Sufficiency experiment. The studies on income tax credit (ITC) are also related to subsidised employment since ITC-programmes provide a reduction in income tax under certain conditions. Meyer and Rosenbaum (2001) and Hotz et al. (2005) estimate the effect of changes in the US Earned Income Tax Credit on the employment rates of the affected persons.

Most of the European studies on subsidised employment rely on evaluation-methods for non-experimental data. One branch of this literature analyses the effects on the employment rates at different points in time after participation in subsidised employment. The papers of Sianesi (2001), Caliendo et al. (2004), Gerfin et al. (2005) and Caliendo et al. (2005) are recent examples for this type of study.

The present paper, however, is part of the branch of the literature which analyses the effect of a transition to subsidised employment on duration outcomes or, equivalently, the labour market transitions of workers after the start of participation.[3] Recent papers that analyse the effect of subsidies on duration outcomes are those of van Ours (2004), Fredriksson and Johansson (2004), Forslund et al. (2004) and Göbel (2006a).

This paper contributes to the existing literature on causal effects of subsidised employment in the following ways: It provides causal evidence for young long-term unemployed school-leavers, a group which is particularly affected by high unemployment rates.[4] Moreover, I present results for different duration outcomes in order to provide deeper insight into the effect of participation in subsidised employment: The effect on unemployment duration, on employment duration and on the duration of the second unemployment spell, after participation. In addition, the model allows us to show how the labour market transitions are affected over time.

[3] See the textbook of Lancaster (1990) or recently van den Berg (2001) for the link between duration analysis and transition rates.

[4] So far, there are only a few studies on causal effects of subsidised employment for young workers. Exceptions are the studies of Larsson (2003), Carling and Larsson (2005) and Göbel (2006a). See Blundell et al. (2004) for the effects of a programme which combines job search assistance and employment subsidies.

To my knowledge, the present study is the first which provides detailed estimates on how the effect of subsidies on the *employment duration* of the participants evolve over time.[5]

Our simulation results show that participation in subsidised employment accelerates the *transitions into regular employment* significantly. Moreover, the effect appears already shortly after the transition into subsidised employment and increases over time. This is in contrast to the literature where in most of the cases locking in effects are reported (e.g. van Ours (2004), Forslund et al. (2004)) or the effects are less important (e.g. Larsson (2003), Forslund et al. (2004)). The particular features of the evaluated employment subsidy programme are likely to contribute to this positive effect. For example, it has been reported in the literature that subsidised employment that provides "normal"-jobs, as it is the case in this paper, performs relatively well. Recently Sianesi (2001), Brodaty et al. (2001) and Gerfin et al. (2005) have reported that subsidised employment in the private sector performs well as compared to the public sector. Moreover, signalling the willingness/ability to work and human capital accumulation might be more important for unemployed school leavers than for unemployed workers with employment experience, as studied in most of the existing studies.[6]

Finally, there exists virtualy no literature on the effect of a former participation in an employment subsidy programme on the *duration in unemployment after* the end of subsidised employment. It is important to understand that in this case the counterfactual situation would be to have a regular employment instead of subsidised employment. We don't find significant effects for a former participation in subsidised employment on the following unemployment spell. Apart from the present paper, only Ridder (1986) analyses the effect of former participation in subsidised employment programmes on the duration in a subsequent unemployment spell. He reports insignificant effects, too.[7]

[5]The studies of Ridder (1986) and Göbel (2006a) analyse the effect on employment duration. However, they provide only a rough picture of the dynamics of the effect.

[6]If experience is a factor which contributes to the accumulation of human capital in a production-function framework, it would be standard in economics to assume decreasing returns to experience. In line with this idea, Light and Ureta (1995) provide estimates which show that at the start of the career the wage is increasing with decreasing returns to work experience.

[7]Ridder (1986) has to rely on a very small sample and is forced to estimate the joint effect of

The present paper is connected to the existing literature on causal analysis using duration models in the following ways: It combines two different strands of literature: the causal framework of Abbring and van den Berg (2003b) and the literature on (mixed semi Markov) event history models as Gritz (1993) and Bonnal et al. (1997). In the latter, the focus is on the effect of a former programme-participation on the subsequent labour market spells while in the former the focus is on the effect of a treatment which occurs during a spell of interest on the duration of this spell.[8] The applied framework has the advantage that it provides both types of outcome and thus allows a thorough investigation of the effects of participation.

This paper is structured as follows. In the next section, I provide a description of the Belgian employment subsidy programme which has been investigated. In section 3 the empirical model is presented. Section 4 contains a brief explanation of the simulation-procedure. In section 5 I describe the used data set. The results of the simulation are discussed in section 6. Finally section 7 concludes.

2 Subsidised employment in Belgium

Before explaining the Belgian employment subsidy programme, called the "Recruitment Plan", it is worthwhile to provide some key features of the Belgian labour market. Despite its small geographical size, Belgium's labour market is characterised by considerable differences between its three regions. In the last year of our observation period, 2001, the Flemish region had a relatively low unemployment rate of 4.0%. At the same time the Walloon region, in the south of Belgium, had a higher unemployment rate of 9.9%[9] and the unemployment rate of the Brussels region was 12.9%.[10] Furthermore, in Belgium the share of

various subsidised employment programmes. Moreover, different from the present paper, he does not control for selection in unobserved characteristics.

[8] Both strands of literature can be regarded as special versions of a more general class of event-history models (Abbring (2006)).

[9] Throughout this section, I use the yearly average of the harmonised unemployment rates from Eurostat (Labour force survey).

[10] These differences are partly explained in the literature by a stronger reduction of employment in the industrial sector of the Walloon region over the last decades. Moreover, the creation of employment in the service sector was faster in the Flemish region (OECD (2001)).

long-term unemployed workers among the total unemployed is slightly higher than in the Eurozone: 48.4% for Belgium compared to 45.6% for the Eurozone, in 2001.[11] Much the same as in most European countries, the unemployment rate for young people is relatively high: 16.8% for people under 25 years of age compared to 6.6% for the whole active population.

In Belgium, the unemployed are entitled to benefits if they have contributed sufficiently to social security in the past. In addition, different from most other countries, in Belgium even young school-leavers without employment experience are entitled to unemployment benefits after a *waiting period*. For the workers considered in this paper, this waiting period is nine months.

The amount of the benefits depends on the family type and previous wage. For the school-leavers, considered in this paper, a flat-rate is applied which is between €240 for singles under 21 years of age and €850 for cohabitants which are in charge of dependants. Benefit exhaustion is limited to cohabitants and applies only after very long periods of inactivity, which are beyond the length of spells , in this study.[12]

In Belgium, akin to other European countries, there exist different active labour market programmes which try to integrate long-term unemployed workers into the labour market. These include work experience programmes, training, temporary employment programmes, direct job-creation and subsidised employment.[13]

In this paper I estimate the effect of participation in the Belgian Recruitment Plan, a labour market programme offering temporary subsidies to employers who hire long term unemployed workers.[14] Note that the Recruitment Plan concerns all types of long-term of unemployed workers and not only the young school-

[11] Long-term unemployment is defined as unemployed since 12 months or more in percentage of total unemployment.

The Eurozone contains all countries which use the Euro as their currency. In 2001 these were Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.

[12] See Cockx and Ries (2004) for a detailed description of benefit exhaustion in Belgium.

[13] See ONEM (2002) for a detailed description of the different programmes.

[14] The French name of the policy-measure is "Plan avantage à l'embauche", the Dutch name is "Voordeelbanenplan".

leavers without employment experience as considered in this paper.[15] In the sequel I restrict the description of the Recruitment Plan to the elements which are relevant for latter group.[16]

The Recruitment Plan is mainly for employment in the private sector.[17] *Employers* who benefit from a reduction in social insurance contributions through the "Recruitment Plan" are not allowed to benefit from other measures for the same individual at the same time.[18]

In order to become eligible, young *employees* have to be unemployed jobseekers for at least 12 months "without interruption". A period of unemployment is considered to be "without interruption" when the period in which the unemployed individual does not receive unemployment benefits is not longer than four months.

The *subsidy* consists in a temporary reduction of social insurance contributions on the employer's side. The entitlement to the subsidy is tied to a specific employment contract and cannot be transferred to a new employment contract.[19] The Recruitment Plan provides subsidies for standard employment contracts, with the only restriction that the employment has to be at least half-time. The Belgian labour legislation applies in the same way as to any non-subsidised working contract. This implies the possibility to hire on the basis of a temporary working contract or a working contract of undetermined duration.[20]

The subsidy is provided in two steps over a period of approximately two years

[15]The statistics provided by ONEM (2000) and ONEM (2001) show that during the observation period 1998-2001 the annual number of work-relationships which received subsidies via the Recruitment Plan stayed between 39000 and 47000. There exist no separate statistics for the participation of school-leavers.

[16]The Belgian Recruitment Plan provides different subsidy-schemes and eligibility criteria depending on age and unemployment-duration of the participants.

[17]The Belgium state, the three language-communities, the regions and related institutions are generally excluded from the programme and cannot profit from the Recruitment Plan. Notable exceptions are teaching and land transport where employment can be subsidised by the Recruitment Plan even in the case of public employment.

[18]See also Vermeersch (1999) for a description of the Recruitment Plan.

[19]This implies that workers lose their entitlement for the Recruitment Plan when they change the employer, or when they negotiate a new employment contract with their current employer. In both cases they do not fulfil the criteria of being long-term unemployed at the start of the new working contract.

[20]This includes the possibility that employer and employee conclude a working contract which finishes at the end of the subsidised period.

and ends after the second year.[21] The level of the subsidy depends on the duration in unemployment prior to the subsidised employment. Basically, there are two different subsidy schemes: One for participants who have been unemployed for at least 12 months and another for participants who have been unemployed for at least 24 months prior to their participation in the Recruitment Plan. Table 1 provides an overview of the reduction in social insurance contributions and how this translates into a reduction in gross wage.

For participants who are unemployed for at least *12 months* the subsidy is 75% of the social insurance contributions during the first year and 50% for the second year. For participants who are unemployed for at least *24 months* the subsidies are higher: 100% of social insurance contributions during the first and 75% during the second year of participation. This translates into a reduction of the gross wage of between 16.2% and 34.1%.

Table 1: Subsidy in percentage of social insurance contributions

preceding unemployment	1st year of subsidy	2nd year of subsidy
12 months ≤unempl. <24 months	**75%** ≙ 24.3-25.6% of gross wage	**50%** ≙ 16.2-17% of gross wage
24 months ≤unempl.	**100%** ≙ 32.4-34.1% of gross wage	**75%** ≙ 24.3-25.6% of gross wage

1st year of subsidy refers to the quarter of entry into subsidised employment and the four subsequent quarters of employment. 2nd year includes the quarter five until eight after the quarter of entry.

The participation of long-term unemployed workers in the Recruitment Plan is not automatic. To become eligible for the subsidy, the unemployed worker must contact the unemployment office. The unemployment office checks if the unemployed worker matches the eligibility conditions and delivers a so called "recruitment card" which testifies that the worker is eligible for the subsidy. The worker has to hand out this recruitment card to the employer who has to submit

[21] In the following I refer to the *first year* of subsidies for the quarter of hiring and the four subsequent quarters and to the *second year* of subsidies from the fifth to the eighth quarter.

it to the social insurance authorities, together with the quarterly declaration.

The take-up rate by the eligible long-term unemployed workers is relatively low. One of the main reasons for the low take-up rate might be that the Recruitment Plan has never been promoted actively by the Belgian state as a tool to integrate long-term unemployed school-leavers into the labour market. As discussed in section 3.2, this low take-up rate plays a role in the identification of the treatment effect.

3 The empirical model

Before going into details of the implementation, I devote some paragraphs to a non-technical explanation of the empirical model. At this point, it may already be helpful to know that the model is applied to longitudinal data on a quarterly basis.[22]

The model reflects the labour market trajectories of young long-term unemployed school-leavers, after they enter paid-unemployment in 1998.[23] I consider three possible labour market states: unemployment, participation in the Recruitment Plan (subsidised employment), and regular employment. I investigate the duration the worker spends in each of these labour market states to determine the dynamics of the transitions between them. Transitions which have a different destination than the described labour market states are not modelled explicitly.[24] The considered labour market states have been chosen with the aim to compute the effect on different outcome variables while keeping the empirical model computationally feasible.

The different labour market trajectories in our model are summarised in figure 1. All workers in our sample start their labour market trajectory by entry into paid-unemployment. They can have two competing transitions out of

[22]For a detailed description of the data set I refer to section 5.

[23]I define paid-unemployment as unemployment with full unemployment benefits. School-leavers, as considered in this paper, enter paid-unemployment after a waiting period of nine months.

[24]The spells of these workers are treated as right censored. The main source of right censoring during the observation period are transitions to inactivity and transitions to another policy-programme. Spells for which no transition is observed are right censored at the end of the observation period.

unemployment:[25] Either they have a transition into programme participation (subsidised employment) or they have a transition to regular employment. The workers who are in subsidised employment face two competing transitions: They can have a transition back to unemployment or they can have a transition from subsidised to regular employment. From regular employment the workers can have a transition back to a second unemployment spell. Finally, I also consider the transition from the second unemployment spell into regular employment.

One key difference between the proposed model framework and the "timing-of-events" approach (Abbring and van den Berg (2003b)) is the presence of competing risks *during* participation in subsidised employment.[26] It is this feature which enables me to investigate the effect on different duration outcomes, like the effect on the employment duration or the effect on the second unemployment spell.

