A Structural Empirical Analysis of Job Search, Active Labor Market Policies and Sickness Absence

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Abstract

Unemployment insurance (UI) agencies often punish refusals to apply for assigned job vacancies by reducing UI payments for a fixed time span. This element of job search monitoring is intended to reduce moral hazard among UI benefit recipients. In practice however such sanctions are rarely imposed. Two potential reasons for the low sanction rate are that sanctions may be avoided by strategically reporting sick and that caseworkers may use their substantial discretionary leeway to suspend due sanctions. This paper provides a structural framework for evaluation of labor market policies related to job referrals and sanctions, explicitly taking into account strategic sick reporting and imperfect sanction enforcement. We use German register data to estimate our structural model. Implications of our estimates are that the number of sick reports is increased by a factor of 1.9 in periods where a job referral occurs and that sanction enforcement varies between 13% and 29%. Policy simulations suggest that moving to a regime where two thirds of all sanctions are enforced reduces the average unemployment duration by 0.5 to 2 months, depending on industry sector.

Keywords: unemployment, vacancy referrals, wage, unemployment insurance, monitoring, moral hazard, structural estimation, counterfactual policy evaluation

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1 Introduction

In many OECD countries unemployment insurance (UI) agencies punish refusals to apply for referred job vacancies by discontinuing unemployment insurance payments for a fixed time span. The combination of sending out job vacancy referrals (VRs) and sanctioning refusals to apply for the referred positions is intended to counteract moral hazard and increase the reemployment rate among UI recipients. By making VRs the UI agency complements individual job search effort of UI benefit recipients and by sanctioning refusal to apply for assigned VRs it is ensured that unemployed individuals cannot be too selective about applying for VRs. However, in many UI systems the requirement to apply for a VR ceases in case of sickness. For a UI recipient this creates an incentive to call in sick strategically in response to receiving VRs that he deems unattractive. Typically by handing in a sick note for a sufficiently long time period UI recipients may completely circumvent the requirement of applying for a VR without facing any risk of being sanctioned. Additionally enforcement of sanctions is typically not structured by binding rules, but to some extent subject to the discretion of individual caseworkers at the UI agency. As a consequence an individual who could be sanctioned on the grounds of the rules of the UI system, may in fact not receive a sanction because the respective caseworker makes use of his discretionary leeway to suspend the sanction.

Strategic sick reporting and imperfect sanction enforcement are aspects, which generally reduce the probability of receiving a sanction. The presence of these aspects thus diminishes any effects of VRs and sanctions on job search behavior that operate via an increased risk of receiving a sanction in the future (i.e. via the "threat potential" of sanctions). As a direct consequence the possibility of strategic sick reporting and the presence of imperfect sanction enforcement may hamper the effectiveness of VRs and sanctions in counteracting moral hazard. In evaluating policy changes related to VRs and sanctions it is thus important to take into account both these aspects.

In this paper we set up and estimate a structural job search model that is tailored to reflect a number of features of the German UI system. Our model incorporates regular job offers, i.e. job offers that job searchers obtain without interference by the UI agency, as well as VRs and sanctions. The model explicitly accounts for strategic sick reporting after unfavorable VRs and imperfect sanction enforcement. We estimate the model using administrative data from social security records as well as data from administrative records collected by the German Public Employment Service. The data we use covers the period 2000 to 2002. In particular we use detailed information on unemployment and employment durations, benefit receipt, the arrival of vacancy referrals, received sanctions, sickness absence during unemployment and daily wages during employment. Additionally the data feature a broad range of socioeconomic characteristics including education, family status and health restrictions. We use our model to simulate a range of counterfactual policy changes related to changing the VR arrival rate and the sanction enforcement rate. Our model is also suited to simulate changes in sanction duration (i.e. for how many time periods a sanction lasts) and sanction severeness (i.e. by how much UI benefits are reduced in case of a sanction). The results of these simulation exercises are helpful for understanding how effective sanctions in the German UI system are in reducing moral hazard and in clarifying the role that sick reports and imperfect enforcement play in this context.

Our paper adds to the literature on job search monitoring and sanctions (see e.g. Arni, Lalive, and van Ours 2013, Lalive, van Ours, and Zweimüller 2005, van den Berg, van der Klaauw, and van Ours 2004) In particular our study complements a growing literature that uses structural models to evaluate active labor market policy. E.g. van den Berg and van der Klaauw (2013) study effects of monitoring in a setting of job search via different channels, Cockx et al. (2011) study effects of a system of monitoring and sanctions on search effort in a non-stationary environment and Fougère, Pradel, and Roger (2009) study the effect of VRs on unemployment duration in a structural framework and investigate to what extent job searchers reduce their search effort if they frequently receive VRs. Lise, Seitz, and Smith (2006) use the exogenous variation of an active labor market program to validate a structural search model. This paper is the first that provides a structural analysis of the interplay of VRs and sanctions with sick reporting and imperfect sanction enforcement.

The remainder of the paper is organized as follows: Section 2 describes the institutional background in Germany, i.e. the rules and institutions related to UI benefits, VRs and sanctions that German UI recipients face. Section 3 describes our data. Section 4 develops the structural model and derives the likelihood function. Section 5 presents estimation results. Section 6 presents the evaluation of counterfactual policies and section 7 concludes.

2 Institutional background

As we aim to analyze the interplay between various policies, it is important to describe the institutional setting in detail. Moreover, the policies are implemented by actors with discretionary powers (notably, by caseworkers and physicians), so our analysis requires knowledge of the range of possible actions they may take. For this purpose we conducted an extensive qualitative survey among eight individuals who are employed by the Federal Employment Office to gather insights into the daily functioning of employment agencies and active labor market programs. These eight individuals worked as caseworkers during our observation period (January 2000 until December 2002). The description below of the institutional setting refers to this observation period.

2.1 Unemployment benefits

In our observation period, UI benefits are paid to individuals who are registered as unemployed and have been working and paying social security contributions for at least twelve months within the last three years prior to unemployment. The entitlement duration depends on the duration of the prior employment period and the age of the recipient. The maximum entitlement duration is 32 months for individuals who are older than 56 years and who have been employed for at least 64 months in the seven years prior to unemployment. Up to 2005, UI benefit recipients were entitled to means-tested unemployment assistance (UA) after expiration of their UI benefits entitlement. Monthly UI benefits amounted to 67% of the previous monthly net wage for unemployed persons with dependent children and to 60% for those without, whereas the corresponding replacement ratios for UA were 57% and 53%, respectively.[1] UA entitlement was unlimited in time. For a detailed description of the UI system and its changes over time, see e.g. Konle-Seidl, Eichhorst, and Grienberger-Zingerle (2010).

2.2 Vacancy referrals

A vacancy referral (VR; also called placement referral) is a directive to apply for a specific job opening. The corresponding job description typically contains the occupation, the working hours and the date of the potential job start, but not the wage. The jobs cover a large variety ranging from job creation schemes to regular jobs. After receiving a VR, the unemployed has to apply for the job as soon as possible. A VR does not entail that the employer is informed about the candidate in advance, or that the employer intends to hire him. The maximum time length for the application and hiring process after a VR depends on the sector and the occupation. According to the interviewed caseworker experts, this length is almost always less than or equal to 2 weeks and is longer for high skilled jobs than for low skilled jobs. Not following a VR to a job opening that is deemed suitable can result in a sanction. The same applies to the rejection of

[1] Benefits levels are capped if gross monthly pre-unemployment wages were above the so-called social security contribution ceiling. In 2000, this ceiling was at 4400 euro, corresponding to a maximum net monthly UI benefits level of around 1700 euro.

an offer of a job found through a VR. In our observation period, "suitability" refers to the total daily commuting time and the wage level. If the commuting time exceeds 2.5 hours then the job is not deemed suitable. Furthermore, within the first 3 months of UI benefit receipt, a job is deemed suitable if the wage is not below 80% of the previous wage; between months four and six, this threshold drops to 70%, and from the seventh month onwards, all jobs that offer a wage above the current benefit level are deemed suitable (Pollmann-Schult, 2005).

