Structural Empirical Evaluation of Job Search Monitoring

Gerard J. van den Berg *
Bas van der Klaauw †

PRELIMINARY AND INCOMPLETE

Abstract
In this paper we develop a rich model that describes the labor market behavior of both unemployed and employed workers. Our job search models explicitly models endogenous job search effort and accounts for monitoring of job search behavior of unemployed workers. To estimate the model we use data from a randomized experiment conducted in the Netherlands to evaluate the effectiveness of job search monitoring. The data are rich on both short-term and long-term labor market outcomes and contain some measures for job search behavior. Reduced-form estimations shows that the data are in agreement with the predictions of the theoretical model. Job search monitoring slightly reduces the length of unemployment spells, but that it causes unemployed workers to accept jobs of lower quality. Individuals who were exposed to stricter job search monitoring receive on average lower wages and have shorter job durations. We use the structural model estimates to compare the efficiency of job search monitoring to other potential active labor market policies such as providing reemployment bonuses and changes in unemployment benefits.

*VU University Amsterdam, IFAU-Uppsala, IZA, IFS, CEPR, CREST.
†VU University Amsterdam, Tinbergen Institute and CEPR.

Address: Department of Economics, VU University Amsterdam, De Boelelaan 1105, NL–1081 HV Amsterdam, The Netherlands.

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1 Introduction

It is well-known that generous benefits schemes for unemployed workers may cause serious moral hazard problems, i.e. unemployed workers reduce search effort and increase reservation wages. Generous unemployment benefits can therefore reduce re-employment rates. These problems have been acknowledged in the past decades and policymakers have become more interested in stimulating re-employment of benefits recipients. Some policy measures are monitoring search behavior, imposing punitive benefits reductions for non-compliance to job search guidelines, and offering re-employment bonuses to unemployed job seekers. Recently some studies appeared in the economic literature that evaluate the effectiveness of such policies.

In this paper we evaluate the effect of Counseling and Monitoring (C&M), which is an activity provided by the local unemployment insurance (UI) agencies.\(^1\) It is provided to UI recipients with relatively good labor market prospects. C&M consists of monthly meetings with an employee of the local UI agency for a period of 6 months starting immediately after inflow into UI. During these meetings past job search activities are evaluated and a planning on the next period’s job search activities is made. The main purpose of C&M is to reduce the duration of unemployment and consequently the total amount paid on UI benefits. An evaluation of C&M should therefore focus on the duration until exit to work and take place at the individual level.

For the investigation of the effect of C&M on the exit rate to work we use a job search model with multiple search channels and endogenous search effort. In economic literature many studies address the importance of distinguishing between various search channels (see Blau and Robins, 1990, Holzer, 1988, Koning, Ridder and Van den Berg, 1997, and Montgomery, 1991). We allow for formal and informal job search. Job search is considered as formal in case the worker applies for a job using formalized search methods like personnel advertisements and the public employment office. Informal search occurs when for example unemployed workers receive job offers through referral by an employed worker, a friend or a relative. We assume that C&M only concerns formal job search, either by increasing the efficiency of formal job search effort (or reducing the associate costs) or by closer monitoring of formal job search. The first effect can be considered as counseling, while the latter is monitoring. This job search model is used to guide interpretation on the results of the empirical analyses.

Our data are from a social experiment. The participants in the experiment are not told in advance that the experiment is going on. Usually, these individuals would all have

\(^1\)Although the local UI agencies are mainly responsible for paying UI benefits, providing training, schooling, etc. are also their tasks. The public employment offices act as matching agents, not only to UI recipients, but also to welfare recipients and employed workers searching for (new) jobs.
received C&M. However, none of the individuals in the control group complained about not receiving C&M. The setup ensures that the data do not suffer from initial nonrandom nonparticipation in the experiment and participants can not leave the experiment for any reason other than stopping collecting UI benefits. Over the last years the use of social experiments to evaluate active labor market policies has become more common. This has been particularly the case in Canada, the U.K. and the U.S. (see for example Ashenfelter, Ashmore and Deschênes, 1999, Card and Robins, 1998, Dolton and O’Neill, 1996, Eberwein, Ham and LaLonde, 1997, and Meyer, 1995). In The Netherlands this approach is relatively new (see Gorter and Kalb, 1996, for a policy evaluation using a social experiment).