After the end of participation in subsidised employment, I use dummy variables to capture the effect of former participation on subsequent spells. In this respect the proposed model framework is similar to studies of Gritz (1993) or Bonnal et al. (1997) which both apply a multistate duration model with dummies for the ex-post effects of programme-participation.[27]

In the simulation, I make use of the estimates for the post-participation period as well as those for the distribution of non-realised durations, which is identified by the competing risks part of the empirical model. While the proposed empirical model requires the simulation of the effects it also has its virtues: First of all, it allows to estimate how the effect on transition rates evolves over time. Secondly, the model framework allows me to simulate *various* outcomes of interest e.g. the effect on the duration until regular employment or the effect on employment duration. Finally, the estimates derived by the model enable one to simulate the dependency of the effect on characteristics of the participants or,

[25] Competing in the sense that only one transition out of the first unemployment spell can be observed.

[26] I model the transitions from subsidised employment into regular employment and back to unemployment for the participating workers.

[27] See also Ridder (1986) for an early application of event history models to evaluation of labour market policies.

as in this paper, effects for different subgroups of the participants.

I take the possibility of selective participation into account by using a method which incorporates a large number of explanatory variables in the duration model and by allowing for correlation of the unobserved heterogeneity terms within a mixed proportional hazard model (Abbring and van den Berg (2003b)).[28]

3.1 Implementation of the grouped duration multivariate mixed proportional hazard model

I specify a multivariate mixed proportional hazard model (van den Berg (2001)). Three different labour market states are considered: unemployment u, regular employment r and participation in subsidised employment p. Since I have quarterly data at my disposal, I implement a grouped duration specification. The Appendix provides details on the derivation of the individual likelihood contributions.

Specifications of the transition rates: All the transition rates $\theta(t|\cdot)$ between the different labour market states have a proportional hazard specification, where the observed characteristics X and the unobserved characteristics V of the individuals shift the respective baseline hazard function $\lambda(t)$ proportionally:

$$\theta_{oq}(t|X, V_q) = \lambda_{oq}(t) \cdot \exp(x'\beta_{oq} + V_q) \tag{1}$$

The subscript oq is for transitions from origin state o to destination state q and $oq \in (u_1r, u_1p, pr, pu_2, ru_2, u_2r)$.[29]

Roughly speaking the baseline hazard $\lambda(t)$ captures how the transition rates evolve over time, while the explanatory part, on the right hand side, captures the effect of explanatory variables on the transition rates. I specify a piecewise constant baseline hazard $\lambda_{oq}(t) = \exp(\alpha_{oq,k})$ for $k = 1$ to K_{oq}, where K_{oq} is the

[28] See also Heckman et al. (1999) or Costa-Dias and Blundell (2002) for an overview of methods for the evaluation of programme participation.

[29] In the following u_1 denotes the first unemployment spell and u_2 denotes the second unemployment spell.

maximum number of periods for which the transition oq can be observed.[30] The set of explanatory variables contains information about the characteristics of the worker as well as indicator variables to capture the effect of participation in subsidised employment for transition rates after participation in subsidised employment.

The individual likelihood contribution: The individual contribution to the likelihood function depends on the observed labour market trajectories of the worker. Each labour market trajectory in our sample can be represented by a set of duration variables (e.g. time in first unemployment) together with variables which indicate the reason for the end of a spell (e.g. transition into a specific labour market state or censoring).

d_o indicates a transition and is equal to one if an individual has a transition out of state o and zero otherwise. In the same spirit d_{oq} indicates a transition between the origin state o and destination state q. Let c_o be an indicator which is equal to one if a spell in the labour market state o is right censored and zero otherwise. For example, the labour market history of a worker who had a transition to subsidised employment in his 4th quarter of unemployment and who is censored in the 7th quarter of subsidised employment can be represented by the following set of variables: $t_k = 4$, $d_{u_1} = 1$, $d_{up} = 1$, $t_m = 7$ and $c_p = 1$, while all other duration variables and indicator variables are equal to zero.

Using $S_o(t_k|\cdot)$ for the survival rate in the origin state o at the end of period k, one can summarise all possible individual likelihood contributions as:

$$
\begin{aligned}
l_m \;=\; & \left\{ \frac{[\theta_{u_1 r}(t_k|\cdot)]^{(1-d_{up})} \cdot [\theta_{u_1 p}(t_k|\cdot)]^{d_{up}}}{\sum_{q\in\{r,p\}} \theta_{u_1 q}(t_k|\cdot)} \left[S_{u_1}(t_{k-1}|\cdot) - S_{u_1}(t_k|\cdot)\right] \right\}^{d_{u_1}} \times \\
& \left\{ \frac{[\theta_{pu_2}(t_m|\cdot)]^{(1-d_{pr})} \cdot [\theta_{pr}(t_m|\cdot)]^{d_{pr}}}{\sum_{q\in\{r,u_2\}} \theta_{pq}(t_m|\cdot)} \left[S_p(t_{m-1}|\cdot) - S_p(t_m|\cdot)\right] \right\}^{d_p} \times \\
& \left[S_r(t_{l-1}|\cdot) - S_r(t_l|\cdot)\right]^{d_r} \times \\
& \left[S_{u_2}(t_{v-1}|\cdot) - S_{u_2}(t_v|\cdot)\right]^{d_{u_2}} \times
\end{aligned}
$$

[30] The baseline hazard is normalised to one at the start of each spell. The scale of the transition rates is captured by the distribution of the unobserved heterogeneity.

$$[S_{u_1}(t_k|\cdot)]^{c_{u_1}} \times \tag{2}$$
$$[S_p(t_m|\cdot)]^{c_p} \times$$
$$[S_r(t_l|\cdot)]^{c_r} \times$$
$$[S_{u_2}(t_v|\cdot)]^{c_{u_2}}$$

All terms in equation (2) are conditional on a set of explanatory variables.[31] In the appendix I provide details of the derivation of the individual contributions to the likelihood function. Note that equation (2) covers all possible labour market histories within our empirical model.

The specification of the heterogeneity distribution: The unobserved heterogeneity terms are specified by a multivariate discrete distribution. van den Berg (2001) underlines the merits of discrete distributions for the unobserved heterogeneity in MMPH-models. He argues that they provide flexibility while limiting the computational cost of the estimation.

For the vector of unobserved covariates $V = (V_r, V_p, V_u)$ I suppose that $V_q(q \in \{r, p, u\})$ can take two values v_{q1} and v_{q2} for each possible destination state q.[32] I allow for all possible combinations of the destination specific values of the unobserved heterogeneity.[33] One probability is associated to each of the eight combinations:

$P_{abc} = P(V = (v_{ra}, v_{pb}, v_{uc})) = p_j$ with $j = 1, ..., 8$, and where each of the indexes $a, b, c \in \{1, 2\}$. The probabilities are specified by a multinomial logit model.

The corresponding individual likelihood contribution can now be written as:

$$l_m(V) = \sum_{a=1}^{2} \sum_{b=1}^{2} \sum_{c=1}^{2} P_{abc} \cdot l_m(v_{ra,}, v_{pb}, v_{uc}) \tag{3}$$

[31] I suppress these components to simplify the notation.

[32] The values of the unobserved heterogeneity for different transitions with the same destination state are allowed to differ by one transition specific factor. e.g. if the values for the transition from unemployment to regular employment are $\{v_{r1}; v_{r2}\}$ then the values for the transition from programme participation to regular employment are $\{m_{pr} \cdot v_{r1}, m_{pr} \cdot v_{r2}\}$

[33] The resulting multivariate heterogeneity distribution has 2^3 points of support.

Maximum duration for subsidised employment: Subsidised employment is provided for a maximum of nine quarters. It follows that individuals who survive the eighth quarter in the programme must have a transition during the ninth quarter of subsidised employment. As shown in section B of the appendix, this implies that the sum of the two competing transition rates in our empirical model are infinite in the ninth quarter of programme participation. Nevertheless, one can estimate the probabilities of having a transition into regular employment or into unemployment, during this period.[34]

3.2 Identification of multivariate mixed proportional hazard models

In this subsection I summarise some of the insights from the recent literature on the identification of competing risks proportional hazard models. In a first step I discuss some of the assumptions which have been shown necessary for the identification of a rather general class of event history models.[35] In a second step I argue that the specific settings of our model provide additional support for the identification.

The model proposed in this paper fits in the class of repeated competing risks multivariate mixed proportional hazard models (MMPH) with lagged duration dependence, where the different transition rates are allowed to be dependent via the terms of their unobserved heterogeneity components. Recent work of Abbring (2006) extends the identification proof for single spell MMPH models, provided by Abbring and van den Berg (2003a), to the more general class of repeated competing risks models.[36]

In order to be able to identify the model non-parametrically, the unobserved factors which are relevant for the observed trajectory are assumed to be jointly independent of the observed characteristics.[37] In addition, one needs to in-

[34]To keep the estimation numerically feasible, I fix one of the transition-rates in the ninth quarter of policy participation at some high value.

[35]For the full set of assumptions I refer to Abbring (2006).

[36]See van den Berg (2001) for a survey of the identification for duration models and van den Berg (2005) for a recent overview of the identification of competing risks MMPH-models.

[37]This generalises a standard assumption for the identification of single spell MPH models. Ab-

clude at least two continuous explanatory variables which affect the competing transition rates in different ways and that are not collinear. In the application provided by this paper I include two continuous variables in the explanatory part of the MMPH-model: the unemployment rates and the age of the workers. The age variable is available in grouped form (i.e. years of age) and provide a proxy to real continuous variables. The arguments provided in the literature on the identification of MMPH models suggest that the additional inclusion of discrete explanatory variables also support the identification.

In the identification proof behind the so-called "timing-of events" approach, Abbring and van den Berg (2003b) place emphasis on a further assumption which is required for the identification of treatment effects: The absence of anticipation of the timing of treatment.[38] This assumption does not exclude that workers are aware of the presence of the employment subsidy programme. Only the absence of anticipation of the timing of participation is required for identification(Abbring and van den Berg (2003b)). In our case, this means that the workers are allowed to be aware of the existence of the Recruitment Plan, but they are assumed not to anticipate the timing of their participation.

In case of the Recruitment Plan, the workers have to search for a job on the labour market and there is no participation guarantee or forced participation, which could allow to deduce the timing of treatment. Therefore, it is unlikely that the workers know in advance the moment of participation and anticipation effects are consequently equally unlikely.

In our specification the unobserved variables are destination specific (up to a factor), and not transition specific as assumed in Abbring (2006). This assumption allows us to augment the number of transitions which is used for the identification of the unobserved characteristics while keeping the dimension of the multivariate distribution low. In our specific case it is plausible to assume that

bring (2006) points out that in cases where panel-data techniques cannot be applied with MMPH-models, this type of assumption is necessary for the identification of the parameters associated to X.

[38] Anticipation would affect the estimation of the competing transition out of the pre-treatment spell. As a consequence the estimates for the distribution of the non-realised durations would be affected.

unobserved characteristics affect the transitions into a certain labour market state, independently of the origin state. For example, unobserved characteristics such as motivation may drive the transition into regular employment in a similar way, independently of the current state (i.e. unemployment or programme participation).[39] In the "timing of events" approach, the same assumption is made implicitly. For the transition from unemployment to regular employment I have repeated observations for some of the workers. The results of Honoré (1993) and Abbring and van den Berg (2003a) suggest that with repeated observations the identifying assumptions could be relaxed. Finally, the workers in our empirical model do not face competing risks in all labour market states. For example workers who have entered regular employment or a second unemployment spell face only a single risk. The required assumptions are weaker for these spells.

To summarise, the provided arguments suggest that the specified model is identified.

4 Simulation of the effect of participation

It is hard to deduce the effect of participation on the duration outcomes of interest directly from the parameter estimates of the empirical model. This is due to the presence of different parameter estimates for the same explanatory variables in different transition rates as well as to the dynamic nature of the model. To visualise the effect of participation in the employment subsidy programme, I therefore compute treatment effects by the means of simulation.

Instead of explaining the simulation for each of the duration outcomes separately, in this section I concentrate on the effect of participation on the duration until regular employment. The simulation of the other outcomes are implemented in an analogous manner.

Before I outline the simulation of the results, I would like to stress that the duration of interest can be composed of several spells. For example, the duration until a transition into regular employment can be composed by up to three

[39] Also for the transition back to unemployment it may be of little importance for the effect of unobserved characteristics if the workers are in subsidised or in regular employment.

different spells $\mathrm{t} = \mathrm{t}_{u_1p} + \mathrm{t}_{pu_2} + \mathrm{t}_{u_2r}$ if a worker first has a transition from unemployment to participation, then a transition back to a second unemployment spell before he finally enters regular employment. Of course, one can also have less spells until a transition into regular employment, for example $\mathrm{t} = \mathrm{t}_{u_1r}$ for the case of a direct transition from unemployment to regular employment.[40]

Here, I concentrate on the effect of employment subsidies on those who participate. To study this effect, I investigate the residual duration t_R, which is the duration until a transition into regular employment that remains after a transition to participation, or equivalently $\mathrm{t}_R = \mathrm{t} - \mathrm{t}_{u_1p}$.