2.3 Monitoring and sanctions

In our observation period, the PES monitors whether UI and UA recipients comply with requirements and guidelines. If the agency observes that an individual violates these then it may punish the individual by way of a benefit reduction (i.e., with a sanction). One may distinguish between 5 grounds for sanctions. (1) The individual quits his job. In this case he does not receive any benefits for the first 12 weeks of unemployment. In the case of hardship, the sanction length can be limited to 6 weeks. If the job would have ended within 4 weeks anyway, the individual is sanctioned by three weeks only. (2) The individual does not apply for a suitable job that has been proposed to him as a VR or rejects a suitable job that has been offered to him. Again, the sanction lasts for 12 weeks. If the corresponding job is temporary, the sanction period reduces to 3 weeks. Notice that the individual may intentionally prevent the employer from making an offer, e.g., by misbehaving during the interview. For the caseworker it is difficult to prove such intention; this critically depends on the quality of the contact between him and the employer. Our interviews with caseworker experts indicate that such misbehavior has been used in a number of cases as a ground to impose a sanction. (3) The individual refuses participation or (4) drops out of an active labor market policy (ALMP) measure. This involves a sanction of 12 weeks. If the scheduled length of the measure is less than 6 weeks, the unemployed worker is sanctioned for 6 weeks. Finally, (5) the individual fails to report to the regional employment agency or to show up at scheduled meetings. This includes a failure to report /show up at medical or psychological appointments with health care workers at the employment agency or PES induced by the employment agency. Ground (5) involves a sanction for 2 weeks. Notice that grounds (1), (2), (3) and (4) generally lead to a sanction length of 12 weeks whereas ground (5) leads to a length of 2 weeks. We call the former "long sanctions" and the latter "short sanctions". In all cases, a sanction always involves a complete withdrawal of benefits during the sanction period. In this sense, sanctions amount to 100% of the benefits level. Such 100% sanctions are substantially more severe than sanctions in many other OECD countries. To prevent starvation, sanc- tioned individuals can apply for means-tested social assistance benefits which are not related to previous wages. To pass the means test for social assistance benefits, the unemployed individual must prove that neither own savings nor support from the immediate family can cover the living costs during the sanction period. Violations of the guidelines are not always observed by the employment agency. Moreover, in case of an observed violation, sanctions are not imposed mechanically; instead, they occur at the discretion of the regional employment agency and the caseworkers (e.g. Müller and Oschmiansky, 2006). Whether an infringement is dis- covered depends on several circumstances, e.g., on the information flow between the caseworker and the human resources department of the employer offering the va- cancy. It also depends on the caseload, i.e. the number of unemployed assigned to one caseworker. The interviewed caseworker experts emphasized that the caseloads between 2000 and 2002 were very high, ranging from 400 to 1000 unemployed per caseworker. Discretion can take place at various stages of the process after a discovered violation. The caseworker must invite the unemployed individual to a hearing to give him the opportunity to justify his action. If the caseworker judges the justification as sufficient then no sanction is imposed, but if he discovers a legal infringement then he reports this to the benefits management department. Having been informed about an infringement, the benefits management department checks the evidence against the unemployed and – in case of no objection – it stops the benefit payments and sends out a letter to the unemployed informing him about the imposition of a sanction but also about the possibility of filing an objection against the sanction within one month. In this paper we restrict attention to imposed sanctions that were not withdrawn. Once a sanction has been enforced, the unemployed has to follow the same job search requirements as before to avoid an additional sanction subsequent to the current one. When the accumulated duration of sanctions adds up to 24 weeks, the benefit recipient loses the claim to all benefits. According to the interviewed experts, some caseworkers monitor individuals more intensively after a sanction, but most of them do not increase monitoring and counseling after a sanction. Specifically, they do not send out more VR to sanctioned individuals to test their availability for work.

2.4 Sick leave during unemployment

In case of sickness, benefit recipients are required to call in sick to the PES and to submit a doctor's note confirming their illness. During the first 6 weeks of sickness, benefits continue to be paid by the PES, and the residual UI entitlement duration continues to decline. If, during an ongoing spell of benefit receipt, the accumulated period of sickness with the same diagnosis exceeds 6 weeks, the unemployed person has to apply to the health insurance agency for sickness benefits.[2] What is important for our purposes is that reporting sick does not provide any direct financial advan- tages such as higher benefits or an extension of the benefit entitlement duration. Thus, there are no financial incentives per se to take sick leave in the case of a brief illness. Incentives do arise, however, from the requirements on the benefit recipient's labor market behavior. During sickness, these requirements do not apply and therefore unemployed individuals cannot be sanctioned. First, this implies an incentive to take sick leave in the case of real sickness. Second, there is an incentive to call in sick immediately after having received a VR if the individual does not find the assigned vacancy attractive. Since the VR application periods are usually not longer than two weeks, as a rule, a sickness spell of two weeks suffices to avoid a VR. An important feature of the German health care system is that benefit recipients can choose their physician themselves and can switch between physicians. This implies that they can search for a doctor who is willing to hand out a sick note. There is no direct way for the caseworker to check the reliability of a sick note. The caseworker can send the unemployed to the medical service of the PES (Ärztlicher Dienst) to check general work-related health restrictions. However, along this route, sickness can only be investigated retrospectively, so the medical service cannot examine whether the physician's sick note was accurate.

3 Data

3.1 Sample

We use administrative records of the German Federal Public Employment Service (Bundesagentur für Arbeit). The data are provided by its Institute for Employment Research (IAB). More specifically, we use the integrated employment history (Integrierte Erwerbsbiographien, IEB) and the applicants pool database (Bewerberangebot, BewA). The IEB consists of different source registers, covering individual employment and benefit receipt histories of the full labor force. It also contains detailed information on labor market outcomes that are relevant for social insurances, including participation in active labor market policies, earnings and transfer payments. The data additionally include a broad range of socioeconomic characteristics including education, family

[2] Eligibility for sickness benefits requires a specific doctor's certificate (cf. e.g. Ziebarth and Karlsson, 2010). The health insurance can use a certified doctor of the medical service of the health insurance (Medizinischer Dienst der Krankenversicherung) to verify that certificate. In this paper, we focus on short-term sickness and treat observations as censored when they enter sickness benefits.

status and health limitations. The data do not contain information about the exact number of working hours and periods in self employment, in civil service, or in inactivity. A detailed description of the IEB is given by, for example, Dundler (2006). Our starting point for the sample selection is the population of individuals entering the state of being a UI recipient in the year 2000. Next, we omit a number of subgroups. (1) We exclude individuals who frequently move in and out of unemployment and seasonally unemployed individuals, by requiring that prior to entering unemployment, the individuals are employed subject to social security contributions for a minimum duration of 12 months. (2) We restrict attention to West Germany because during our observation period East and West Germany were substantially different in terms of economic and labor market performance. The share of unemployed individuals entering public employment programs and receiving a VR was considerably higher in the East than in the West, and in the East the transition from unemployment into unsubsidized work (which is our primary outcome of interest) was much less common. (3) We focus on male job seekers. Among primary carers of children below age 3, the behavioral requirements are different. The latter situation concerns more often women than men. We prefer to avoid this additional heterogeneity and also to avoid the issue of endogenous fertility in the analysis of VR and sanction effects among women. Furthermore, the high share of part timers among women renders an evaluation of wages in the first job after leaving unemployment difficult for women as we do not observe working hours. (4) We also drop individuals with a university degree, because sanctions among them are rare. (5) We focus on individuals aged above 24 and below 58 years when entering unemployment benefit receipt. This is motivated by the educational system and by early retirement schemes. We right-censor duration variables once the individual reaches the age of 58. We terminate the observation interval for the outcome variables at December 31, 2002, since in 2003 several labor market reform were introduced. We right-censor duration variables at December 31, 2002. Thus, we have an observation window of three years. As a result, the sample we use consists of 118,275 individuals.

3.2 Treatment and outcome variables

The key events in our analysis are arrivals of VRs, sanctions or sickness absences and transitions from unemployment to work. Additionally we observe accepted wages upon exit to employment. We are interested in the overall effect of sanctions on job search outcomes. I.e. in effects that the risk of potentially being sanctioned in the future has on search behavior and hence on job search outcomes (ex ante effects) as well as effects of actually receiving a sanction on job search outcomes (ex post effects). While the ex post effects of a sanction only affect the subpopulation of individuals who receive a sanction at some point, ex ante effects are relevant for the whole population of UI benefit recipients. Moreover we are interested in the effect of the arrival of a VR on the probability of sickness absence. At this stage it is useful to point out that the models we will estimate are in discrete time with one month as the time unit.[3]

In the sequel, we use unemployment (duration) as synonymous to (the duration of) benefit receipt. We do not distinguish between UI and UA spells, because the institutional rules with respect to VR and sanctions are the same for both types of benefit payments. If individuals leave benefit receipt without finding an unsubsidized job, or if they exit to subsidized employment or move into ALMP programs where they receive training measure benefits (Unterhaltsgeld, UHG), the unemployment spells are treated as right-censored. The reason we censor spells upon a transition into UHG is that we do not observe sanctions during the receipt of this type of transfer payments. We observe all VRs given to individuals in the sample. This information comes from the so-called applicants pool database (BewA). Most VR were reported at the end of a month by the employment agencies to the statistical department of the PES. As a result, instead of observing the exact VR arrival day, we only observe whether or not a person has received a VR in a given calender month. No further information about the referred vacancy is available, such as the wage or the occupation. Recall that the latter is typically observed by the unemployed individual before applying to the referred job, and the former after having applied. For each sanction we observe the dates at which they are imposed and their intended length. Because of our interest in the impacts of VR, and to keep the analysis manageable, we ignore short sanctions. We also exclude sanctions at the beginning of an unemployment spell due to voluntary job loss, because the data do not enable us to identify selection due to voluntary job quits. In sum, we restrict attention to 12-week sanctions that are either due to the rejection of a VR or its ensuing job offer, or due to the noncompliance with ALMP measures. Unfortunately, we do not observe which of these reasons applies to any of the long sanctions in the data. However, according to statistics of the PES, sanctions related to VRs were about 4 times as common as sanctions due to refusing or dropping out of a training measure (Bundesagentur für Arbeit, 2004), so that the vast majority of the sanctions we observe are connected to VR. In our analysis we assume that any sanction that occurs in the same month in which a VR was rejected or in the following month is related to the rejection of the VR.