To estimate the structural model we have a sample of 393 unemployed workers who started collecting UI benefits between August 24 and December 2, 1998. From the administrative database of the UI agency we observed unemployment and employment durations and wages. In addition to the administrative database, we also have access to a written questionnaire. This questionnaire was sent to the participants after the experiment was completed. In the questionnaire the UI recipients were asked questions about their job search behavior and their opinion on the local UI agency. The questions on the job search behavior mainly focused on the number of job applications and the job search channels used by the unemployed worker. The questions about the local UI agency differed between the treatment and control group. Both groups were asked if they experienced the activities of the local UI agency as being controlling and stimulating. The individuals in the treatment group were also asked questions about C&M. In particular, they were asked questions about how they experienced the specific components of C&M, checking job applications, providing information, etc. We try to match the answers to this written questionnaire to the administrative database and perform some formal analyses on the answers to the questions.

**RELATED LITERATURE**

For the U.K., Dolton and O’Neill (1996) find that C&M is a very efficient tool for increasing re-employment probabilities of long-term unemployed workers. The Restart program evaluated by Dolton and O’Neill (1996) consists of a set of six-monthly compulsory meetings during which advice on job search is provided (the first meeting takes place after an uninterrupted unemployment spell of 6 months). In addition, the unemployed workers are placed in contact with employers and training agencies. An important feature of Restart is that the unemployment benefits are reduced or suspended if individuals do not participate in the program (or do not search for jobs sufficiently). Meyer (1995) studies 5 U.S. job search assistance programs (which do not offer any bonuses). These programs consist of several different combinations of services. In general, these programs are intense and they often include workshops on job search techniques. Most of these programs decrease the UI entitlement period with around half a week. Although, the
more intense the program is, the higher the individual exit rates to work are. Ashenfelter, Ashmore and Deschênes (1999) investigate the impact of stricter verification of job search behavior on the amount of UI benefits paid and the duration of collecting UI benefits. They do not find any significant effects of this type of monitoring. The target population in their study consists of all applicants for UI benefits in four U.S. states. These results show that in some cases C&M can be a very effective policy in reducing UI entitlement. The success of the policy depends on the intensity of the program and the target population.

See Abbring, Van den Berg and Van Ours, 2005; Lalive, Van Ours and Zweimüller, 2005; and Van den Berg, Van der Klaauw and Van Ours, 2004; for studies on the effectiveness of sanctions.

See Ashenfelter, Ashmore and Deschênes, 2005; Johnson and Klepinger, 1994; Klepinger, Johnson and Joesch, 2002; Micklewright and Nagy, 2005; Van den Berg and Van der Klaauw, 2006; McVicar, 2007; for the effectiveness of job search monitoring.

Re-employment bonuses (Meyer, 1995).

Card and Hyslop.

2 Some background information

2.1 Unemployment insurance

In this section we describe the Dutch UI system in the late 1990s. The aim of the Unemployment Law in The Netherlands is to insure employees against the financial consequences of unemployment. Excluded from this law are self-employed and civil servants, who have an alternative arrangement. It insures around 70% of all workers. Here, we explain its essence, and we highlight aspects that are relevant for our purpose. Given that the observation window of our database covers less than 6 months after inflow, we mostly restrict attention to features that are important for that period.

If a worker younger than 65 years becomes unemployed, he is entitled to UI benefits, provided that some conditions are fulfilled. Specifically, the worker has to face a reduction in his original working hours of at least 5 hours per week, or half of his original working hours if less than 10 hours per week, he should not get paid for this working hour reduction and he should be willing to accept a new job. Individuals receiving UI benefits are therefore not always full-time unemployed. Furthermore, the individual should have had a job for at least 26 weeks in the past 39 weeks prior to the start of the unemployment period. The level of the benefits is fully determined by the history of labor force attachment. The income levels of other household members and private assets do not matter for UI. There are two possible schemes of UI benefits: (i) wage-related benefits, and (ii) short-period benefits.
To be entitled to wage-related benefits, the unemployed worker must have worked at least 52 days during each of 4 years out of the past 5 calendar years. The wage-related benefits start with a period of initial benefits. The level of the initial benefits equals 70% of the wage in the job previous to unemployment with a maximum of 138.84 euro per day.\textsuperscript{2} The exact duration of the entitlement period lies between 6 months and 5 years and depends on the employment history of the unemployed worker. After the entitlement to initial benefits expires, the unemployed worker receives extended benefits for a period of 2 years if his age was under 57.5 years at the first day of unemployment and 3.5 years otherwise. The extended benefits level is equal to 70% of the minimum wage or 70% of the wage in the last job before unemployment, whichever is lower.

Individuals who do not meet the requirement for collecting wage-related benefits, receive “short-period” benefits. The duration of receiving short-period benefits is always 6 months. The level of short-period benefits is similar to extended benefits, 70% of the minimum wage or 70% of the wage in the last job, whichever was lower. If, after the expiration of (either type of) UI benefits, the individual has not found a job, he may receive means-tested welfare benefits.