In a first step, I compute the cumulative distribution of t_R for the subpopulation of workers who participate in the employment subsidies. Then, I compute the same cumulative distribution function, assuming non-participation. Finally, the effect of participation can be expressed as the difference between the two cumulative distribution functions. Formally this can be written as:

$$\begin{aligned} Diff\,(t) \quad = \quad & \int_v \int_x Pr(\mathrm{t}_R < t | P = 1, x, v, c = 0) \; - \\ & Pr(\mathrm{t}_R < t | P = 0, x, v, c = 0)\, dK(x|P = 1)\, dG(v|P = 1) \end{aligned} \tag{4}$$

where $K(x|P = 1)$ and $G(v|P = 1)$ are the empirical distributions of observed and unobserved covariates in the participating population.

The cumulative distributions in equation (4) are computed by means of a simulation. I start with draws of random values from the distribution of the unobserved heterogeneity for each worker in the sample. In the next step, I draw independent values for the durations of each spell, conditional on the characteristics of the workers, x and v.[41] These draws are then used to determine the subpopulation of participation, which is defined by $\mathrm{t}_{u_1p} < \mathrm{t}_{u_1r}$.[42] For this sub-

[40] See figure 1 for all possible combinations of transitions which can lead to regular employment.

[41] See section C in the appendix for how to draw continuous random durations from a distribution derived by a piecewise constant hazard rate.

[42] For each spell the transition with the smallest duration is realised. In the simulation, I take censoring into account, by drawing a random duration for the time of censoring, derived by an auxiliary estimation. Durations which go beyond the observation period are censored, too.

population of participants I compute the remaining duration until a transition into regular employment. For the counterfactual situation of non-participation, I can derive the remaining duration, as $t_R = t_{u_1 r} - t_{u_1 p}$. Once the durations are drawn, one can compute the cumulative probabilities and the effect defined by equation (4).

In order to account for the imprecision of the estimated parameters, we repeat this simulation 300 times and draw each time from the vector of parameters using the estimated variance-covariance matrix.[43]

After presenting the used data set in the next section, I describe the simulation results in section 6.

5 Description of the database

The administrative data I use has been provided by the Belgian "Crossroad Bank for Social Security" (CBSS).[44] The available information allows me to construct the labour market histories for the sampled unemployed workers for the period from 1998-2002.[45] In addition, a reduced set of variables is available for the year 1997.

The raw data provides no way to observe the individuals from the moment they leave schooling. Instead I selected the flow of young workers who entered paid-unemployment (unemployment with full unemployment benefits) for the first time after a waiting period of nine months in 1998. Recall that to become eligible for the Recruitment Plan one has to be in unemployment for at least 12 months after leaving school. Thus, the workers in our sample cannot have had

[43] We use the fact that the asymptotic distribution of the maximum likelihood estimator is normal.

[44] The data have been provided by the "Datawarehouse marché du travail et protection sociale", a project of the CBSS which is in charge of the provision of data and statistics concerning the labour market and social security.

[45] The database contains information from the following institutions: The national unemployment office (ONEM), the national office for social security (ONSS), which is in charge of the collection of social insurance contributions from the employer and employees of the private and public sector (with exception of the individuals which are covered by the ONSSAPL). The national office for social security of the local and provincial administration (ONSSAPL). The national institute for the Social Security of the self-employed (INASTI). The national office for family allowances for employees (ONAFTS). Finally there is some complementary information from the national institute of statistics (INS).

a transition into subsidised employment during the quarter of entry.

In Belgium, compulsory school attendance applies until the age of 18 years and the individuals who leave school before are obliged to follow some form of education or vocational training until the age of 18. In order to avoid mixing up such training schemes with post-school employment, I focus on individuals who were at least 18 years old when they finished schooling.

The analysis is based on a sample of 15009 workers, who are between 18 and 26 years old when they start their waiting period. All workers receive unemployment benefits prior to the participation in the Recruitment Plan. The resulting database is homogeneous with respect to the labour market history of the workers in the sense that none of the individuals has registered employment experience before entering paid-unemployment in 1998, after a waiting period of nine months.

Figure 2 provides an overview of the size of the risk set in the different states for all possible trajectories. I have 15.009 workers who have a transition into a first unemployment spell. 6.487 of these workers have a direct transition from the first unemployment to regular employment. There are 814 transitions from unemployment to the subsidised employment programme. The remaining 7.708 workers are right censored during their first spell.

Of the workers who have a direct transition from the first unemployment spell to regular employment, 2.950 then have a transition to a second unemployment spell and 1.624 have a transition to a second regular employment.

In our model-framework the individuals who enter subsidised employment can either have a transition back to unemployment, this is the case for 272 participants, or a transition to regular employment, which applies for 344 workers. 67 of the participants who have a direct transition from subsidised to regular employment have a transition back to a second unemployment spell from which 30 individuals have a transition to a second regular employment. 107 of the participants who fall back to unemployment directly after the participation have a transition from this second unemployment spell to regular employment in the observation period.

The number of transitions into the subsidised employment programme is relatively low compared to the number of direct transitions to regular employment. This is partly due to the fact that some of the workers have a direct transition into regular employment during the months before they become eligible for the Recruitment Plan.[46] As mentioned in the description of the Recruitment Plan in section 2, another reason for the low take-up might be that the programme has never been promoted actively by the Belgian state as a programme to integrate long-term unemployed school-leavers.

Figure 3 shows the non-parametric survival rates for the different labour market states. The survival rate for the first unemployment spell decreases considerably over the observation period, despite the fact that the unemployed workers have already survived the nine months waiting period prior to the considered unemployment spell.

The survival rate for regular employment is marked by a strong decrease during the first 4 quarters of employment duration. At the end of the 4th quarter the survival rate is only 0.56. In the following quarters the survival rate stays relatively stable and at the end of the 14th quarter the survival rate is 0.44.

The survival rate for subsidised employment decreases even stronger and at the end of the 8th quarter the survival rate is a mere 0.27. This means that it is unlikely that the participating workers stay in the subsidised employment for the maximum duration. At the end of the ninth quarter the survival rate is zero, because of maximum duration of the entitlement period.

The survival rate in the second unemployment spell decreases fast and after 2 quarters of unemployment the survival rate is already down at 0.51. Consequently most of the workers who have a second unemployment spell have a transition back to regular employment rather fast.

Now I describe some features of the explanatory variables in the used data set. Table 2 contains a detailed overview with descriptive statistics for the ex-

[46] Our sample consists of workers who enter paid-unemployment after a waiting period of nine months, and workers have to be in unemployment for at least twelve months to become eligible for the Recruitment Plan. Therefore, during the first three month of paid-unemployment the transitions into employment are necessarily to regular, non subsidised, employment.

planatory variables. The descriptive statistics are provided for different subgroups. First for the participants of the Recruitment Plan, separated for the 491 participants who receive the subsidy after 12-24 months of unemployment (policy12) and the 323 participants who have been in unemployment for at least 24 months (policy24). I also present the statistics for the 6487 individuals who have a direct transition from the first unemployment spell to regular employment. The remaining workers are either censored because they enter inactivity or a different policy programme or because they stay in unemployment until the end of the observation period.

The 15009 individuals who are sampled at their start of paid-unemployment are roughly 20 years old at the end of 1997. Almost half (42.6%) of the workers in the final database are female.

With respect to the highest school degree it is remarkable that while policy12 participants are very similar to the workers who have a direct transition from unemployment to regular employment this is not the case for policy24 participants whose school degrees are substantially lower.

The fraction of individuals who enter paid unemployment from April until June sums up to almost 70%. This is due to Belgian schooling system where individuals normally finish school during the summer months. E.g. high school graduates who register as unemployed directly after school enter paid-unemployment in June.[47] Individuals who do not register as unemployed directly after finishing school enter paid-unemployment in the months from January to March or from July to December.

With respect to the position of the workers in the household it is worth noting that more than 3/4 of the workers are the child of the head of the household in which they live.

The database also has information on the number of persons in the household for different age-classes. In 7.1% of the households there are small children under 3 years of age. In 15.5% there are children of age over 3 but under 12 years.

[47] For this group the waiting period starts the first of September and ends at the end of May.

Two variables help to control for local labour market characteristics. First of all, I have the gender specific local unemployment rate for young people.[48] On average the unemployment rate is 23.1%. The large standard errors point to large differences in the local unemployment rates. Finally, I have information about the region where the workers live. 65.6% of the workers in our database come from the French speaking Wallonia. The remaining 34.3% of the workers come either from the Flemish or from the Brussels region.

As a general pattern, it seems that the participants have slightly worse characteristics than the individuals who have a direct transition into regular employment. This is especially true for the policy24 participants who enter the subsidised employment after being in unemployment for at least 24 months.

6 The effects of subsidised employment

Table 3 contains all parameter estimates for our model. Instead of dealing with the parameter estimates one by one I concentrate on the simulation results. However, before discussing the results I make some general remarks on the estimation itself and on the estimates for the unobserved characteristics.

The correlation coefficients for the unobserved heterogeneity factors for the transitions to the three different labour market states are reported at the end of table 3. The coefficients indicate the presence of selection in unobservables. In effect, I find a small negative correlation coefficient for the unobserved characteristics between transitions into subsidised and regular employment. This points to the fact that unobserved characteristics that are favourable for a transition to regular employment are negatively correlated with unobserved characteristics which determine a transition into programme participation. Similarly, unobserved characteristics that determine a transition into subsidised employment are positively correlated with unobserved characteristics for a transition into a second unemployment spell. Finally, favourable unobserved characteristics

[48] The numbers for the unemployment rate in our database are defined by the Belgian public administration as the number of completely enumerated unemployed workers as a percentage of the number of workers who are covered by the unemployment insurance.

that determine a transition into regular employment are negatively correlated with unobserved characteristics for a transition into unemployment.

In the following I discuss the simulation results. As mentioned before, the estimates identified by the proposed empirical model enable us to simulate the effect of participation in subsidised employment on different outcomes of interest. I present results for the effects of a transition into subsidised employment (i.e. programme participation) for the following duration outcomes:

- the duration until a first transition to regular employment
- the duration in employment until a transition to unemployment
- the duration of the second unemployment spell until a transition to regular employment

In addition, I provide simulation results for a set of subpopulations to give some insights on how the effects of participation in subsidised employment vary between different type of workers.

The different duration outcomes are presented separately. For each simulation I briefly summarise related economic theory, present and interpret the results. As an informal specification test, I use simulations to check if the estimates from the empirical model are able to reproduce the observed outcomes. In all considered cases the simulation is able to reproduce the observed outcomes over time, in the sense that statistics derived by simulation are never significantly different from statistics for the observed durations.

Effect of subsidised employment on the duration until regular employment
We first evaluate whether a transition into a subsidised job can accelerate the rate at which a regular job is entered. For this purpose, we analyse the elapsed duration between the moment of entry in a subsidised job and the moment at which one enters a regular job.[49] This duration is compared to the counterfactual duration until a transition into regular employment, if the worker would not

[49]Here, the duration is measured after the quarter of the transition into subsidised employment.

have entered the subsidised job.[50]

From Figure 1 one can see that after a transition into subsidised employment there are two different labour market trajectories which can lead to regular employment: Participants may either have a direct transition from subsidised employment to regular employment or they may have a transition to a second unemployment spell and find a regular employment afterwards. For the computation of the duration until a first transition to regular employment I take both possibilities into account.

From the theoretical economic literature it is not clear how participation in subsidised employment affects the transitions into regular employment. On the one hand, labour market experience may have an impact on the accumulation of human capital or on the building of a professional network which can both be expected to be favourable. In addition, a subsidised employment spell may provide a signal to future employers. On the other hand, participants may not look for a regular job with the same intensity while being in subsidised employment and consequently the duration until regular employment may be increased.[51]

I use the simulation to compute the fraction of participants who had a transition to regular employment by the end of each quarter starting from the quarter of a transition into subsidised employment.

As an informal test for the model, I contrast the simulated fractions to the fractions which are actually observed for the participants in our data. Figure 4 shows that the simulation is able to reproduce the observed fraction of workers who had a transition to regular employment, over time.

In the next step, I contrast the simulated fractions for the participants to those of the counterfactual situation of non-participation. Figure 5 shows these fractions for the time after the transition to participation. At this aggregate level, the simulated fraction of workers who had a transition to regular employment is

[50] The analysis of the duration until regular employment is related to the "timing-of-events" approach (Abbring and van den Berg (2003b)) where the effect of a treatment on the duration of interest is captured by a post-participation dummy. See Lubjova and van Ours (1999), van Ours (2004) and Göbel (2006b) for applications of the timing-of-events approach for the evaluation of participation in subsidised employment on the duration until regular employment.

[51] Low transition rates during participation have been referred to as locking-in effect in the literature (van Ours (2004)).

significantly higher after one year for the case of participation. At the maximum length of programme participation (9th quarter) there is a jump for the case of participation which reflects the fact that most workers who are still in subsidised employment at the end of the subsidies have a transition to regular employment.

The effect of participation on the fraction of workers who had a transition into regular employment are displayed in Figure 6. At the end of the first quarter after the quarter of a transition into subsidised employment the median difference is negative which points to a locking-in effect at the start of subsidised employment. However, already at the end of the second quarter the median is positive and after one year I find participation to cause significant positive effects. In the ninth quarter there is a jump in the effect. After the ninth quarter the fraction of participants for whom a transition to regular employment is observed is 23% higher compared to the case of hypothetical non-participation. To summarise, the results one can state that participation in subsidised employment shortens the duration until a transition into regular employment. Moreover the effect appears quickly, after one quarter.