In those cases in which more than one long sanction during an unemployment spell was

[3] The latter is motivated by the observation of the arrivals of VR, as explained later in this subsection.

imposed, we analyze the first sanction only and we ignore subsequent sanctions. In our sample, only around 2% of the sanctioned individuals are sanctioned again within the same spell. As noted in Section 2, the VR application periods are usually not longer than two weeks, so individuals can avoid an application to the assigned vacancy by reporting sick for two weeks or longer. Therefore, we only consider sickness absence spells during unemployment that exceed 13 days. One may argue that spells exceeding two weeks signify a genuine spell of ill health. However, if an unemployed individual repeatedly wishes to use sickness absence to avoid VR, then it clearly makes sense to obfuscate this by randomizing the length of reported sickness spells. One can therefore not use the sickness spell length as a highly informative indicator of the extent to which sickness was genuine. If we observe unemployment benefit receipt parallel to employment, we treat the spell as an unemployment spell. If we observe a gap of up to 31 days between two employment spells or two unemployment spells, without information about the state in between, we close the gap. We also close gaps of up to three days between two sickness spells, because these are typically gaps arising in weekends. If we observe two transitions between employment and unemployment (or between unemployment and employment) within one calendar month and the middle spell is longer than 7 days, we move the second transition to the next calendar month. If the middle spell is shorter than 7 days, we drop the middle spell and close the gap. Next, we consider the observation of post-unemployment outcomes. The employment duration after job acceptance is defined from the start of the first regular job until reentry into unemployment. We define an individual as being regularly employed if he holds a job where he is paying social security contributions and does not receive any benefits from the PES at the same time. In our analysis we ignore minor employment (mini-jobs) in which a very low income is paid for a small number of working hours because this is not regarded to be regular employment. In the data we observe the initial daily gross wage but as mentioned above the actual working time is not stored in the data, so we do not observe hourly wages. Moreover, the wage information is right-censored at the social security contribution ceiling. This aspect should be of limited relevance for our analysis, since almost all observed post-unemployment wages are below this threshold.[4]

We do not observe the reason for a sanction, and hence we do not observe whether a specific sanction in the data is caused by the rejection of a VR that was received shortly before that. With a small probability, such a sanction may also be due to the refusal to enter a training program. Similarly, we do not observe whether a specific sickness spell is causally connected to a VR shortly before that. We also do not observe whether an

[4]In 2002, the cap was at 4500 euro per month in West Germany. Only 2.1% of our sample took up a job that paid more than 4000 euro per month.

accepted job has been referred to the individual through a VR or whether he found the job in a different way.

3.3 Descriptive Statistics

Table 1 provides summary statistics for the relative frequency of transitions and events in different subsamples. Around two thirds of all time periods in our sample start in unemployment. In 11% of time periods starting in unemployment a VR occurs. Sickness absence occurs substantially more often in periods with a VR (2.6%) than in periods without a VR (1.5%). Upon job take-up wages are on average lower (by around 70 euros) for jobs taken up in periods where no VR occurred. Few of the observed time periods end with a sanction (around 0.6% of all time periods in which a VR occurs).

Table 2 lists descriptive statistics by individuals for the full sample and for subgroups by sanction status, by sickness absence and by VR receipt. The local unemployment rate and the vacancy rate are measured on a monthly basis and at the level of the catchment area of the regional PES.[5] Around 72% of all sampled individuals receive a VR at least once during unemployment while 1.7% are sanctioned at least once.

Figure 1 displays frequencies of accepted wages, separately for jobs that were taken up in a month in which a VR occurred and jobs taken up in a month without a VR. Figure 2 shows a histogram of observed UI benefits. The median (average) of UI benefits observed in our data is 900 (833) and the 90 and 10 percentile are at 580 and 1120, respectively.

Figure 3 provides a stylized fact indicating a positive response in sickness absences to the arrival of VRs. The figure is plotted based on VR arrivals that are not preceded/followed by another VR, sanction or sickness absence in the 6/8 month before/after the VR receipt in question.

4 Structural analysis

4.1 Job Search Model with monitoring, sanctions, sickness absence and imperfect enforcement

For the structural analysis we extend a standard partial equilibrium job search model (see e.g. Mortensen 1986, Rogerson, Shimer, and Wright 2005) by a number of aspects relevant to evaluating the effectiveness of VRs and sanctions in reducing moral hazard.

[5] There are about 140 regional employment agencies in West Germany. The local vacancy rate (or, more precisely, the V/U ratio) is the number of open vacancies registered at the regional employment agency divided by the number of unemployed workers in that region.

In particular we add VRs, i.e. job offers that if rejected lead to a risk of receiving a sanction and account for an exogenous probability of falling sick as well as an endogenous probability of handing in a sick note after the arrival of a VR. Imperfect sanction enforcement is reflected in our model by a parameter that governs how likely it is to indeed receive a sanction after refusing to apply for a VR.

The model is in discrete time with a month as the time unit. This is a natural choice in the given context where a sanction lasts a fixed number of month. The future is discounted at rate β. As no benefits are payed out during a sanction spell, the value of unemployment in our model depends on the number of periods an unemployed is sanctioned for. Technically this is reflected by making the value of unemployment functionally dependent on a state variable s, which is zero for individuals who are not sanctioned and counts down the remaining sanction periods for sanctioned individuals. UI benefits b are payed out only if $s = 0$, while no benefits are payed out if $s > 0$. If a sanction is imposed s is increased by an ex-ante fixed number K, i.e. the unemployed is sanctioned for K additional periods in which no UI benefits are payed out. On the whole s evolves according to

$$s' = \max\{s - 1, 0\} + Ksa\,,$$

where sa is an indicator variable which is 1 if and only if a sanction arrives. If the number of periods for which an unemployed is sanctioned exceeds a fixed threshold $\overline{S}$ he receives a terminal sanction. In case of a terminal sanction an unemployed's UI benefits are shut down and VRs are discontinued indefinitely. We model reception of a terminal sanction as transition to an absorbing state. The value of this state, Φ, is obtained by solving a simple job search problem in which no benefits are received and in which only regular job offers (but not VRs) arrive with positive probability.[6] Sickness absences enter the model in two ways. In any given period an unemployed falls sick with exogenous probability p_{sick}. We assume that when sick an unemployed does not receive regular job offers and cannot apply for any VRs he may receive, but does not receive a sanction in case he fails to apply for a VR.[7] Additionally after receiving a VR with an unfavorably low attached wage offer an unemployed may try to obtain a sick note to be released of the duty of applying for the VR (and avoid the risk of receiving a sanction). We assume that an attempt to obtain a sick note in response to receiving an unfavorable VR is successful with exogenous probability p_{doc}. I.e. the decision whether to try to obtain a sick note or not is endogenous, while the probability

[6] For details on how Φ is solved for see Appendix A.1.

[7] We think this assumption is justified, since sick UI claimants are likely able to hand in a sick note and hence are released of the duty to apply for VRs with a probability close to 1.

of being successful in trying to obtain a sick note is exogenously given. We proceed by giving a formal outline of the model and characterize the solution by a system of reservation wage equations.

Regular Job Offers

In any given period in which he did not fall sick the unemployed receives a regular job offer with probability p_{jo}, i.e. he draws from the corresponding wage offer distribution F_{jo} and decides to accept or reject the job offer. Upon acceptance he transits to employment at the offered wage. Upon rejection he transits to the next period of unemployment.

Formally the value of receiving a JO for an unemployed with s remaining sanction periods is

$$R_{jo}(s) = \int max\left\{ E(w),\ U(max\{s-1,0\})\right\} dF_{jo}(w)\,,$$

where $U(s)$ denotes the value of being unemployed with s remaining sanction periods and $E(w)$ is the value of being employed at wage w.

We assume that jobs are destroyed with exogenous separation rate δ, i.e. the value of being employed at wage w is

$$E(w) = w + \beta(\delta U(0) + (1-\delta)E(w))\,.$$

Vacancy Referrals and Sickness Absence Decision

With probability p_{vr} the unemployed receives a VR. At reception of a VR the unemployed obtains some information about the offered job (e.g. occupation, working hours, employer) but does not learn all characteristics of the offered job, notably not the exact wage attached to the offered job. We assume that the unemployed is able to infer the wage attached to the VR, i.e. in our model we assume that the agent knows the exact wage that comes with a VR at the moment he receives the VR.

After having received a VR the agent needs to decide whether he will apply for the VR or not and whether he will try to obtain a sick note or not. Note that not applying simultaneously not trying to obtain a sick note is never optimal. This is because an agent who plans to reject a VR is always better off if he minimizes the risk of being sanctioned by trying to obtain a sick note. The effective trade-off thus is between applying or trying to obtain a sick note.

We denote the value of applying for a VR and of trying to obtain a sick note by $A_{vr}(s, w)$

and $A_{doc}(s,w)$ respectively (depending on the offered wage and the number of remaining sanction periods). Formally the value of receiving a VR can be written

$$R_{vr}(s) = \int max\{A_{vr}(s,w), A_{doc}(s,w)\}\, dF_{vr}(w)$$

We assume that if an attempt to obtain a sick note is made, the agent receives such a note with probability p_{doc}. In this case he transits to the next period of unemployment without applying for the VR and without running risk of being sanctioned. If the agent does not succeed in obtaining a sick note he is left with the options to apply for the VR. The value of trying to obtain a sick note thus can be expressed as

$$A_{doc}(s,w) = p_{doc}\, U(max\{s-1,0\}) + (1-p_{doc})\, A_{vr}(s,w)$$

If the agent applies for the VR with probability $1-\lambda_{vr}$ he will be rejected by the prospective employer and thus remain in unemployment. Crucially in this case no sanction is imposed. With probability λ_{vr} he is accepted by the employer and needs to make the decision whether to start at the job or to reject himself and run the risk of a sanction. In the latter case if a sanction is in fact imposed depends on whether the case-worker uses his decision making leeway to suspend the sanction. We denote the probability with which an unemployed who is actually not sick and rejected a VR obtains a sick note by p_{doc} and the probability that the case-worker decides to impose a sanction by p_{sanc}. If a sanction is imposed s is increased by K, while if no sanction is imposed the unemployed transits to the next period of unemployment. Formally,

$$\begin{aligned} A_{vr}(s,w) = &\lambda_{vr}\; max\Big\{E(w)\,,\, p_{sanc}\, U(max\{s-1,0\}+K) + (1-p_{sanc})\, U(max\{s-1,0\})\Big\} \\ &+ (1-\lambda_{vr})\; U(max\{s-1,0\}) \end{aligned} \tag{1}$$

Model Solution

The value of being unemployed with $s \in \{0, 1, ..., \overline{S}\}$ remaining sanction periods in our model is

$$\begin{aligned} U(s) = \quad & b\,\mathbf{1}_{\{s=0\}} + \beta(1-p_{sick})\Big(p_{jo}R_{jo}(s) + p_{vr}R_{vr}(s) \\ & +(1-p_{jo}-p_{vr})U(max\{s-1,0\})\Big) + \beta p_{sick}U(max\{s-1,0\}) \end{aligned}$$

and $U(s) = \Phi$ for $s > \overline{S}$.

Recall that the value of being employed at wage w is

$$E(w) = \quad w + \beta(\delta U(0) + (1-\delta)E(w)). \tag{2}$$

Solving for $E(w)$ shows that $E(w)$ is strictly increasing in w, for given s the optimal strategy of an unemployed person is thus of the reservation wage form, i.e. there exists a collection of reservation wages $\{\overline{w}_{jo,s}, \overline{w}_{vr,s}\}_{s=0}^{\overline{S}}$, such that in state s it is optimal to accept any JO with wage weakly greater than $\overline{w}_{jo,s}$ and any VR with wage weakly greater than $\overline{w}_{vr,s}$, while any other JO or VR is rejected. The outlined model implies a system of nonlinear equations that characterize the collection of reservation wages. For details on the derivation see appendix A.2. In particular the model can be solved for the system of reservation wage equations

$$\begin{aligned}
\overline{w}_{jo,s+1} + \beta\delta\overline{w}_{jo,0} &= \beta(1 - p_{vr}\lambda_{vr}(1-p_{sick}))\overline{w}_{jo,s} \\
&+ \beta(1-p_{sick})\Bigg(p_{jo}\lambda_{jo}\int\limits_{\overline{w}_{jo,s}}^{+\infty} w - \overline{w}_{jo,s}\, dF_{jo}(w) \\
&+ p_{vr}\lambda_{vr}\int\limits_{\overline{w}_{vr,s}}^{+\infty} w - \overline{w}_{vr,s} dF_{vr}(w) + p_{vr}\lambda_{vr}\overline{w}_{vr,s}) \\
&+ p_{vr}\, p_{doc}\, \lambda_{vr}\left(F_{vr}(\overline{w}_{jo,s})(\overline{w}_{jo,s} - \overline{w}_{vr,s}) - \int\limits_{\overline{w}_{vr,s}}^{\overline{w}_{jo,s}} w - \overline{w}_{vr,s} dF_{vr}(w)\right)\Bigg)
\end{aligned} \tag{3}$$

for $s = 1, ..., \overline{S} - 1$ and

$$\begin{aligned}
&\frac{1}{p_{sanc}}\left(\overline{w}_{vr,\overline{S}-K+1} - (1-p_{sanc})\overline{w}_{jo,\overline{S}-K+1}\right) + \beta\delta\overline{w}_{jo,0} = \\
&\quad \beta(1 - p_{vr}\lambda_{vr}(1-p_{sick}))\overline{w}_{jo,\overline{s}} + \beta(1-p_{sick})\Bigg(p_{jo}\lambda_{jo}\int\limits_{\overline{w}_{jo,\overline{S}}}^{+\infty} w - \overline{w}_{jo,\overline{S}}\, dF_{jo}(w) \\
&\quad + p_{vr}\lambda_{vr}\int\limits_{\overline{w}_{vr,\overline{S}}}^{+\infty} w - \overline{w}_{vr,\overline{S}} dF_{vr}(w) + p_{vr}\lambda_{vr}\overline{w}_{vr,\overline{S}} \\
&\quad + p_{vr}\, p_{doc}\, \lambda_{vr}\left(F_{vr}(\overline{w}_{jo,\overline{S}})(\overline{w}_{jo,\overline{S}} - \overline{w}_{vr,\overline{S}}) - \int\limits_{\overline{w}_{vr,\overline{S}}}^{\overline{w}_{jo,\overline{S}}} w - \overline{w}_{vr,\overline{S}} dF_{vr}(w)\right)\Bigg)
\end{aligned} \tag{4}$$

Moreover we have the following relationships between $\overline{w}_{jo,s}$ and $\overline{w}_{vr,s}$:

$$\overline{w}_{vr,s} = p_{sanc}\,\overline{w}_{jo,s+K} + (1 - p_{sanc})\,\overline{w}_{jo,s} \tag{5}$$

for $s = 1, ..., \overline{S} - K$ and

$$\overline{w}_{vr,s} = p_{sanc}\left(\big(1 - \beta(1-\delta)\big)\Phi - \frac{\beta\delta}{1-\beta}\overline{w}_{jo,0}\right) + (1 - p_{sanc})\,\overline{w}_{jo,s} \tag{6}$$

for $s = \overline{S} - K + 2, ..., \overline{S}$.

Finally note that from $U(1) = U(0) - b$ we get by straightforward manipulation

$$\overline{w}_{jo,2} = \overline{w}_{jo,1} - (1 - \beta(1-\delta))\, b\,. \tag{7}$$

Further note that an unemployed with $s = 0$ and an unemployed with $s = 1$ face the exact same decision problem after they collected/ did not collect UI benefits in the beginning of the period. As a consequence the optimal decision rule for agents with $s = 0$ and $s = 1$ is identical, i.e. $\overline{w}_{jo,0} = \overline{w}_{jo,1}$ and $\overline{w}_{vr,0} = \overline{w}_{vr,1}$.[8] After substituting $\overline{w}_{jo,0} = \overline{w}_{jo,1}$ and $\overline{w}_{vr,0} = \overline{w}_{vr,1}$ in (3)-(7), we arrive at a system of ten nonlinear equations in ten unknowns. For any given configuration of model parameters the thusly given reservation wage equation system can be solved numerically for the collection of reservation wages.

4.2 Likelihood Function

Recall that we observe balanced panel data on employment status, the occurrence of VRs, reported sicknesses and imposed sanctions. In this subsection we derive the likelihood function of this data given the structure of the job-search model discussed in the previous section and given a vector of unknown model parameters.

We denote the vector of observed data for individual i in time period t by $Z_{it} = (e_{it}, vr_{it}, sick_{it}, sanc_{it}, s_{it})$, where e_{it} is an indicator for employment status (1 for employed 0 for unemployed), vr_{it} indicates the arrival of a vacancy referral, $sick_{it}$ is an indicator for a reported sickness, $sanc_{it}$ indicates occurrence of a sanction and s_{it} counts the remaining sanction periods.[9] In time periods when an individual accepts a job, Z_{it} additionally includes the accepted wage, w_{it}^{acc}.

We do not estimate the discount factor β and thus treat it as given in the derivation of

[8] See appendix A.2 for a formal argument.

[9] We include s_{it} in Z_{it} for notational convenience.

the likelihood function. Moreover for computational tractability we impose a parametric form on the wage offer distributions, i.e. we assume that $F_{jo} = F_{\gamma_{jo}}$ and $F_{vr} = F_{\gamma_{vr}}$ are specified up to finite dimensional unknown parameters γ_{jo} and γ_{vr} .