The absence of a significant and lasting locking-in effect is astonishing at first sight.[52] However, economic theory provides some arguments as to why locking-in effects may be less important in the present paper. Working experience provided by subsidised employment programmes is likely to be especially beneficial for long-term unemployed workers without employment experience, as in our case. There are at least two theoretical arguments in favour of this: Firstly, the potential for the accumulation of human capital might be especially high for workers without employment experience. In fact, if experience is a factor to "produce" human capital, one would expect that human capital increases with experience and has decreasing returns.[53] Secondly, the fact that the workers accept a job may be a signal of motivation and other capacities. This signal is observed by other employers that might hire them.

[52]The existing literature on the effect of participation in subsidised employment provides hardly results without a significant locking-in effect. One exception is the study of Fredriksson and Johansson (2004).

[53]Light and Ureta (1995) provide estimates which show, for the US, that at the start of the career the wages are increasing with decreasing returns to work experience.

The descriptive statistics provide a hint regarding the way in which the positive effect is realised. Roughly half of the transitions out of subsidised employment are towards a second unemployment spell, before the maximum entitlement period of two years is finished. In addition, the survival rate in the second unemployment spell goes down rapidly which means that after a first employment experience the transitions to regular employment are relatively high. These observations suggest that at least part of the positive effect is realised via an intermediate transition into unemployment.

The fact that the subsidised employment provides experience in the private rather than the public sector may also be important to understand the relatively positive results. In the recent literature it has been repeatedly reported that subsidised employment programmes in "normal" jobs have better results on individual labour market outcomes than programmes in the public or non-market sector.[54]

Finally, the jump in the effect after the end of the subsidised employment reflects the fact that most workers who are still in subsidised employment at this moment have a direct transition to regular employment.[55]

Since the labour market perspectives are known to vary with the characteristics of the workers, it is likely that the effect of participation also depends on these characteristics. This is investigated in the next subsection.

Effect of subsidised employment for different subpopulations Now, I contrast the effects of participation in subsidised employment for different subpopulations in our sample.[56] This is especially useful if one wants to take the correlation of explanatory variables in different subpopulations into account. As before, I simulate the effect of participation on the duration until regular employment.

[54] See for example Sianesi (2001) or Gerfin et al. (2005) who report that subsidised employment in the market sector performs better than programmes in the public sector. Also Brodaty et al. (2001) reports better performance for programmes in the private sector, however for a mix of programmes which combine subsidised employment with training.

[55] This is similar to Fredriksson and Johansson (2004) who report a significant drop for the survival rate in "unemployment" at the end of the subsidised employment programme.

[56] Alternatively one could also simulate how the effects vary with explanatory variables.

To start with, I contrast the effects for subpopulations with different levels of *schooling*. One subgroup has less than a higher secondary school education and another subgroup has more than a higher secondary school education.[57] Figure 7 shows the effects for these two subpopulations. Despite the fact that in the long run the effects for both groups are almost identical, there is a difference in the time-pattern of the effects. Workers with a low education do not have a drop in the effect directly after the transition into subsidised employment. To the contrary, the fraction of workers who have a transition to regular employment starts to increase as from the beginning of participation. This points to higher transition rates out of the subsidised employment for the low-educated. Once these workers have participated in subsidised employment they seem to have a higher transition rate to regular employment than for the counterfactual case of non-participation.[58] The locking-in effect for the well-educated workers is likely to be caused by the relatively stable employment relations during participation, for this group.

In a next step, I contrast the effects for workers who are from a subregion with an *unemployment rate* lower than 15% with workers who are from a subregion with an unemployment rate higher than 34%. Although not significantly different, the median effect for the unemployment offices with high unemployment rates are always higher. Figure 8 shows that in the long run the difference between the median simulations is 8%. This provides some evidence that subsidised employment has stronger effects in subregions with higher unemployment rates.

Since the Belgian *regions* differ considerably in their economic performance I expect similar results when contrasting the economically more successful Flemish region with the Walloon region. Indeed, Figure 9 shows that during the first eight quarters the effects of subsidised employment are larger for Wallonia. How-

[57] Here, the subpopulation with a higher secondary school degree and with unknown school degree are left out to contrast the school education at the upper end with education at the lower end.

[58] See also Lubjova and van Ours (1999), who report better effects for low educated workers who participate in a Slovak subsidised employment programme in the public sector, compared to a programme without restriction on education in the private sector.

ever, in the long run there are hardly any differences in the effect of participation between the two regions.

Finally, the effects for *female* participants are slightly better than those for male participants. Figure 10 shows the effects for both subgroups. In the long run the simulated median effect for female participants is around 4% higher than those of their male counterparts.[59]

To summarise, these simulation results provide some evidence that participation in subsidised employment has stronger effects for subpopulations which are defined by unfavourable labour market characteristics. The effects are larger for the group of workers with low education, in regions with high unemployment rates, and for the group of female workers.

Effect of subsidised employment on the duration in employment A different way to investigate whether participation in subsidised employment is helpful for the integration of unemployed workers is to consider the time in subsidised employment as a period in which the participating worker is already integrated into the labour market, and to study if the duration of integration (subsidised plus regular employment) is affected by the subsidy. The idea is that employment subsidies could enhance the integration of the subsidised workers by lengthening the first employment experience.

In this subsection, I follow this approach and compute the effect of subsidised employment on the employment duration. For this purpose I contrast simulated employment spells starting with subsidised employment to employment spells starting as regular, non-subsidised, employment. Employment spells are explicitly allowed to be composed of several successive employment contracts and I investigate the duration until a transition back to unemployment.

The counterfactual (non-participation) situation is a hypothetical transition from regular employment to unemployment. The simulations provide some insight as to which extent the subsidised employment is different from regular

[59]This is in line with Ridder (1986) who reports a higher parameter estimate for female participants in subsidised employment.

employment.[60]

Theoretical arguments provided by Mortensen and Pissarides (2003) suggest that permanent subsidies increase the expected employment duration, while hiring subsidies, paid once at the start of employment, increase unemployment incidence.[61] Even though they do not investigate the case of temporary employment subsidies, the provided arguments suggest that employment subsidies can be expected to affect the employment duration.

Figure 11 shows that the simulation is able to reproduce the observable statistics. In Figure 12 I contrast the fractions for the case of participation with the counterfactual case of employment which starts with regular employment. One can see that from the beginning, the fraction of the workers who have already left employment is significantly lower for the case of participation than for the hypothetical case of non-participation. Taking the simulated difference between both situations, Figure 13 clearly confirms that at the start of the employment spell there is a substantial difference in fractions of workers who had a transition out of employment. At the end of the first quarter, the median of the simulated fractions is almost 15% lower for the case of participation in subsidised employment. As time goes by, the difference decreases slightly but stays still around 10% at the end of the 14th quarter. It seems that the duration in employment is mainly affected at the start of the employment spell where the transition rate out of employment is considerably lower for the case of participation in subsidised employment. Furthermore it is remarkable that there is no sudden change in the effect at the maximum duration of subsidised employment.

The economic arguments on the effect of subsidies on the employment duration provided by Mortensen and Pissarides (2003) fit the estimated effects only

[60] The simulation provides evidence for differences in the employment duration when controlling for selection in the characteristics of the participants. It is beyond the scope of this paper to control for employer characteristics. Note however that in their evaluation study for two subsidised employment programmes in Switzerland Gerfin et al. (2005) stratify with respect to the sectors of the employer and do not find effect heterogeneity.

[61] In their search and matching equilibrium framework with endogenous job-destruction and free entry Mortensen and Pissarides (2003) consider only job-duration. In their model job-destruction leads necessarily to unemployment.

roughly. Their arguments suggest that employment durations might be longer during the subsidised period whereas the transition rates out of employment can be expected to increase after the end of the subsidies (at least if the workers stay with the same employer). Even though the shape of the effects suggests that the transition rate out of employment is lower at the start of a subsidised employment spell and the transition rate into unemployment is higher afterwards, it is remarkable that the effect appears mainly at the very start of the employment spell. A possible explanation for the concentration of the positive effect in the first quarter of subsidised employment is that the employers observe the productivity of their new workers at the start of the employment spell - in the case of subsidised employment it may be worth to keep certain workers which would be laid off without the subsidy.

Effect of participation in subsidised employment on the duration in the second unemployment spell In this subsection I present the effects of a preceding participation in subsidised employment on the duration in the second unemployment spell. The counterfactual outcome is being in a second unemployment spell after a regular employment spell without any participation in subsidised employment.

The preceding subsections show that participation in subsidised employment has at least two different effects for the participants: Firstly the expected duration until a regular employment spell is shorter and secondly the expected employment experience is longer. Theoretically, human capital accumulation and the building of professional networks could provide a long-term advantage to participants of subsidised employment.

The simulation results for the effects are based on the dummies which capture the lagged duration dependence. This is similar to the models which have been applied by Ridder (1986), Gritz (1993), and Bonnal et al. (1997) who identify the effect of a former programme participation for different types of labour market programmes by modelling the lagged duration dependence.

Figure 14 provides the differences in fractions of workers who had a tran-

sition to regular employment caused by a former participation in subsidised employment.[62] At the start of the second unemployment spell I find a insignificant, small positive difference for the median which approaches zero for longer durations. This indicates that participation in subsidised employment does not have long-term effects on the labour market transitions of the young workers.[63]

To assess this result one should remember that for the described subsidised employment programme one can practically exclude stigma effects, since a former participation in subsidised employment is virtually invisible to potential future employers. It is remarkable that the additional employment experience provided by the means of subsidised employment compared to an employment spell in regular employment is not sufficient to affect the future employment prospects significantly.

7 Conclusion

Most European countries suffer from high unemployment rates for young people. Subsidised employment is a form of active labour market policy aiming at the integration of young workers into the labour market. The present paper provides new evidence for the effect of subsidised employment on the labour market transitions for the participating young long-term unemployed school-leavers.

In order to address possible selection problems, I apply a multivariate mixed proportional hazard model. I use the estimated parameters of the empirical model to simulate different labour market outcomes.

The findings can be summarised as follows:

Participation in subsidised employment affects labour market transitions in the short an medium term. Firstly participation shortens significantly the expected duration until regular employment. Furthermore, the simulation results

[62] As for the simulation results before, I checked if the observed fractions of individuals who have already left unemployment in our data set can be reproduced by our simulation. The corresponding graph is available on request from the author.

[63] This is in line with the results of Larsson (2003) and Carling and Larsson (2005) which report the absence of long-term effects of participation in subsidised employment for young workers in Sweden.

See also Card and Hyslop (2005) who report no effects after programme participation after the end of the subsidies for the Canadian Self-Sufficiency Program.

for different subpopulations suggest that the effects of participation in subsidised employment are better for individuals with unfavourable labour-market characteristics.

Secondly, by contrasting the duration in subsidised employment to the hypothetical case of regular employment, I find that as an effect of participation the transition rate from employment into unemployment is much lower in the first quarter after the quarter of entry into subsidised employment, and slightly higher afterwards. The expected employment duration increases as a result of participation in subsidised employment.

I do not find significant effects of a participation in subsidised employment on the transition rate out of a subsequent, second unemployment spell. After the end of the first employment spell, a former participation in subsidised employment has the same effect as a regular employment experience without programme participation.

The results in this paper suggest that participation in subsidised employment programmes is effective for young long-term unemployed school-leavers without working experience.

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Appendix

A Individual contributions to the likelihood

First I consider the state of unemployment.[64] For this state I define three random durations:
T_{u_1r} := the random duration in first unemployment until regular employment
T_{u_1p} := the random duration in first unemployment until programme participation (subsidised employment)
T_{u_2r} := the random duration in second unemployment spell until regular employment
For the programme participation states I define:
T_{pr} := the random duration in programme participation until regular employment
T_{pu_2} :=the random duration in programme participation until unemployment
Finally, for the state of regular employment I define:
T_{ru_2} := the random duration in regular employment until unemployment

I assume that all individual differences in the joint distribution

$T = (T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, T_{ru_2}, T_{u_2r})$ can be characterised by explanatory variables X, V where X is observed and V is not.

The joint distribution $T|X,V$ can be expressed in terms of the distributions
$(T_{u_1r}|X,V)$,
$(T_{u_1p}|X,V)$,
$(T_{pr}|T_{u_1r}, T_{u_1p}, X, V)$,
$(T_{pu_2}|T_{u_1r}, T_{u_1p}, X, V)$,
$(T_{ru_2}|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, X, V)$,
$(T_{u_2r}|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, T_{ru_2}, X, V)$.

The latter distributions are characterised by their hazard rates:
$\theta_{u_1r}(t|X,V)$,
$\theta_{u_1p}(t|X,V)$,
$\theta_{pr}(t|T_{u_1r}, T_{u_1p}, X, V)$,
$\theta_{pu_2}(t|T_{u_1r}, T_{u_1p}, X, V)$,
$\theta_{ru_2}(t|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, X, V)$,
$\theta_{u_2r}(t|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, T_{ru_2}, X, V)$.

Let $V := (V_r, V_p, V_u)$ be a (3×1)-vector of unobserved (destination specific) covariates.

Let $T_{u_1r} \perp\!\!\!\perp (V_p, V_u)|X, V_r$, implying that $\theta_{u_1r}(t|X,V) = \theta_{u_1r}(t|X,V_r)$

Let $T_{u_1p} \perp\!\!\!\perp (V_r, V_u)|X, V_p$, implying that $\theta_{u_1p}(t|X,V) = \theta_{u_1p}(t|X,V_p)$

[64] Note that all individuals have been waiting for nine months before becoming entitled to unemployment benefits. Only individuals who become entitled to unemployment benefits are considered for the first unemployment spell.