Given observations of individuals $i = 1, ..., N$ in time periods, $t = 1, ..., T$ the likelihood function is

$$\mathcal{L}\big(\{\{Z_{it}\}_{t=1}^{T}\}_{i=1}^{N} \big| \{e_{i0}\}_{i=1}^{n}, \theta\big) = \prod_{i=1}^{N}\prod_{t=1}^{T} h_{it}(Z_{it}, e_{it-1}|\, \theta),$$

where h_{it} is the likelihood contribution of individual i in period t with observables Z_{it} and given previous period employment status e_{it-1} .

We assume that log-accepted wages are observed with additive measurement error, i.e. $ln(\tilde{w}^{acc}) = ln(w^{acc}) + \epsilon$, with ϵ normally distributed with mean zero and variance σ_ϵ^2 (cf. e.g. Eckstein and van den Berg 2007, Wolpin 1987). The measurement error variance σ_ϵ^2 is treated as unknown parameter, i.e. estimated along with the parameters of the structural model. Accounting for measurement error is important to reduce the influence of the lowest sampled wage on parameter estimates (see Flinn and Heckman 1982). In the used data measurement error in observed wages, comes from scaling up daily payments to monthly wages.

For the likelihood contributions of transitions from unemployment to employment $h_t^{ue} = h_t(e_t = 1,\, vr_t,\, e_{t-1} = 0|\, \theta)$ we thus have

$$h_t^{ue} = \begin{cases} (1 - p_{sick})p_{jo}\lambda_{jo} \int f_{\gamma_{jo}}(w)\, \mathbf{1}\{w \geq \overline{w}_{jo,s}\}\, \frac{1}{\sigma_\epsilon}\, \phi\big(\frac{w-\tilde{w}^{acc}}{\sigma_\epsilon}\big)dw & \text{if } (vr_t = 0, \tilde{w}_t^{acc}, s_t = s) \\ (1 - p_{sick})p_{vr}\lambda_{vr} \int f_{\gamma_{vr}}(w)\, \mathbf{1}\{w \geq \overline{w}_{vr,s}\}\, \frac{1}{\sigma_\epsilon}\, \phi\big(\frac{w-\tilde{w}^{acc}}{\sigma_\epsilon}\big)dw & \text{if } (vr_t = 1, \tilde{w}_t^{acc}, s_t = s) \end{cases}$$

Where ϕ denotes the density of a standard normal distribution. For the complete list of likelihood contributions see appendix A.3.

5 Estimation and results

For estimating the model by maximum likelihood we make several further specifications. We fix the discount factor at $\beta = 0.997$. For the wage offer distributions F_{jo} and F_{vr} we assume log-normality with parameters μ_{jo}, σ_{jo} and μ_{vr}, σ_{vr} respectively. The complete vector of unknown parameters hence is

$$\theta = \big(\mu_{jo},\, \sigma_{jo},\, \mu_{vr},\, \sigma_{vr},\, p_{jo},\, p_{vr}, \lambda_{vr},\, p_{sick},\, p_{doc},\, p_{sanc},\, \delta,\, \sigma_\epsilon\big).$$

In order to allow for observed heterogeneity we allow a subset of the unknown parameters to vary with observables. Let X denote a vector of individual specific observed characteristics. For model parameters p that have an interpretation as probabilities we specify the functional form $p = (1 + \exp(-\gamma' X))^{-1}$ to restrict them to be in $[0, 1]$. For the remaining parameters q that are not interpreted as probabilities we specify $q = \exp(\gamma' X)$. We choose to include age and dummy variables indicating respectively completion of vocational training and presence of health restrictions in X. For computational tractability we project UI benefits and the age variable onto discrete grids. In particular we project UI benefits onto a grid of 8 points dividing the relevant benefit range (500-2000) into bins of size 200. Similarly the age variable is projected onto a grid of 7 points dividing the relevant age range (20-60 years) into equal bins of size 10. Maximizing the likelihood function requires solving the structural model at each iteration of the maximization algorithm for each realized value of X. Since a number of model parameters likely take fundamentally different values across industry sectors, we choose to conduct separate estimations for four sectors (manufacturing, construction and trade).

Table 3 presents the parameter estimates. For most parameters the impact of age, health restrictions and vocational training on the model parameters is significantly different from zero and precisely estimated, indicating that it is important to account for observed heterogeneity. The uniformly small estimate of the measurement error variance, suggests that measurement error in wages plays a subordinate role.

For illustration table 4 provides the implied model parameters for individuals of median age (40 years) and for varying configurations of health status and vocational training. For the manufacturing and trade sector the arrival rate of VRs, is generally higher than the arrival rate of regular job offers ($p_{vr} > p_{jo}$), while for the construction sector it is the other way around. Recall however that a VR is merely a referral of vacant position that upon application could or could not lead to job take-up. Regular job offers in contrast if accepted immediately lead to job take-up. For this reason a direct comparison of these parameters is hard to interpret. The probability of falling sick ranges from 0.02 to 0.05 depending on health restrictions and vocational training with only minor differences across sectors. The probability of being successful in strategically calling in sick is estimated to be between 0.03 and 0.08 is higher in the construction sector than in the other two sectors independently of health restrictions and vocational training. Sanction enforcement is lowest for individuals in manufacturing (0.13-0.19) slightly higher in the construction sector (0.2-0.22) and highest in the trade sector (0.2-0.29). λ_{vr}, the rate at which individuals who apply for VRs are accepted for the job ranges from 0.06 to 0.16

and is generally lowest in the trade sector. Tables 5-7 displays the implied reservation wage profiles for individuals of median age and with median benefit level (900 euros).

6 Policy Simulations

We use the estimated structural model to simulate counterfactual policy changes. In particular we consider policies that counteract imperfect sanction enforcement as well as policies that increase the VR arrival rate. As outcome variables we focus on job take-up, average unemployment duration, job take-up given arrival of a VR, sanction frequency and mean accepted wages. As we are assuming policy invariant wage offer distributions equilibrium effects are abstracted from in our policy analysis. We report simulation results separately for manufacturing, construction and trade sector.

In our model the policy changes we simulate relate to the parameters p_{sanc} and p_{vr}. Increasing p_{sanc} generally reduces the option value of search due to increased risk to receive a sanction in future periods of search. As an immediate consequence job searchers lower their reservation wages and job take-up increases. In contrast the effects of increasing p_{vr} on the option value of search are ambiguous. On the one hand increasing p_{vr} increases the risk of receiving unattractive VRs and receiving a sanction upon rejection. On the other hand also the chance of receiving attractive VRs is increased. Which of the two effects dominates, i.e. whether job take-up is fostered or reduced in response to an increase in p_{vr} depends on the specific values of the remaining model parameters.

Denote by p'_{sanc} (p'_{vr}) a counterfactual sanction enforcement rate (counterfactual VR rate). For p_{sanc} we consider switches to regimes where p'_{sanc} is set equal to some externally fixed value that is the same across individuals. In particular we simulate our model with sanction enforcement rate fixed at $p'_{sanc} = \frac{1}{3}$ (respectively $p'_{sanc} = \frac{2}{3}$) for all model agents. For the VR rate we consider proportional changes, such that each individual specific VR rate is increased by a percentage amount of its value. In particular we consider two policies such that $p'_{vr} = 1.1p_{vr}$ and respectively $p'_{vr} = 1.2p_{vr}$.

The simulation results are presented in tables 8-10. The first table column contrasts outcome variables for our observed sample to outcomes from simulations based on the estimated model. Comparing these quantities gives an indication of how well the model fits the observed data. The remaining columns report the outcome variables for the counterfactual policy simulations. Across sectors we find that increasing sanction enforcement has a strong positive impact on job take-up in periods where a VR has arrived. The impact on overall job take-up in contrast is moderate. This pattern holds in particular in construction and trade, while the effects on job take-up in the manufacturing sector are smaller. For the stricter regime (i.e. $p'_{sanc} = \frac{2}{3}$) we find a 0.6 (0.5, 2) month reduction in average unemployment duration for the manufacturing (construction, trade) sector. At the same time sanction frequencies, while slightly increasing in response to the policy change, remain below 1% for each industry sector. Average wages drop in response to increased sanction enforcement, but by relatively small amounts of less than 30 euros.

Increasing the individual VR rates likewise has a clear positive impact on job take-up. In particular increasing p_{vr} by 20% reduces average unemployment durations by 0.5 (0.7, 3) months for the manufacturing (construction, trade) sector. Sanction frequency is increased marginally in response to the simulated increased VR rates, but this increase is of negligible magnitude in all sectors. The impact of increased VR arrival on average wages is positive and sizable (up to 161 euros, for a 20% increase in p_{vr} in trade) with the exception of the manufacturing sector, where average wages decrease slightly. The positive response in wages in construction and trade reflects an increase in the option value of search due to an increased chance of receiving attractive VRs in the future. If this positive effect dominates the negative effects from the increased threat of being sanctioned at some future point in time reservation wages tend to increase. Which of these counteracting effects dominates depends on the specific values of the related model parameters.

7 Conclusion

In this paper, we develop and estimate a structural job search model that incorporates VRs and sanctions accounting for their interaction with strategic sickness absence decisions and imperfect sanction enforcement. The model reflects that for UI benefit recipients calling in sick constitutes an opportunity to avoid applying for an assigned VR without being at risk of receiving a sanction. Imperfect sanction enforcement additionally hampers the effectiveness of VRs and sanctions in reducing moral hazard among benefit recipients. We find that both these aspects seem to influence the search behavior unemployed individuals who are subject to job search monitoring schemes with VRs and sanctions. Receiving a VR leads to a strong increase in the rate of reporting sick. Moreover our estimates suggest that sanction enforcement is low ranging from 13% to 29% depending on individual health status and education as well as industry sector.

Policy simulations based on the estimated model suggest that increasing sanction enforcement has the potential to foster a sizable reduction in mean unemployment duration, while hardly increasing the rate of received sanctions and only mildly reducing post-unemployment wages. Similarly, moderate increases in individual VR rates are predicted to lead to a substantial decrease in mean unemployment duration, while the rate of received sanctions hardly increases and post-unemployment wages increase. The positive impact of increasing the VR rate on wages is driven by an increase in reservation wages due to increased chances of receiving attractive VRs in the future. At the estimated parameter values this effect dominates the increased threat of receiving a sanction in the future after rejection of an unfavorable VR.

At a broader level this paper investigates in how far policy measures intended to reduce moral hazard are hampered by imperfect policy enforcement and additional layers of moral hazard, taking the form of active avoidance behavior such as strategic sick reporting. Our simulation results suggest that counteracting avoidance behavior and imperfect enforcement has the potential to increases the effectiveness of job search monitoring schemes with VRs and sanctions substantially. We think of these results as relevant information for policy makers.

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A Derivations

A.1 Continuation Value of a Terminal Sanction

When terminally sanctioned an unemployed worker searches for a job but does not receive UI benefits or vacancy referrals by the unemployment agency. The value of being terminally sanctioned thus is

$$\Phi = \beta\Big(p_{jo}\int max\{E_\Phi(w),\, \Phi\} dF_{jo}(w) + (1-p_{jo})\Phi\Big), \tag{8}$$

where

$$E_\Phi(w) = w + \beta\big(\delta\Phi + (1-\delta)E_\Phi(w)\big) \tag{9}$$

Rearranging and inserting (9) into (8) yields

$$(1-\beta)\Phi = \beta\, p_{jo} \int\limits_{(1-\beta)\Phi} \frac{w-(1-\beta)\Phi}{1-\beta(1-\delta)} dF_{jo}(w)$$

This equation is solved for Φ numerically.

A.2 Derivation of the System of Reservation Wage Equations

From (2) we have

$$E(w) = \frac{1}{1-\beta(1-\delta)}\Big(w + \beta\delta U(0)\Big). \tag{10}$$

Using the reservation wage property it is straightforward to show

$$E(\overline{w}_{jo,0}) = U(0), \tag{11}$$

$$E(\overline{w}_{jo,s}) = U(s-1) \tag{12}$$

for $s > 0$ and

$$E(\overline{w}_{vr,s}) = \begin{cases} (1-p_{sanc})U(s-1) + p_{sanc}U(s+2), & \text{for } s = 1,2,3 \\ (1-p_{sanc})U(s-1) + p_{sanc}\Phi, & \text{for } s = 4,5 \end{cases} \tag{13}$$

Inserting (12) into (13) yields

$$E(\overline{w}_{vr,s}) = \begin{cases} (1-p_{sanc})E(\overline{w}_{jo,s}) + p_{sanc}E(\overline{w}_{jo,s+3}), & \text{for } s = 1,2 \\ (1-p_{sanc})E(\overline{w}_{jo,3}) + p_{sanc}U(5), & \text{for } s = 3 \\ (1-p_{sanc})E(\overline{w}_{jo,s}) + p_{sanc}\Phi, & \text{for } s = 4,5. \end{cases} \tag{14}$$

Note that (11) and (10) imply

$$U(0) = \frac{\overline{w}_{jo,0}}{1-\beta}. \tag{15}$$

(14) and (10) together yield the relationships between $\overline{w}_{jo,s}$ and $\overline{w}_{vr,s}$ presented in equation (5) and (6).

Moreover for $s = 3$ equation (14) can be rearranged to

$$U(5) = \frac{1}{1-\beta(1-\delta)}\left(\frac{\overline{w}_{vr,3} - (1-p_{sanc})\overline{w}_{jo,3}}{p_{sanc}} + \beta\delta U(0)\right). \tag{16}$$

From (2) it follows for $s > 0$

$$\begin{aligned} U(s) = \; & \beta(1-p_{sick})\Bigg(p_{jo}\lambda_{jo}\int_{\overline{w}_{jo,s}}^{+\infty}\frac{w-\overline{w}_{jo,s}}{1-\beta(1-\delta)}dF_{jo}(w) + p_{vr}\lambda_{vr}\int_{\overline{w}_{vr,s}}^{+\infty}\frac{w-\overline{w}_{vr,s}}{1-\beta(1-\delta)}dF_{vr}(w) \\ & + p_{vr}(\lambda_{vr}E(\overline{w}_{vr,s}) + (1-\lambda_{vr})E(\overline{w}_{jo,s})) + (1-p_{vr})E(\overline{w}_{jo,s})\Bigg) + \beta p_{sick}E(\overline{w}_{jo,s}) \end{aligned} \tag{17}$$

Inserting the above equations (10), (15) and (16) and rearranging yields the reservation wage equations (3) and (4). Finally note that (11) and (12) together imply $\overline{w}_{jo,0} = \overline{w}_{jo,1}$ and $\overline{w}_{vr,0} = \overline{w}_{vr,1}$.

A.3 Likelihood Contributions

In the following the individual subscript i is omitted for notational convenience. For transitions from unemployment to unemployment the likelihood contribution $h_t^{uu} = h_t(e_t = 0,\, vr_t,\, sick_t,\, sanc_t, e_{t-1} = 0|\,\theta)$ is given by

$$h_t^{uu} = \begin{cases} (1-p_{sick})(1-p_{jo}\lambda_{jo}(1-F_{\gamma_{jo}}(\overline{w}_{jo,s}))-p_{vr}) & \text{if } (vr_t = 0,\, sick_t = 0, s_t = s) \\ p_{sick}(1-p_{vr}) & \text{if } (vr_t = 0,\, sick_t = 1) \\ p_{vr}(p_{sick}+(1-p_{sick})F_{\gamma_{vr}}(\overline{w}_{jo,s})p_{doc}) & \text{if } (vr_t = 1,\, sick_t = 1, s_t = s) \\ p_{vr}(1-p_{sick})\big(F_{\gamma_{vr}}(\overline{w}_{vr,s})(1-p_{doc})\lambda_{vr}(1-p_{sanc})+(1-p_{doc}F_{\gamma_{vr}}(\overline{w}_{jo,s}))(1-\lambda_{vr})\big) & \text{if } (vr_t = 1,\, sick_t = 0,\, sanc_t = 0,\, s_t = s) \\ p_{vr}(1-p_{sick})F_{\gamma_{vr}}(\overline{w}_{vr,s})(1-p_{doc})\lambda_{vr}p_{sanc} & \text{if } (vr_t = 1,\, sick_t = 0,\, sanc_t = 1, s_t = s)\,. \end{cases}$$

For transitions from unemployment to employment $h_t^{ue} = h_t(e_t = 1,\, vr_t,\, e_{t-1} = 0|\,\theta)$ we have

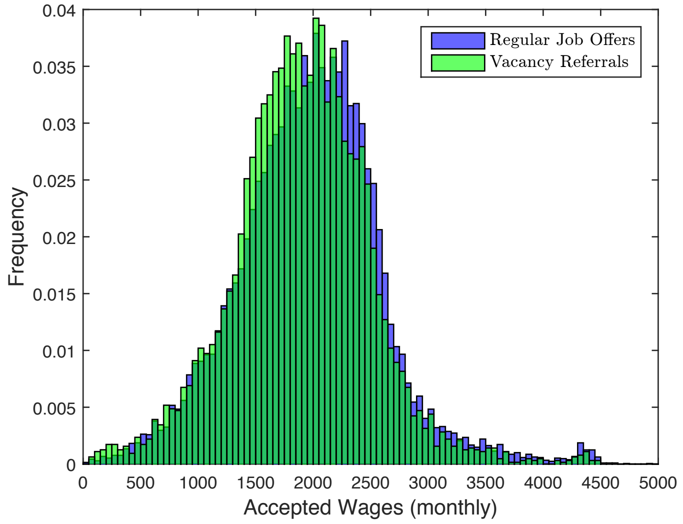
$$h_t^{ue} = \begin{cases} (1-p_{sick})p_{jo}\lambda_{jo}\int f_{\gamma_{jo}}(w)\,\mathbf{1}\{w \geq \overline{w}_{jo,s}\}\,\frac{1}{\sigma_\epsilon}\,\phi\big(\frac{w-\tilde{w}^{acc}}{\sigma_\epsilon}\big)dw & \text{if } (vr_t = 0, \tilde{w}_t^{acc}, s_t = s) \\ (1-p_{sick})p_{vr}\lambda_{vr}\int f_{\gamma_{vr}}(w)\,\mathbf{1}\{w \geq \overline{w}_{vr,s}\}\,(1-p_{doc})^{\mathbf{1}\{w \leq \overline{w}_{jo,s}\}}\,\frac{1}{\sigma_\epsilon}\,\phi\big(\frac{w-\tilde{w}^{acc}}{\sigma_\epsilon}\big)dw & \text{if } (vr_t = 1, \tilde{w}_t^{acc}, s_t = s) \end{cases}$$