Let $T_{pr} \perp\!\!\!\perp (V_p, V_u)|T_{u_1r}, T_{u_1p}, X, V_r$, implying that
$\theta_{pr}(t|T_{u_1r}, t_{u_1p}, X, V) = \theta_{pr}(t|T_{u_1r}, T_{u_1p}, X, V_r)$
Let $T_{pu_2} \perp\!\!\!\perp (V_r, V_p)|T_{u_1r}, T_{u_1p}, X, V_u$, implying that
$\theta_{pu_2}(t|T_{u_1r}, T_{u_1p}, X, V) = \theta_{pu_2}(t|T_{u_1r}, T_{u_1p}, X, V_u)$
Let $T_{ru_2} \perp\!\!\!\perp (V_r, V_p)|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, X, V_u$, implying that
$\theta_{ru_2}(t|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, X, V) = \theta_{ru_2}(t|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, X, V_u)$
and $T_{u_2r} \perp\!\!\!\perp (V_p, V_u)|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, T_{ru_2}, X, V_r$, implying that
$\theta_{u_2r}(t|T_{u_1r}, T_{u_1p}, T_{pr}, T_{pu_2}, T_{ru_2}, X, V) = \theta_{u_2r}(t|T_{u_1r}, T_{u_1r}, T_{pr}, T_{pu_2}, T_{ru_2}, X, V_r)$.

Consider an individual in the *flow* sample and consider first the likelihood contribution conditional on the unobservables. I can distinguish the following cases:

1. right censored at unemployment duration t_k:

$$\begin{aligned} l_1(V) &= P(T_{u_1r} > t_k, T_{u_1p} > t_k|\cdot) \\ &= \exp\left[-\int_0^{t_k} \theta_{u_1r}(\tau|x, V_r)d\tau\right] \exp\left[-\int_0^{t_k} \theta_{u_1p}(\tau|x, V_p)d\tau\right] \quad (5) \\ &= \exp\left[-\sum_{j=1}^{k} [\theta_{u_1r}(t_j|x, V_r) + \theta_{u_1p}(t_j|x, V_p)]\right] \quad (6) \\ &= S_{u_1}(t_k|\cdot) \quad (7) \end{aligned}$$

Equation (5) gives the individual likelihood contribution of an individual in continuous time. $\int_0^{t_k}$ is the integral from the start of the first unemployment spell to the end of the k-th quarter in unemployment. Equation (6) is the individual likelihood contribution for grouped duration data.

The individual likelihood contribution in the case of right censoring at unemployment duration t_k is the survival rate in a competing risk model with two competing transitions at the end of the time period t_k.

2. leaving first unemployment for regular employment within $(t_{k-1}, t_k]$ and right censored during regular employment after t_l quarters:

$$\begin{aligned} l_2(V) &= P(t_{k-1} < T_{u_1r} \leq t_k, T_{ru_2} > t_l|\cdot) \\ &= \int_{t_{k-1}}^{t_k} \theta_{u_1r}(t|x, V_r) \exp\left[-\int_0^t [\theta_{u_1r}(\tau|x, V_r) + \theta_{u_1p}(\tau|x, V_p)]\, d\tau\right] dt \times \\ &\qquad \exp\left[-\sum_{j=1}^{l} \theta_{ru_2}(t_j|x, V_u)\right] \quad (8) \\ &= \left\{\frac{\theta_{u_1r}(t_k|x, V_r)}{\theta_{u_1r}(t_k|x, V_r) + \theta_{u_1p}(t_k|x, V_p)} \left[\exp\left[-\sum_{i=1}^{k-1}(\theta_{u_1r}(t_i|x, V_r) + \theta_{u_1p}(t_i|x, V_p))\right] -\right.\right. \end{aligned}$$

$$\exp\left[-\sum_{i=1}^{k}(\theta_{u_1r}(t_i|x,V_r)+\theta_{u_1p}(t_i|x,V_p))\right]\Bigg]\Bigg\}\times$$
$$\exp\left[-\sum_{j=1}^{l}\theta_{ru_2}(t_j|x,V_u)\right] \tag{9}$$

$$= \left\{\frac{\theta_{u_1r}(t_k|\cdot)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k|\cdot)}\left[S_{u_1}(t_{k-1}|\cdot)-S_{u_1}(t_k|\cdot)\right]\right\}S_r(t_l|\cdot) \tag{10}$$

where in the last line (and the sequel) the conditioning on x and V is implicit.

See Cockx (1997) for derivation from equation (8) to equation (9). I consider time periods of one quarter $(t_{k-1},t_k]$.

One could use the information about the month of entry together with the quarter of transition out of unemployment to identify transition rates out of unemployment on a monthly basis. See Göbel (2006a) for such an approach. To reduce the computational burden I don't consider this information here.

3. leaving first unemployment for regular employment within $(t_{k-1},t_k]$ and leaving for unemployment within $(t_{l-1},t_l]$ and right censored during unemployment at t_v.

$$\begin{aligned} l_3(V) &= P(t_{k-1}<T_{u_1r}\le t_k, t_{l-1}<T_{ru_2}\le t_l, T_{u_2r}>t_v|\cdot) \\ &= \left\{\frac{\theta_{u_1r}(t_k)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k)}\left[S_{u_1}(t_{k-1})-S_{u_1}(t_k)\right]\right\}\times \\ &\quad [S_r(t_{l-1})-S_r(t_l)]\times S_{u_2}(t_v) \end{aligned} \tag{11}$$

4. leaving unemployment for regular employment within $(t_{k-1},t_k]$ and leaving for unemployment within $(t_{l-1},t_l]$ and leaving for regular employment within $(t_{v-1},t_v]$.

$$\begin{aligned} l_4(V) &= P(t_{k-1}<T_{u_1r}\le t_k, t_{l-1}<T_{ru_2}\le t_l, t_{w-1}<T_{u_2r}\le t_w|\cdot) \\ &= \left\{\frac{\theta_{u_1r}(t_k)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k)}\left[S_{u_1}(t_{k-1})-S_{u_1}(t_k)\right]\right\}\times \\ &\quad [S_r(t_{l-1})-S_r(t_l)]\times[S_{u_2}(t_{v-1})-S_{u_2}(t_v)] \end{aligned} \tag{12}$$

5. leaving unemployment for programme participation within $(t_{k-1},t_k]$ and right censored during programme participation after t_m quarters:

$$\begin{aligned} l_5(V) &= P(t_{k-1}<T_{u_1p}\le t_k, T_{pr}>t_m, T_{pu_2}>t_m|\cdot) \\ &= \int_{t_{k-1}}^{t_k}\theta_{u_1r}(t|x,V_r)\exp\left[-\int_0^t\left[\theta_{u_1r}(\tau|x,V_r)+\theta_{u_1p}(\tau|x,V_p)\right]d\tau\right]dt\ \times \end{aligned}$$

$$\exp\left[-\sum_{j=1}^{m}(\theta_{pr}(t_j|\cdot,x,V_r)+\theta_{pu_2}(t_j|\cdot,x,V_u)\right]$$

$$= \left\{\frac{\theta_{u_1p}(t_k)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k)}\left[S_{u_1}(t_{k-1})-S_{u_1}(t_k)\right]\right\}S_p(t_m|\cdot) \tag{13}$$

6. leaving unemployment for programme participation within $(t_{k-1},t_k]$ and leaving for regular employment within $(t_{m-1},t_m]$ and right censored during regular employment at t_l.

$$\begin{aligned} l_6(V) &= P(t_{k-1}<T_{u_1p}\leq t_k, t_{m-1}<T_{pr}\leq t_m, T_{ru_3}>t_m|\cdot) \\ &= \left\{\frac{\theta_{u_1p}(t_k)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k)}\left[S_{u_1}(t_{k-1})-S_{u_1}(t_k)\right]\right\}\times \\ &\quad \left\{\frac{\theta_{pr}(t_m)}{\sum_{q\in\{r,u_2\}}\theta_{pq}(t_m)}\left[S_p(t_{m-1})-S_p(t_m)\right]\right\}\times \\ &\quad S_r(t_l) \end{aligned} \tag{14}$$

7. leaving unemployment for programme participation within $(t_{k-1},t_k]$ and leaving for unemployment within $(t_{m-1},t_m]$ and right censored during unemployment at t_v.

$$\begin{aligned} l_7(V) &= P(t_{k-1}<T_{u_1p}\leq t_k, t_{m-1}<T_{pu_2}\leq t_m, T_{u_2r}>t_w|\cdot) \\ &= \left\{\frac{\theta_{u_1p}(t_k)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k)}\left[S_{u_1}(t_{k-1})-S_{u_1}(t_k)\right]\right\}\times \\ &\quad \left\{\frac{\theta_{pu_2}(t_m)}{\sum_{q\in\{r,u_2\}}\theta_{pq}(t_m)}\left[S_p(t_{m-1})-S_p(t_m)\right]\right\}\times \\ &\quad S_{u_2}(t_v) \end{aligned} \tag{15}$$

8. leaving unemployment for programme participation within $(t_{k-1},t_k]$ and leaving for regular employment within $(t_{m-1},t_m]$ and leaving for unemployment within $(t_{l-1},t_l]$ and right censored during unemployment at t_v.

$$\begin{aligned} l_8(V) &= P(t_{k-1}<T_{u_1p}\leq t_k, t_{m-1}<T_{pr}\leq t_m, t_{l-1}<T_{ru_2}\leq t_l, T_{u_2r}>t_v|\cdot) \\ &= \left\{\frac{\theta_{u_1p}(t_k)}{\sum_{q\in\{r,p\}}\theta_{u_1q}(t_k)}\left[S_{u_1}(t_{k-1})-S_{u_1}(t_k)\right]\right\}\times \\ &\quad \left\{\frac{\theta_{pr}(t_m)}{\sum_{q\in\{r,u_2\}}\theta_{pq}(t_m)}\left[S_p(t_{m-1})-S_p(t_m)\right]\right\}\times \\ &\quad [S_r(t_{l-1})-S_r(t_l)]\times\ S_{u_2}(t_v) \end{aligned} \tag{16}$$

9. leaving unemployment for programme participation within $(t_{k-1},t_k]$ and leaving for regular employment within $(t_{m-1},t_m]$ and leaving for unemploy-

ment within $(t_{l-1}, t_l]$ **and leaving unemployment within** $(t_{v-1}, t_v]$**.**

$$\begin{aligned} l_9(V) &= P(t_{k-1} < T_{u_1p} \leq t_k, t_{m-1} < T_{pr} \leq t_m, t_{l-1} < T_{ru_2} \leq t_l, \\ &\quad t_{v-1} < T_{u_2r} \leq t_v|\cdot) \\ &= \left\{ \frac{\theta_{u_1p}(t_k)}{\sum_{q\in\{r,p\}} \theta_{u_1q}(t_k)} \left[S_{u_1}(t_{k-1}) - S_{u_1}(t_k)\right] \right\} \times \\ &\quad \left\{ \frac{\theta_{pr}(t_m)}{\sum_{q\in\{r,u_2\}} \theta_{pq}(t_m)} \left[S_p(t_{m-1}) - S_p(t_m)\right] \right\} \times \\ &\quad \left[S_r(t_{l-1}) - S_r(t_l)\right] \times \left[S_{u_2}(t_{v-1}) - S_{u_2}(t_v)\right] \end{aligned} \tag{17}$$

10. leaving unemployment for programme participation within $(t_{k-1}, t_k]$ **and leaving for unemployment within** $(t_{m-1}, t_m]$ **and leaving for regular employment within** $(t_{v-1}, t_v]$**.**

$$\begin{aligned} l_{10}(V) &= P(t_{k-1} < T_{u_1p} \leq t_k, t_{m-1} < T_{pu_2} \leq t_m, t_{v-1} < T_{u_2r} \leq t_v|\cdot) \\ &= \left\{ \frac{\theta_{u_1p}(t_k)}{\sum_{q\in\{r,p\}} \theta_{u_1q}(t_k)} \left[S_{u_1}(t_{k-1}) - S_{u_1}(t_k)\right] \right\} \times \\ &\quad \left\{ \frac{\theta_{pu_2}(t_m)}{\sum_{q\in\{r,u_2\}} \theta_{pq}(t_m)} \left[S_p(t_{m-1}) - S_p(t_m)\right] \right\} \times \\ &\quad \left[S_{u_2}(t_{v-1}) - S_{u_2}(t_v)\right] \end{aligned} \tag{18}$$

B Transition rates for the ninth quarter of programme participation

The maximum duration in the employment subsidy programme is nine quarters. This implies that the sum of the continuous time transition rates in the ninth quarter of participation is infinite.

This can be seen by taking a look at the survival rate in participation:

$$\begin{aligned} S_p(t_m|\cdot) &= \exp\left[-\int_0^{t_m} \left[\theta_{pr}(\tau|x, V_r) + \theta_{pu_2}(\tau|x, V_u)\right] d\tau \right] \\ &= S_p(t_{m-1}|\cdot) \times \exp\left[-\int_{t_{m-1}}^{t_m} \left[\theta_{pr}(\tau|x, V_r) + \theta_{pu_2}(\tau|x, V_u)\right] d\tau \right] \end{aligned} \tag{19}$$

Since the maximum duration in subsidised employment implies that the survival rate at the end of the ninth quarter $S_p(9)$ is equal to zero and given that there is a positive survival rate at the end of the 8th quarter $S_p(8) > 0$, the integral $\int_8^9 \left[\theta_{pr}(\tau|x, V_r) + \theta_{pu_2}(\tau|x, V_u)\right] d\tau$ has to be infinite. This implies that the sum of the transition rates for the ninth quarter of participation have to be infinite as well.