and finally for transitions from employment to unemployment $h_t^{eu} = h_t(e_t = 0,\, e_{t-1} = 1|\,\theta)$ and transitions from employment to employment $h_t^{ee} = h_t(e_t = 1,\, e_{t-1} = 1|\,\theta)$ we have

$$h_t^{eu} = 1 - h_t^{ee} = \delta\,.$$

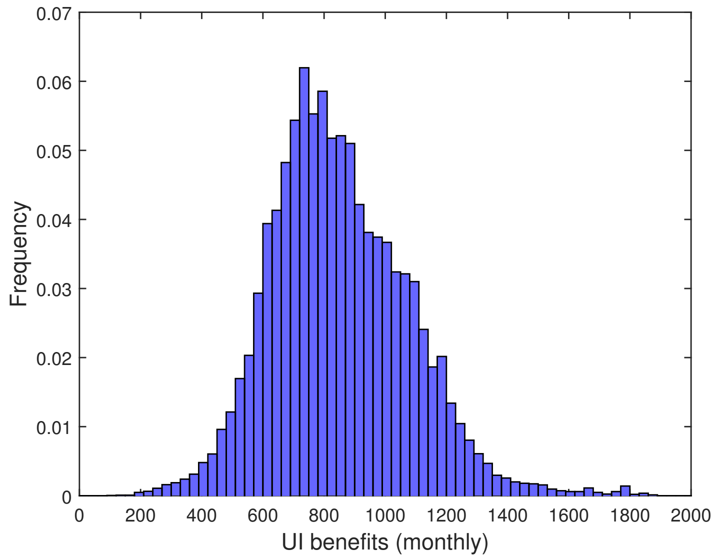
B Figures

Figure 1: Empirical Distribution of Accepted Wages



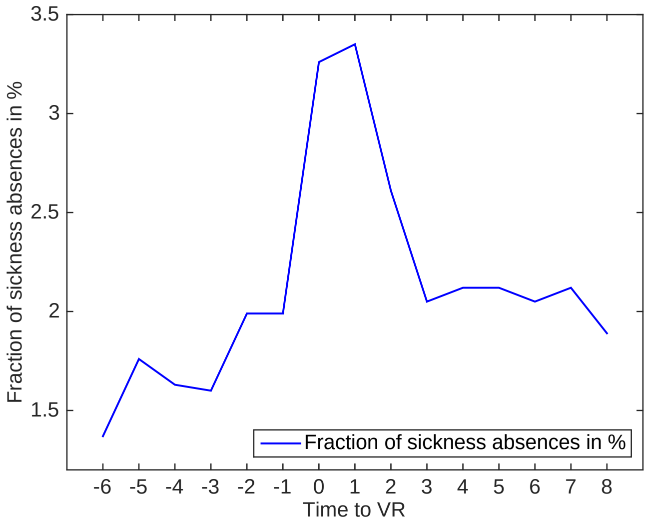
Note: Monthly accepted wages in euro for the sample described in 3.1 and plotted separately for jobs taken up in a month with/ without a VR.

Figure 2: Empirical Distribution of UI Benefits



Note: Monthly UI benefits in euro for the sample described in 3.1.

Figure 3: Timing of VRs and Sickness Absence



Note: Month t=0 refers to the arrival of a VR. The figure is plotted based on 3506 VR arrivals not preceded/followed by another VR, sanction or sickness absence in the 6/8 month before/after t=0.

C Tables

Table 1: Relative frequencies of events and transitions

Sample	
Full sample	
Months starting in unemployment	65.62%
Months starting in employment	34.38 %
Months starting in unemployment	
VR	11.09%
Sickness absence ($\geq$ 2 weeks)	1.51%
Sanction	0.061%
Job take-up	3.84%
Avg. accepted wage	2044
VR received	
Sickness absence ($\geq$ 2 weeks)	2.85%
Sanction	0.58%
Job takeup	11.76%
Avg. accepted wage	1971

Note: The time unit of observation is a month. The sampled individuals are selected as described in 3.1. The different subsamples refer to months starting in unemployment and month in which a VR was received.

Table 2: Descriptive Statistics

Sample			
Full Sample			
	Age	38.2 (8.7)	
	German (%)	84.4	
	Married (%)	57.3	
	Child (%)	47.2	
	Medium secondary school (%)	18.4	
	Upper secondary school (%)	10.2	
	Vocational training (%)	59.4	
	Health restrictions (%)	16.3	
	VR received (%)	71.9	
	Sanction received (%)	1.7	
	Local unemployment rate (%)	8.5 (3.4)	
	Local vacancy rate (%)	14.9 (9.6)	
Sanctioned		*Yes*	*No*
	Age	35.0 (7.5)	38.3 (8.7)
	German (%)	75.0	84.5
	Married (%)	43.5	57.2
	Child(%)	41.9	47.2
	Medium secondary school (%)	15.7	18.2
	Upper secondary school (%)	5.9	10.1
	Vocational training (%)	49.3	59.6
	Health restrictions (%)	11.1	16.2
	Local unemployment rate (%)	7.8 (2.8)	8.5 (3.5)
	Local vacancy rate (%)	16.7 (10.2)	14.8 (9.6)
Sick		*Yes*	*No*
	Age	40.2 (8.8)	38.0 (8.6)
	German (%)	82.4	84.5
	Married (%)	58.2	56.8
	Child (%) 48.0	47.0	
	Medium secondary school (%)	13.2	18.8
	Upper secondary school (%)	5.3	10.6
	Vocational training (%) 55.0	60.0	
	Health restrictions (%)	25.9	14.9
	Local unemployment rate (%)	8.5 (3.5)	8.5 (3.4)
	Local vacancy rate (%)	15.0 (9.9)	14.9 (9.6)
VR received		*Yes*	*No*
	Age	37.7 (8.3)	39.5 (9.4)
	German (%)	83.8	85.8
	Married (%)	55.7	60.4
	Child (%)	47.6	45.7
	Medium secondary school (%)	18.3	17.8
	Upper secondary school (%)	9.6	11.2
	Vocational training (%)	59.1	60.1
	Health restrictions (%)	15.0	19.4
	Local unemployment rate (%)	8.5 (3.4)	8.67 (3.6)
	Local vacancy rate (%)	15.0 (9.7)	14.6 (9.6)

Note: Characteristics are measured in first month of first unemployment spell. Standard deviations in parentheses. The vacancy rate is defined as the number of vacancies divided by the number of job seekers. The different subsamples refer to whether the job seekers have been sanctioned, have been sick and have received a VR, respectively, at least once during their first unemployment spell.

Table 3: Parameter estimates

Parameter	Estimate		
Sector	A	B	C
μ_{jo} :			
Intercept	1.96 (0.000)	1.94 (0.001)	2.03 (0.002)
Vocational training	0.02 (0.002)	0.01 (0.000)	0.00 (0.002)
Health restrictions	0.02 (0.003)	-0.02 (0.001)	-0.03 (0.003)
Age (divided by 10)	-0.00 (0.000)	-0.00 (0.001)	-0.00 (0.000)
σ_{jo} :			
Intercept	-1.29 (0.023)	-0.87 (0.009)	-1.06 (0.058)
Vocational training	0.01 (0.028)	-0.02 (0.010)	-0.03 (0.030)
Health restrictions	-0.01 (0.034)	0.02 (0.018)	-0.01 (0.036)
Age (divided by 10)	0.01 (0.003)	0.02 (0.000)	-0.01 (0.013)
μ_{vr} :			
Intercept	1.97 (0.013)	2.03 (0.000)	2.14 (0.014)
Vocational training	0.00 (0.005)	-0.00 (0.000)	0.01 (0.004)
Health restrictions	-0.00 (0.006)	-0.02 (0.001)	-0.04 (0.011)
Age (divided by 10)	0.00 (0.003)	0.00 (0.001)	-0.03 (0.003)
σ_{vr} :			
Intercept	-1.32 (0.100)	-0.98 (0.027)	-0.99 (0.107)
Vocational training	-0.02 (0.068)	-0.01 (0.011)	0.01 (0.045)
Health restrictions	0.09 (0.073)	-0.02 (0.021)	0.05 (0.095)
Age (divided by 10)	-0.00 (0.021)	-0.00 (0.006)	0.04 (0.025)
Job offer arrival rate, p_{jo} :			
Intercept	-2.48 (0.060)	-1.71 (0.046)	-3.70 (0.061)
Vocational training	-0.04 (0.027)	0.55 (0.025)	0.35 (0.028)
Health restrictions	-0.44 (0.042)	-0.04 (0.042)	-0.09 (0.050)
Age (divided by 10)	0.04 (0.014)	-0.08 (0.010)	0.06 (0.015)
Vacancy referral rate, p_{vr} :			
Intercept	-0.89 (0.031)	-1.14 (0.026)	-0.90 (0.034)
Vocational training	0.38 (0.014)	0.14 (0.011)	0.29 (0.014)
Health restrictions	-0.37 (0.017)	-0.49 (0.015)	-0.39 (0.018)
Age (divided by 10)	-0.28 (0.008)	-0.21 (0.006)	-0.27 (0.009)
Sickness rate, p_{sick} :			
Intercept	-4.55 (0.073)	-4.71 (0.059)	-4.81 (0.072)
Vocational training	-0.14 (0.034)	-0.13 (0.025)	-0.18 (0.034)
Health restrictions	0.79 (0.034)	0.65 (0.027)	0.59 (0.034)
Age (divided by 10)	0.15 (0.017)	0.20 (0.013)	0.19 (0.017)
Sick note rate, p_{doc} :			
Intercept	-4.14 (1.236)	-3.39 (0.539)	-4.46 (1.131)
Vocational training	-0.04 (0.561)	0.37 (0.209)	-0.01 (0.284)
Health restrictions	0.59 (0.448)	0.20 (0.072)	0.28 (0.328)
Age (divided by 10)	0.15 (0.255)	0.10 (0.011)	0.32 (0.191)
Sanc. enforcement, p_{sanc} :			
Intercept	-1.54 (2.829)	-1.16 (0.624)	-1.85 (6.998)
Vocational training	0.37 (1.296)	-0.11 (0.025)	-0.38 (2.349)
Health restrictions	-0.09 (1.621)	-0.03 (0.061)	-0.12 (2.940)

Table 3: Parameter estimates (contd.)

Parameter	Estimate		
Sector	A	B	C
Age (divided by 10)	-0.06 (0.696)	-0.01 (0.015)	0.24 (1.405)
Employer accept., λ_{vr} :			
Intercept	-0.31 (0.141)	-1.19 (0.075)	-1.85 (0.139)
Vocational training	0.39 (0.061)	0.04 (0.031)	0.19 (0.045)
Health restrictions	0.13 (0.083)	-0.02 (0.052)	-0.17 (0.140)
Age (divided by 10)	-0.46 (0.037)	-0.13 (0.018)	-0.19 (0.036)
δ	0.04 (0.014)	0.05 (0.008)	0.04 (0.014
σ_ϵ	0.89 (0.011)	0.96 (0.004)	1.02 (0.011)

Notes: Sector A-C refer to manufacturing, construction and trade respectively. Standard deviations are in parantheses.

Table 4: Implied model parameters

Sector	A				B			
voc. train.	0	0	1	1	0	0	1	1
health restr.	1	0	1	0	1	0	1	0
μ_{jo}	7.19	7.06	7.31	7.17	6.73	6.90	6.80	6.97
σ_{jo}	0.28	0.28	0.28	0.29	0.46	0.45	0.45	0.44
μ_{vr}	7.26	7.29	7.28	7.31	7.56	7.68	7.56	7.68
σ_{vr}	0.29	0.26	0.28	0.26	0.36	0.37	0.36	0.37
p_{jo}	0.06	0.09	0.06	0.09	0.11	0.12	0.18	0.19
p_{vr}	0.09	0.12	0.12	0.17	0.08	0.12	0.09	0.14
p_{sick}	0.04	0.02	0.04	0.02	0.04	0.02	0.03	0.02
p_{doc}	0.05	0.03	0.05	0.03	0.06	0.05	0.08	0.07
p_{sanc}	0.13	0.14	0.18	0.19	0.22	0.23	0.20	0.21
λ_{vr}	0.12	0.11	0.16	0.15	0.15	0.15	0.15	0.16

Sector	C			
voc. train.	0	0	1	1
health restr.	1	0	1	0
μ_{jo}	7.38	7.58	7.41	7.61
σ_{jo}	0.34	0.34	0.32	0.33
μ_{vr}	7.14	7.43	7.25	7.54
σ_{vr}	0.46	0.43	0.46	0.44
p_{jo}	0.03	0.03	0.04	0.04
p_{vr}	0.09	0.12	0.11	0.16
p_{sick}	0.03	0.02	0.03	0.01
p_{doc}	0.05	0.04	0.05	0.04
p_{sanc}	0.26	0.29	0.20	0.22
λ_{vr}	0.06	0.07	0.07	0.08

Note: The displayed parameter estimates are for individuals with median UI benefits (900) and of median age (40).

Table 5: Reservation wages, manufacturing

voc. train.	health restr.		s 0/1	2	3	4	5
0	1	$\overline{w}_{jo}(s)$	1264	1227	1192	1158	1126
		$\overline{w}_{vr}(s)$	1250	1214	1179	1019	991
0	0	$\overline{w}_{jo}(s)$	1249	1212	1177	1143	1111
		$\overline{w}_{vr}(s)$	1234	1197	1163	967	940
1	1	$\overline{w}_{jo}(s)$	1374	1337	1301	1268	1236
		$\overline{w}_{vr}(s)$	1354	1318	1284	1031	1005
1	0	$\overline{w}_{jo}(s)$	1362	1325	1290	1258	1226
		$\overline{w}_{vr}(s)$	1342	1306	1272	959	934

Note: The displayed reservation wages are implied by our parameter estimates for individuals of median age (40) and with median UI benefits (900).

Table 6: Reservation wages, construction

voc. train.	health restr.		s 0/1	2	3	4	5
0	1	$\overline{w}_{jo}(s)$	1233	1184	1137	1092	1049
		$\overline{w}_{vr}(s)$	1202	1154	1108	397	363
0	0	$\overline{w}_{jo}(s)$	1416	1367	1320	1276	1233
		$\overline{w}_{vr}(s)$	1384	1336	1291	238	205
1	1	$\overline{w}_{jo}(s)$	1333	1284	1238	1194	1152
		$\overline{w}_{vr}(s)$	1305	1257	1212	640	607
1	0	$\overline{w}_{jo}(s)$	1538	1489	1443	1400	1359
		$\overline{w}_{vr}(s)$	1509	1462	1417	578	546

Note: The displayed reservation wages are implied by our parameter estimates for individuals of median age (40) and with median UI benefits (900).

Table 7: Reservation wages, trade

voc. train.	health restr.		s 0/1	2	3	4	5
0	1	$\overline{w}_{jo}(s)$	1249	1212	1175	1139	1104
		$\overline{w}_{vr}(s)$	1220	1183	1147	849	823
0	0	$\overline{w}_{jo}(s)$	1460	1423	1386	1351	1316
		$\overline{w}_{vr}(s)$	1429	1392	1356	886	861
1	1	$\overline{w}_{jo}(s)$	1363	1325	1289	1253	1219
		$\overline{w}_{vr}(s)$	1341	1304	1268	1008	981
1	0	$\overline{w}_{jo}(s)$	1633	1595	1559	1524	1490
		$\overline{w}_{vr}(s)$	1609	1572	1537	1083	1056

Note: The displayed reservation wages are implied by our parameter estimates for individuals of median age (40) and with median UI benefits (900).

Table 8: Policy simulations sector A (manufacturing)

	Estimated model/ Sample	$p'_{sanc} = \frac{1}{3}$	$p'_{sanc} = \frac{1}{6}$	$p'_{vr} = 1.1p_{vr}$	$p'_{vr} = 1.2p_{vr}$
Job take-up	0.047 (0.047)	0.047	0.048	0.047	0.048
Avg. unemp. duration (month)	21.5	21.4	20.9	21.3	21.0
Job take-up given VR	0.089 (0.094)	0.092	0.096	0.087	0.088
Sanction frequency	0.001 (0.001)	0.002	0.004	0.001	0.002
Avg. accepted wage	2217 (2021)	2185	2188	2212	2215

Table 9: Policy simulations sector B (construction)

	Estimated model/ Sample	$p'_{sanc} = \frac{1}{3}$	$p'_{sanc} = \frac{1}{6}$	$p'_{vr} = 1.1 p_{vr}$	$p'_{vr} = 1.2 p_{vr}$
Job take-up	0.073 (0.079)	0.074	0.076	0.075	0.077
Avg. unemp. duration (month)	13.7	13.5	13.2	13.3	13.0
Job take-up given VR	0.149 (0.149)	0.170	0.185	0.151	0.151
Sanction frequency	0.001 (0.001)	0.007	0.008	0.001	0.002
Avg. accepted wage	2319 (2159)	2295	2292	2332	2348

Table 10: Policy simulations sector C (trade)

	Estimated model/ Sample	$p'_{sanc} = \frac{1}{3}$	$p'_{sanc} = \frac{1}{6}$	$p'_{vr} = 1.1 p_{vr}$	$p'_{vr} = 1.2 p_{vr}$
Job take-up	0.041 (0.045)	0.043	0.045	0.042	0.043
Avg. unemp. duration (month)	24.3	23.3	22.3	23.8	21.3
Job take-up given VR	0.067 (0.079)	0.079	0.185	0.065	0.066
Sanction frequency	0.001 (0.001)	0.007	0.008	0.001	0.002
Avg. accepted wage	2216 (1930)	2189	2180	2341	2377