Although I cannot identify the transition rates for the ninth quarter, I am able to estimate the probability of having a transition to one of the two possible outcomes in this period. Generally the probability of having a transition to regular employment in the period t_m conditional on survival until the end of the preceding quarter can be written as:

$$P(t_{m-1} < T_{pr} \leq t_m) = \left\{ \frac{\theta_{pr}(t_m|\cdot)}{\theta_{pr}(t_m|\cdot) + \theta_{pu_2}(t_m|\cdot)} \left[S_p(t_{m-1}|\cdot) - S_p(t_m|\cdot) \right] \right\} \tag{20}$$

Since all workers who survive the 8th quarter have to leave during the ninth quarter, the survival rate at the end of the ninth quarter has to be zero. Then, the probability that a participant who survives the 8th quarter in participation has a transition to regular employment can be written as: $P(8 < T_{pr} \leq 9) = \left\{ \frac{\theta_{pr}(9|\cdot)}{\theta_{pr}(9|\cdot)+\theta_{pu_2}(9|\cdot)} \left[S_p(8|\cdot) - 0 \right] \right\}$ where the term on the left hand side is the probability that the transition is into regular employment, and the term on the right hand side is the probability of having a transition in the ninth quarter, which is equivalent to the survival rate at the end of the 8th quarter.[65]

To keep the estimation numerically feasible, I fix one of the transition-rates in the ninth quarter of policy participation at some high value.[66]

C Drawing continuous random durations from a distribution derived by a piecewise constant hazard rate

In continuous time it is well known that there is a unique relationship between the survival rate $S(t)$ and the hazard rate $h(t)$.

$$S(t) = exp\left[- \int_0^t h(\tau) d\tau \right] \tag{21}$$

Knowing the hazard rate this relationship can be exploited to draw random duration times from the distribution by drawing a random survival rate $S(t)$ from a uniform distribution and solving equation (21) for t. In certain cases an analytical solution to this problem exists.

For the case where t is defined by a piecewise constant hazard rates the survival rate at the end of a time period can be computed by using equation (21). I assume here that the piecewise constant hazard rate corresponds to time periods of equal length.[67]

[65] The equivalent equation for a transition into second unemployment given that an individual survives the 8th quarter of participation is: $\left\{ \frac{\theta_{pu_2}(9|\cdot)}{\theta_{pr}(9|\cdot)+\theta_{pu_2}(9|\cdot)} \left[S_p(8|\cdot) - 0 \right] \right\}$

[66] In the final estimates, the transition rate from participation into a second unemployment spell has been fixed to one. The estimation results are hardly sensitive with respect to this workaround.

[67] In this case I can compute the survival rate at the end of k-th period as the sum over the preceding hazard rates $S(t_k) = \sum_{t=1}^{k} h_t$

Let us assume that the duration t is in the k-th time-interval: $t_{k-1} < t \leq t_k$ where t_k denotes the end of the k-th time-interval. This implies also that $S(t_{k-1}) > S(t) \geq S(t_k)$.

One can rewrite equation (21) as

$$S(t) = \underbrace{exp\left[-\int_0^{t_{k-1}} h(\tau)d\tau\right]}_{S(t_{k-1})} \cdot exp\left[-\int_{t_{k-1}}^{t} h(\tau)d\tau\right] \tag{22}$$

where the first factor of the right hand side is simply the survival rate at the end of the time interval $k-1$. Since the hazard rate is constant within the k-th time interval I can rewrite equation (22) as:

$$\frac{S(t)}{S(t_{k-1})} = exp\left[-\int_{t_{k-1}}^{t} h_k d\tau\right] \tag{23}$$

where h_k is the piecewise constant hazard rate of the k-th time interval. This equation can be solved for t:

$$t = \frac{-\log\left[\frac{S(t)}{S(t_{k-1})}\right]}{h_k} + t_{k-1} \tag{24}$$

This is the analytical solution for t given $S(t)$ and h_k and knowing that t is in the k-th time interval.[68]

To draw a random duration from a distribution defined by a piecewise constant hazard rate h_t for $t = 1, ..., K$ one can proceed as follows:

1. Draw a random survival rate $\widetilde{S}(t)$ from a uniform $[0; 1]$ distribution
2. Compute the survival rate at the end of each time-interval for the given piecewise constant hazard rate and determine to which time-interval the random $\widetilde{S}(t)$ corresponds.
3. Compute the continuous duration t by applying equation (24).
4. If $\widetilde{S}(t)$ is smaller than the survival rate at the end of the last observed period t_K one knows that $t > t_K$ and the drawn duration is beyond the considered time horizon.

[68] Equation (24) holds also in the case of time-varying explanatory variables, if the attributed effects are not allowed to vary within a piecewise constant interval.

D Tables

Table 2: Descriptive Statistics

	policy 12	policy 24	regular em-ployment	censored unem-ployment	stay in unem-ployment	all
Number of workers	491	323	6487	6388	1320	15009
INDIVIDUAL CHARACTERISTICS:						
Age at the end of 1997	20.6	20.0	20.7	20.3	20.0	20.4
standard error	1.9	1.8	2.0	1.9	1.9	2.0
Female	48.5%	51.7%	46.8%	39.1%	35.1%	42.6%
Nationality:						
Belgian	88.4%	83.9%	90.3%	87.9%	81.5%	88.3%
EU not Belgian	7.3%	7.1%	5.1%	4.8%	7.6%	5.3%
Not EU	4.3%	9.0%	4.6%	7.3%	10.9%	6.4%
School degree:						
Primary school	6.5%	9.6%	6.4%	11.1%	20.1%	9.7%
Secondary school - base	18.5%	30.7%	18.6%	28.1%	37.8%	24.6%
Secondary school - high	51.7%	52.3%	47.2%	44.9%	36.5%	45.6%
College - non-university	12.6%	5.3%	14.7%	8.4%	2.7%	10.7%
College - university	4.9%	1.2%	6.6%	3.8%	1.1%	4.8%
Other education	1.0%	0.6%	0.6%	0.9%	1.7%	0.9%
Unknown education	4.7%	0.3%	5.8%	2.7%	0.1%	3.9%
Entry in paid-unemployment:						
Month of entry, January	1.6%	1.6%	2.1%	2.5%	2.5%	2.3%
Month of entry, February	1.2%	1.2%	2.0%	2.2%	2.4%	2.1%
Month of entry, March	3.1%	2.2%	2.9%	3.5%	2.4%	3.1%
Month of entry, April	35.8%	31.9%	32.9%	25.9%	29.7%	29.7%
Month of entry, May	12.4%	11.8%	12.1%	10.3%	8.6%	11.0%
Month of entry, June	24.4%	29.4%	27.7%	28.1%	23.2%	27.4%
Month of entry, July	7.9%	6.8%	7.2%	8.1%	8.5%	7.7%
Month of entry, August	4.7%	4.0%	3.7%	5.8%	6.2%	4.9%
Month of entry, September	2.9%	2.5%	2.5%	4.8%	3.8%	3.6%
Month of entry, October	2.9%	4.3%	2.7%	3.2%	4.5%	3.1%
Month of entry, November	0.8%	2.5%	2.1%	2.7%	3.4%	2.5%
Month of entry, December	2.2%	1.9%	2.1%	2.8%	4.9%	2.7%
Characteristics of the household:						
Head of the household (hoh)	7.5%	6.8%	6.9%	11.0%	12.1%	9.1%
Husband/wife of the hoh	2.0%	2.5%	1.7%	4.7%	3.5%	3.2%
Son/daughter of the hoh	84.9%	83.9%	83.1%	72.9%	70.8%	77.7%
Other family relationships to the hoh	1.8%	2.2%	2.3%	2.9%	3.1%	2.6%
No family relationship to the head hoh	3.7%	4.6%	5.9%	8.6%	10.5%	7.4%
# of persons in household [age):						
Indicator (# of persons [0-3) $>$ 0)	4.7%	5.6%	4.2%	8.8%	14.8%	7.1%
mean (# of persons [0-3)	1.1	1.1	1.1	1.1	1.1	1.1
Indicator (# of persons [3-12) $>$ 0)	13.0%	20.1%	14.1%	16.4%	18.1%	15.5%
mean (# of persons [3-12)	1.4	1.3	1.4	1.5	1.5	1.4
Total # of persons in household	2.9	3.1	2.8	2.7	2.8	2.8
standard error	1.7	1.9	1.7	1.9	2.1	1.9
LABOUR MARKET CHARACTERIST.:						
Unemployment rate - quarter of entry	23.6	24.1	21.8	23.5	26.8	23.1
standard error	8.4	8.3	9.1	9.1	8.2	9.1
Region of residence:						
Flemish region	16.7%	15.2%	27.0%	21.2%	8.6%	22.3%
Walloon region	70.3%	73.7%	62.4%	65.7%	77.5%	65.6%
Brussels region	13.0%	11.1%	10.5%	13.1%	13.9%	12.0%

Note: *policy12* refers to workers who have a transition to the subsidised employment after being in unemployment for at least 12 months. *policy24* refers to workers who

have a transition to subsidised employment after being in unemployment for at least 24 months. *Regular employment* refers to workers who have a direct transition from the first unemployment spell to regular employment. *Censored unemployment* refers to the workers who have been right censored during the observation period while being in the first unemployment spell. *Stay in unemployment* refers to workers who have been right censored in first unemployment due to the end of the observation period.

Table 3: Estimation results

-log (likelihood): 38689.3
parameters: 149
workers: 15009

	b	exp(b)	standard error	p-value
EXPLANATORY VARIABLES				
1st unemployment to regular employment				
Age - mean(age)	−0.003	0.997	0.010	0.757
Female	−0.133	0.876	0.040	0.001
Belgian				
EU not Belgian	−0.016	0.984	0.068	0.816
Not EU	−0.501	0.606	0.071	0.000
Primary school	−0.798	0.450	0.066	0.000
Lower secondary school	−0.572	0.565	0.043	0.000
Higher secondary school				
College - non-university	0.733	2.080	0.052	0.000
College - university	0.686	1.985	0.071	0.000
Other education	−0.634	0.531	0.184	0.001
Unknown education	0.889	2.431	0.084	0.000
Month of entry 1,2,7,8,9,10,11,12	−0.182	0.834	0.040	0.000
Month of entry 3,5,6	−0.106	0.900	0.035	0.002
Month of entry 4				
# of persons in the household [0-3)	−0.577	0.562	0.062	0.000
# of persons in the household [3-12)	−0.002	0.998	0.028	0.955
Unemployment rate/10 - quarter of entry	−0.239	0.787	0.029	0.000
Walloon region				
Flemish region	0.357	1.429	0.058	0.000
Brussels region	0.067	1.069	0.052	0.197
1st unemployment to policy				
Age - mean(age)	−0.055	0.946	0.030	0.066
Female	−0.481	0.618	0.131	0.000
Belgian				
EU not Belgian	0.251	1.285	0.182	0.169
Not EU	−0.371	0.690	0.214	0.083
Primary school	−0.957	0.384	0.193	0.000
Lower secondary school	−0.633	0.531	0.132	0.000
Higher secondary school				
College - non-university	0.410	1.507	0.167	0.014
College - university	0.466	1.594	0.250	0.062
Other education	−0.612	0.542	0.491	0.212
Unknown education	1.415	4.116	0.302	0.000
Month of entry 1,2,7,8,9,10,11,12	−0.282	0.754	0.123	0.021
Month of entry 3,5,6	−0.200	0.819	0.108	0.063
Month of entry 4				
# of persons in the household [0-3)	−0.480	0.619	0.173	0.005
# of persons in the household [3-12)	−0.034	0.967	0.084	0.686
Unemployment rate/10 - quarter of entry	−0.021	0.980	0.092	0.821
Walloon region				
Flemish region	0.024	1.024	0.200	0.904
Brussels region	0.192	1.211	0.154	0.214
policy to regular employment				
Age - mean(age)	0.032	1.032	0.047	0.504
Female	0.154	1.166	0.198	0.437
Belgian				
EU not Belgian	−0.840	0.432	0.362	0.020
Not EU	−0.392	0.675	0.447	0.380
Primary school	0.579	1.783	0.331	0.080
Lower secondary school	0.387	1.472	0.201	0.055

Higher secondary school				
College - non-university	0.075	1.078	0.252	0.767
College - university	0.269	1.309	0.383	0.483
Other education	1.182	3.260	1.435	0.410
Unknown education	−0.253	0.777	0.429	0.556
Month of entry 1,2,7,8,9,10,11,12	−0.295	0.745	0.210	0.160
Month of entry 3,5,6	0.015	1.015	0.168	0.929
Month of entry 4				
# of persons in the household [0-3)	0.113	1.120	0.308	0.713
# of persons in the household [3-12)	−0.015	0.985	0.158	0.922
Unemployment rate/10 - quarter of entry	−0.198	0.821	0.121	0.103
Walloon region				
Flemish region	−0.410	0.664	0.290	0.157
Brussels region	−0.456	0.634	0.281	0.105
Participation Policy24	−0.159	0.853	0.164	0.334
policy to 2nd unemployment				
Age - mean(age)	−0.094	0.911	0.071	0.186
Female	0.343	1.409	0.239	0.150
Belgian				
EU not Belgian	0.050	1.051	0.348	0.887
Not EU	−0.124	0.883	0.411	0.763
Primary school	1.005	2.731	0.338	0.003
Lower secondary school	0.367	1.443	0.244	0.133
Higher secondary school				
College - non-university	−0.036	0.965	0.389	0.926
College - university	−0.312	0.732	0.747	0.676
Other education	1.219	3.383	1.282	0.342
Unknown education	−3.066	0.047	1.070	0.004
Month of entry 1,2,7,8,9,10,11,12	−0.252	0.777	0.240	0.294
Month of entry 3,5,6	−0.262	0.770	0.217	0.227
Month of entry 4				
# of persons in the household [0-3)	0.064	1.066	0.398	0.872
# of persons in the household [3-12)	0.122	1.130	0.149	0.413
Unemployment rate/10 - quarter of entry	−0.236	0.790	0.134	0.078
Walloon region				
Flemish region	−0.386	0.680	0.341	0.258
Brussels region	−0.008	0.993	0.300	0.980
Participation Policy24	0.331	1.392	0.199	0.097
regular employment to 2nd unemployment				
Age - mean(age)	−0.034	0.967	0.015	0.028
Female	0.133	1.142	0.056	0.019
Belgian				
EU not Belgian	0.201	1.223	0.093	0.030
Not EU	0.135	1.145	0.100	0.177
Primary school	0.820	2.271	0.092	0.000
Lower secondary school	0.495	1.641	0.063	0.000
Higher secondary school				
College - non-university	−0.268	0.765	0.079	0.001
College - university	−0.691	0.501	0.132	0.000
Other education	0.267	1.307	0.262	0.308
Unknown education	−2.369	0.094	0.217	0.000
Month of entry 1,2,7,8,9,10,11,12	0.002	1.002	0.059	0.980
Month of entry 3,5,6	−0.071	0.931	0.051	0.164
Month of entry 4				
# of persons in the household [0-3)	0.057	1.058	0.085	0.506
# of persons in the household [3-12)	0.031	1.031	0.040	0.444
Unemployment rate/10 - quarter of entry	0.079	1.082	0.039	0.046
Walloon region				
Flemish region	0.109	1.115	0.080	0.174
Brussels region	−0.122	0.885	0.076	0.111

Participation Policy12	−0.880	0.415	0.188	0.000
Participation Policy24	−0.344	0.709	0.252	0.173
2nd unemployment to regular employment				
Age - mean(age)	0.001	1.001	0.019	0.953
Female	−0.003	0.997	0.069	0.963
Belgian				
EU not Belgian	−0.006	0.995	0.113	0.961
Not EU	−0.136	0.873	0.136	0.317
Primary school	−0.411	0.663	0.110	0.000
Lower secondary school	−0.393	0.675	0.076	0.000
Higher secondary school				
College - non-university	0.499	1.647	0.095	0.000
College - university	0.436	1.546	0.141	0.002
Other education	−0.396	0.673	0.359	0.270
Unknown education	1.318	3.735	0.294	0.000
Month of entry 1,2,7,8,9,10,11,12	−0.015	0.985	0.073	0.836
Month of entry 3,5,6	0.109	1.115	0.063	0.083
Month of entry 4				
# of persons in the household [0-3)	−0.273	0.761	0.130	0.036
# of persons in the household [3-12)	−0.051	0.951	0.050	0.311
Unemployment rate/10 - quarter of entry	0.015	1.015	0.047	0.746
Walloon region				
Flemish region	0.315	1.371	0.099	0.001
Brussels region	−0.229	0.796	0.098	0.020
Participation Policy12	0.799	2.224	0.240	0.001
Participation Policy24	−0.280	0.756	0.524	0.593
Participation Policy12 x policy to 2nd unempl.	−0.837	0.433	0.267	0.002
Participation Policy24 x policy to 2nd unempl.	0.244	1.276	0.555	0.660
BASELINE HAZARD				
1st unemployment to regular employment				
Quarter 1	const			
Quarter 2	0.371	1.449	0.040	0.000
Quarter 3	0.244	1.276	0.051	0.000
Quarter 4,5	0.279	1.321	0.057	0.000
Quarter 6,7	0.254	1.289	0.072	0.000
Quarter 8,9,10,11	0.084	1.087	0.084	0.318
Quarter 12,13,14	−0.228	0.797	0.114	0.047
Quarter 15	−0.899	0.407	0.272	0.001
1st unemployment to policy				
Quarter 1	-inf			
Quarter 2,3,4	const			
Quarter 5,6,7	0.656	1.928	0.127	0.000
Quarter 8,9,10,11,12	0.713	2.039	0.214	0.001
Quarter 13,14,15	0.410	1.507	0.316	0.194
policy to regular employment				
Quarter 1,2,3,4,5,6,7,8	const			
Quarter 9	3.163	23.634	0.667	0.000
policy to 2nd unemployment				
Quarter 1	const			
Quarter 2,3,4	0.363	1.438	0.365	0.319
Quarter 5,6,7,8	−0.001	0.999	0.426	0.998
Quarter 9 normalised	1.000			
regular employment to 2nd unemployment				
Quarter 1	const			
Quarter 2	−0.376	0.686	0.099	0.000
Quarter 3	−0.826	0.438	0.120	0.000

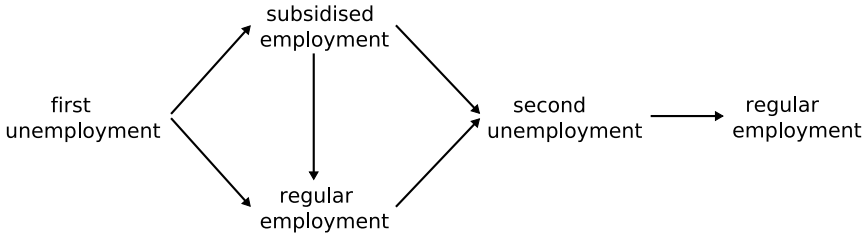
Quarter 4	−0.602	0.548	0.127	0.000
Quarter 5	−1.400	0.246	0.150	0.000
Quarter 6	−1.561	0.210	0.158	0.000
Quarter 7	−1.881	0.152	0.181	0.000
Quarter 8	−1.350	0.259	0.160	0.000
Quarter 9,10	−2.176	0.113	0.176	0.000
Quarter 11,12,13	−2.456	0.086	0.199	0.000
Quarter 14	−1.335	0.263	0.293	0.000
2nd unemployment to regular employment				
Quarter 1	const			
Quarter 2,3	−0.225	0.799	0.060	0.000
Quarter 4,5,6	−0.698	0.498	0.097	0.000
Quarter 7,8,9,10,11,12	−1.050	0.350	0.169	0.000
DISTRIBUTION - Unobserved heterogeneity				
points of support:				
1st unemployment to regular employment r1	−2.460	0.085	0.125	0.000
1st unemployment to regular employment r2	−1.033	0.356	0.103	0.000
1st unemployment to policy p1	−4.703	0.009	0.374	0.000
1st unemployment to policy p2	−1.724	0.178	0.410	0.000
Regular employment to 2nd unemployment u1	−1.963	0.140	0.162	0.000
Regular employment to 2nd unemployment u2	0.380	1.463	0.243	0.118
Multiplier - policy to regular employment	0.874	2.396	0.142	0.000
Multiplier - policy to 2nd unemployment	1.464	4.325	0.248	0.000
Multiplier - 2nd unemployment to regular empl.	0.692	1.998	0.080	0.000
probability mass: lam_rpu				
lam_111	2.396	10.982	0.436	0.000
lam_112	1.173	3.230	0.352	0.001
lam_121	0.706	2.025	0.292	0.016
lam_122	-Inf			
lam_211	2.549	12.789	0.390	0.000
lam_212	-Inf			
lam_221	-Inf			
Probabilities P_rpu:				
P_111	0.366			
P_112	0.108			
P_121	0.067			
P_122	0.000			
P_211	0.426			
P_212	0.000			
P_221	0.000			
P_222	0.033			
Correlation of UH-terms				
Corr(rp)	−0.086			
Corr(ru)	−0.181			
Corr(pu)	0.183			

Note: Since there are no transitions from unemployment to subsidised employment in the first quarter of paid-unemployment the hazard rate has been fixed to zero ($\alpha_1^{up} = -infinity$). I impose the following normalisation: $\alpha_1^{u_1 r} = \alpha_2^{u_1 p} = \alpha_1^{pr} = \alpha_1^{pu_2} = \alpha_1^{u_2 r} = \alpha_1^{r u_2} = 1$. The scale of transition rates is captured by the distribution of the unobserved heterogeneity.

Note: Some of the parameters which determine the probability mass associated to a point of support converge to $-infinity$ which lead to a probability-mass of zero for the respective point of support.

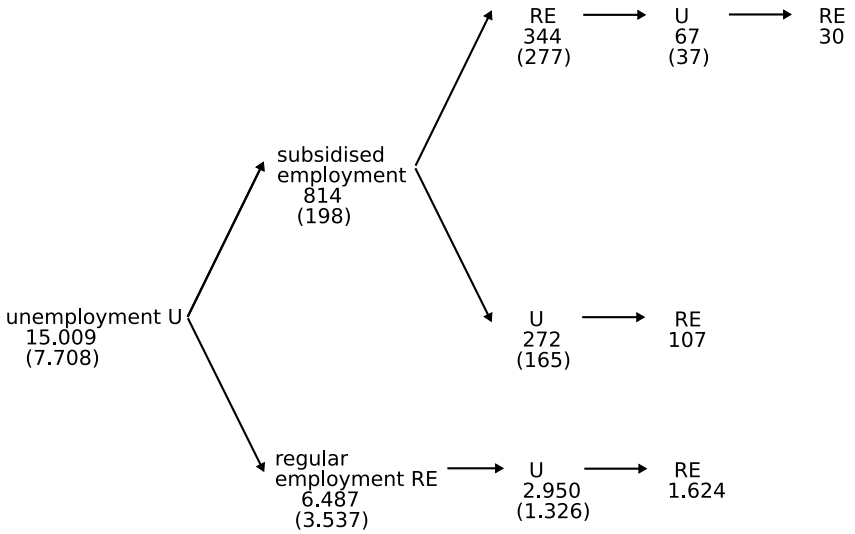
E Figures

Figure 1: Scheme of the possible labour-market transitions



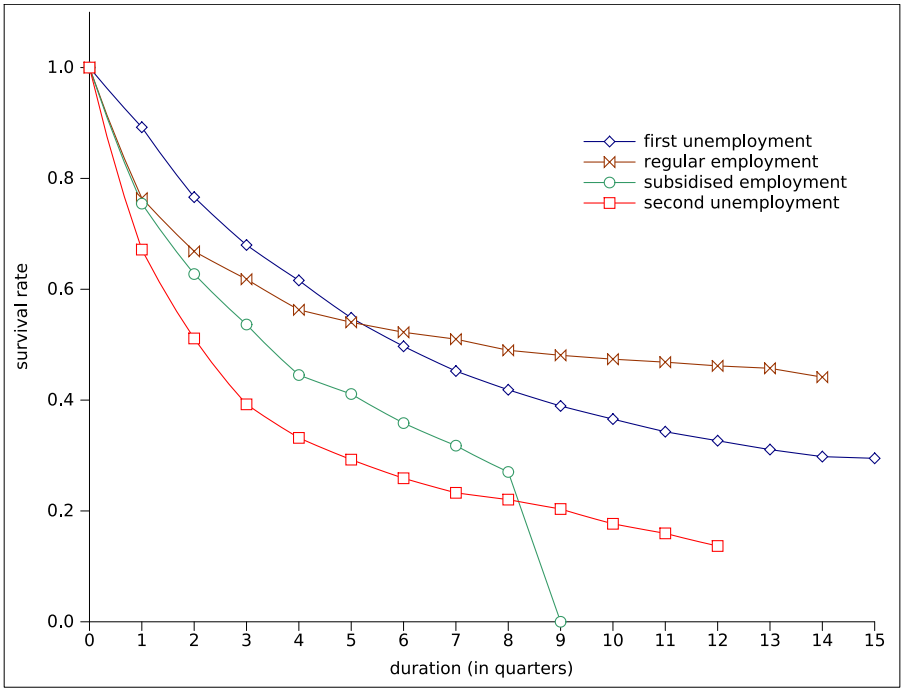
Note: The arrows represent transitions between the considered labour market states. All individuals start with an unemployment spell (at the extreme left).

Figure 2: Labour market flows within our transition model



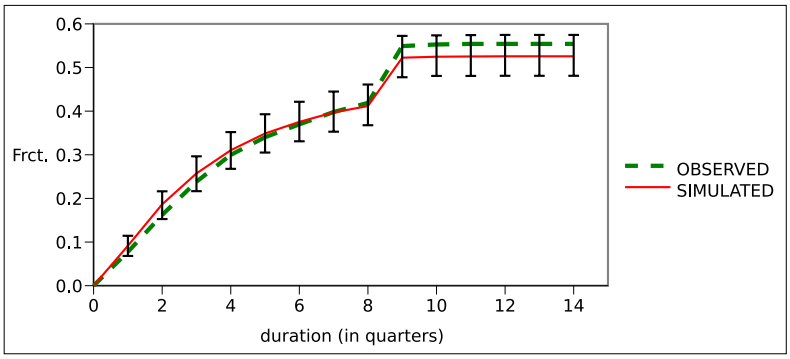
Note: The upper number indicates how many workers have entered the corresponding labour market state. The number of workers who are censored while being in the corresponding state is given in brackets.

Figure 3: Descriptive survival rates



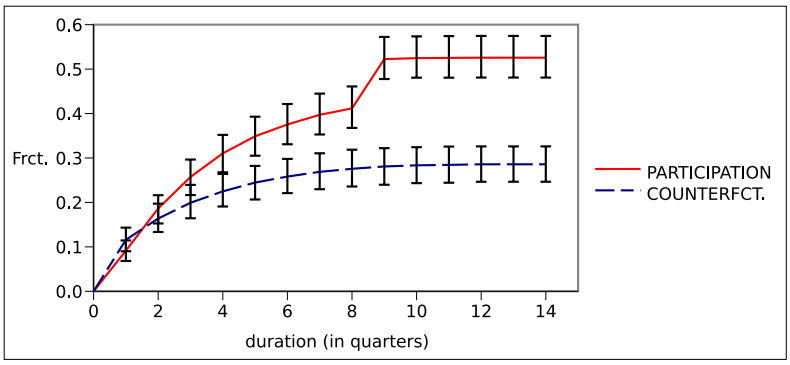
Note: The nonparametric survival rates are computed at the end of each quarter.

Figure 4: Observed versus simulated fraction of participants who had a transition to regular employment



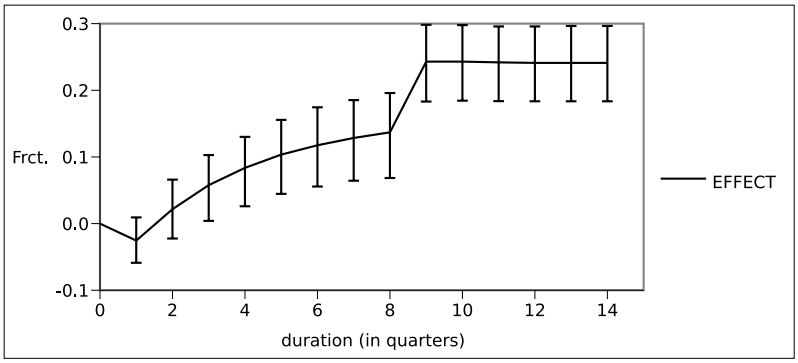
Note: The time is measured after the quarter of the transition into subsidised employment. The dashed line describes the fraction of participants in our database for which a transition into regular employment is observed. The solid line indicates the median fraction for the simulated participation. 95% of the simulation results are within the confidence intervals.

Figure 5: Simulation results for the duration until a transition to regular employment - participants vs. counterfactual



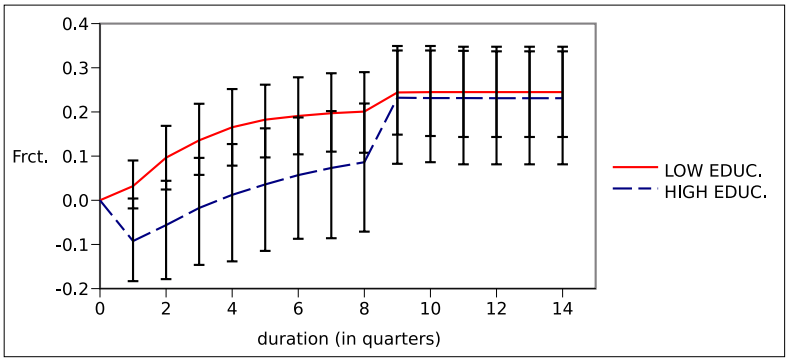
Note: The time is measured after the quarter of the transition into subsidised employment. The solid line indicates the median fraction of individuals who had a transition to regular employment for the simulated participants. The dashed line indicates the median fraction for the simulated counterfactual (non-participation). 95% of the simulation results are within the confidence bands.

Figure 6: Difference in fractions caused by participation for the transition to regular employment



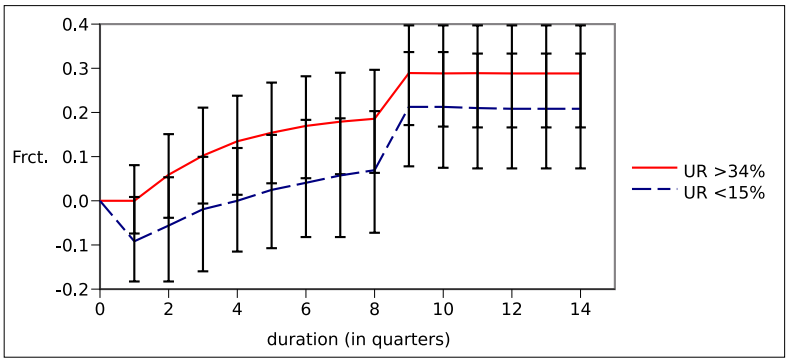
Note: The time is measured after the quarter of the transition into subsidised employment. The solid line indicates the difference between the fractions of participants and counterfactual for the median simulation. 95% of the simulation results are within the confidence intervals.

Figure 7: Difference in fractions caused by participation for the transition to regular employment - education



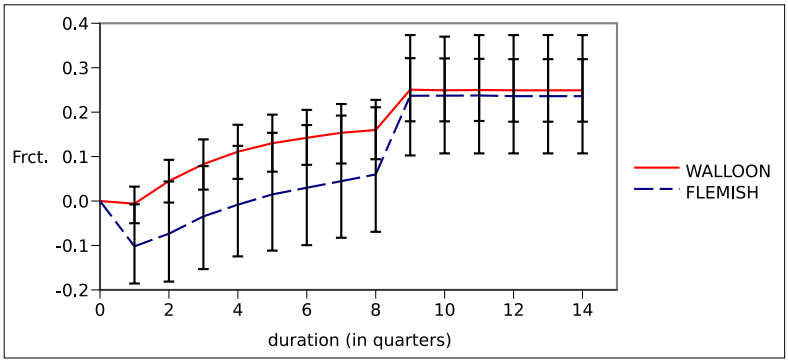
Note: The time is measured after the quarter of the transition into subsidised employment. Low education refers to participants who have less than a higher secondary school education. High education refers to participants who have more than higher secondary school education. 95% of the simulation results are within the confidence intervals.

Figure 8: Difference in fractions caused by participation for the transition to regular employment - regional unemployment rate



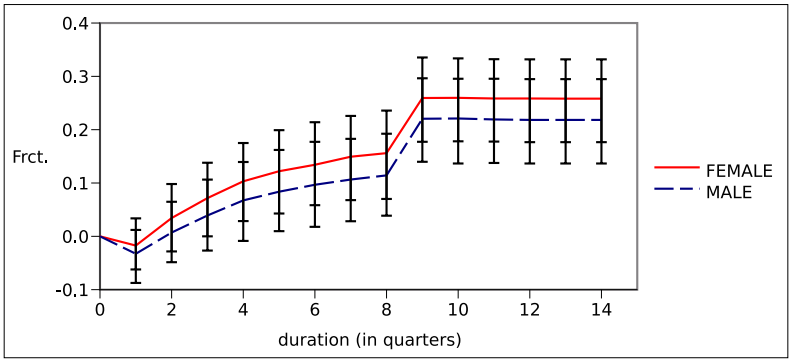
Note: The time is measured after the quarter of the transition into subsidised employment. UR > 34% refers to participants in subregions with an unemployment rate higher than 34%. UR < 15% refers to participants in subregions with an unemployment rate lower than 15%. 95% of the simulation results are within the confidence intervals.

Figure 9: Difference in fractions caused by participation for the transition to regular employment - regions



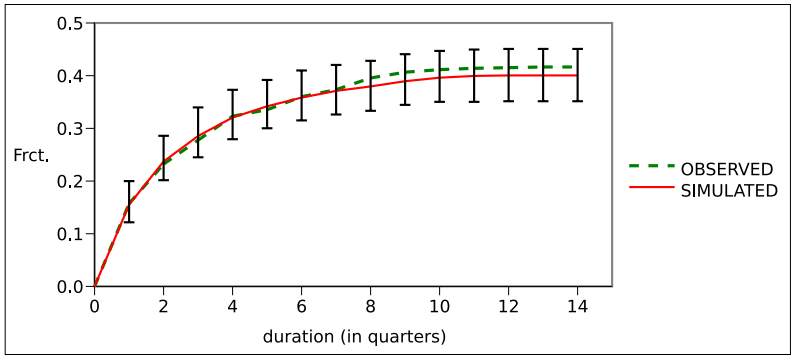
Note: The time is measured after the quarter of the transition into subsidised employment. Walloon refers to participants from the French speaking region Wallonia in the south of Belgium. Flemish refers to participants from the Flemish speaking region Flanders in in the north of Belgium. 95% of the simulation results are within the confidence intervals.

Figure 10: Difference in fractions caused by participation for the transition to regular employment - gender



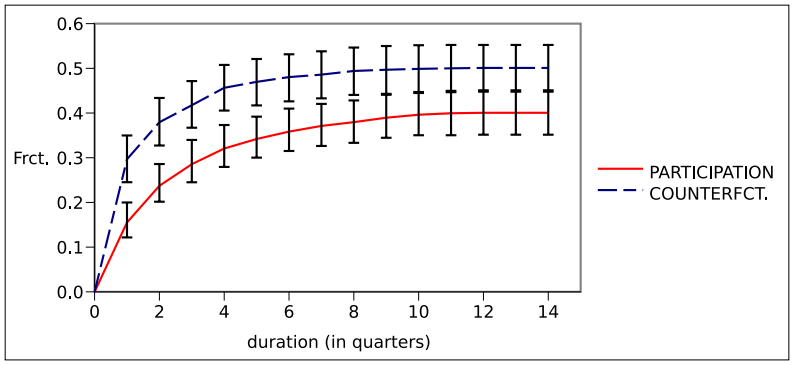
Note: The time is measured after the quarter of the transition into subsidised employment.The simulated differences in fractions are for the subgroups of female and male participants. 95% of the simulation results are within the confidence intervals.

Figure 11: Observed versus simulated fraction of participants who had a transition from employment to unemployment



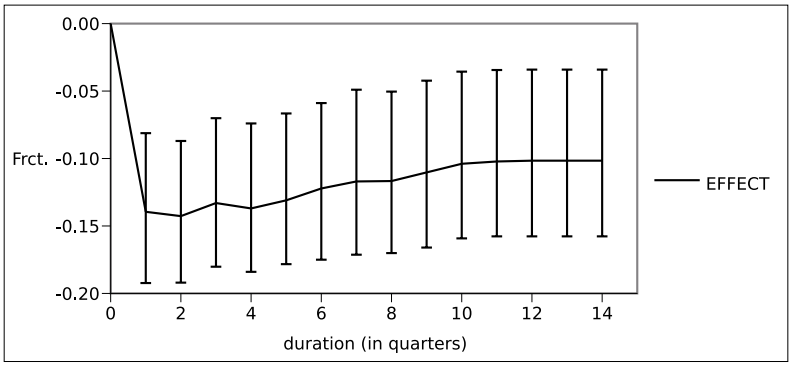
The time is measured after the quarter of the transition into subsidised employment. The dashed line describes the fraction of participants in our database for which a transition from employment to unemployment is observed. The solid line indicates the median fraction for the simulated participation. 95% of the simulation results are within the confidence intervals.

Figure 12: Simulation results for the duration until a transition from employment to unemployment - participants vs. counterfactual



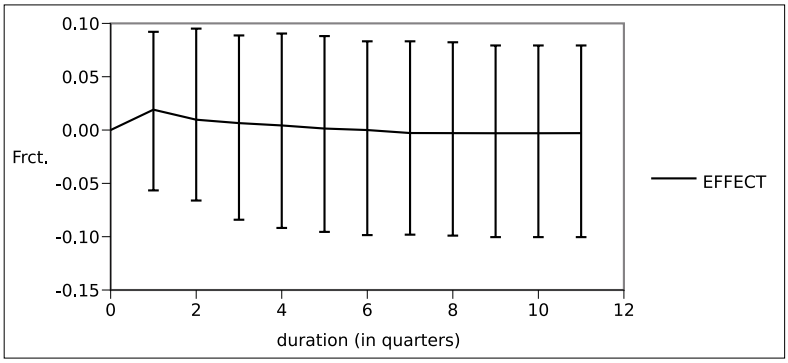
The time is measured after the quarter of the transition into subsidised employment. The solid line indicates the median fraction of individuals who had a transition to unemployment for the simulated participants. The dashed line indicates the median fraction for the simulated counterfactual (non-participation). 95% of the simulation results are within the confidence intervals.

Figure 13: Difference in fractions caused by participation for the transition from employment to unemployment



The time is measured after the quarter of the transition into subsidised employment. The solid line indicates the difference between the fractions of participants and counterfactual for the median simulation. 95% of the simulation results are within the confidence intervals.

Figure 14: Difference in fractions caused by participation for the transition from second unemployment (after a first employment spell) to regular employment



The time is measured after the quarter of the transition into the second unemployment spell. The solid line indicates the difference between the fractions of participants and counterfactual for the median simulation. 95% of the simulation results are within the confidence intervals.