According to the Unemployment Law, an unemployed worker has the following obligations in order to be entitled to UI benefits: (i) prevent unnecessary job loss, (ii) take actions to prevent him from staying unemployed, so he has to search for a job and accept appropriate job offers, register as a job searcher at the public employment office, participate in education and training, etc., and (iii) keep the local UI agency informed about everything that is relevant to the payment of the UI benefits. If an unemployed worker does not comply to these rules, the local UI agency is authorized (not obliged) to apply a sanction to that worker. See Abbring, Van den Berg and Van Ours (2005) for a study on the effects of imposing sanctions on the exit rate to work. The administration of the UI system is organized at the industry level. There are 4 nation-wide UI agencies that each represent a number of sectors of the economy. In The Netherlands, at the end of 1997, 335,000 individuals collected UI benefits.\textsuperscript{3}

At the \textit{intake meeting} of UI, an individual is classified (“profiled”) into one of four “types”, based on individual characteristics such as work experience, age and education, and on some subjective measures such as expected job search behavior, flexibility, language skills and presentation skills. See Van den Berg and Van der Klaauw (2006) for a detailed description of the process of profiling. The Type I individuals are expected to have sufficient skills to find a job. The Type II and III individuals are considered not to have the skills to

\textsuperscript{2}Actually, less than 5% of the inflow in our data set receives the maximum benefits.

\textsuperscript{3}The Netherlands has 16 million inhabitants, of which 10.5 million are aged between 15 and 65. The 1997 labor force consists of 6.8 million individuals, of which 438,000 do not work. The 1997 yearly in- and outflow into and out of UI equal 486,000 and 531,700 individuals, respectively.
find work without assistance such as training and schooling. The Type IV individuals are
the most disadvantaged and need more care. They are often unable to work or not obliged
to search for work (lone parents with dependent children, drug addicts, etc.). In the inflow
of unemployed workers into UI, 75% to 80% is classified as Type I, whereas in the stock of
UI recipients, about 60% is classified as Type I.

All UI recipients have to send in weekly reports concerning job search activities. This
can be done by mail. Once every four weeks, the UI agency determines whether the
individual is still eligible for UI benefits.

2.2 The experiment

The scale of the social experiment is modest. The experiment concerns all Type I unem-
ployed workers, who started collecting UI benefits between August 24 and December 2,
1998 at two local branches of one particular nation-wide UI agency. Only individuals who
already know at the beginning of their UI entitlement period that they will start a new job
within 3 weeks are excluded from the experiment, as they are not subject to monitoring.
The local agencies are in two of the largest cities of The Netherlands. In the remainder we
simply refer to these cities as City 1 and City 2. The inflow into UI at these local agencies
is relatively large, and the agencies have a good reputation for carrying out monitoring
activities in a highly orderly fashion. Both facts have played a role in the selection of these
local agencies as venues for the experiment.

In the initial setup of the experiment individuals were supposed to be randomly assigned
to 5 groups. The first group would be the control group and the individuals in the other
groups would all be monitored. After the end of the experiment, one of the 4 “treatment”
groups would be chosen randomly to construct the final database together with the control
group. This final database would thus approximately count the same number of individuals
who were monitored as individuals who were not. The main purpose of this setup was to
avoid having the local UI agencies give special attention to the individuals in the treatment
group, which would bias the results of the experiment. The local UI agencies get paid for
the monitoring and are therefore eager to get a positive evaluation of monitoring. However,
because the inflow of Type I unemployed workers into UI was too small, the initial setup
was not followed. In practice, about 50% of the inflow was assigned to the treatment group
and the control group. All individuals were included in the final database.

During the UI intake meeting, the employee of the local UI agency establishes whether
or not a UI recipient is eligible for the monitoring. An independent agency then decides
based on a series of random numbers, which were realized in SPSS before the start of
the experiment, whether this unemployed worker is selected in the treatment group or the
control group. At this stage the independent agency only knows the unique ID-number
of the individual. Individuals selected in the treatment group have to show up at an monitoring intake meeting within 3 days. The unemployed workers in the control group only communicate with the local UI agency by way of sending in written forms stating the current status of their job search activities.

At the local UI agency in City 2, the experiment was not performed exactly as prescribed. At the first intake meeting not all the eligibility criteria for monitoring were checked. In particular, some Type II unemployed workers entered the experiment. The Type II unemployed workers who were selected into the treatment group were identified as being a Type II unemployed worker at the monitoring intake meeting, and were excluded from the experiment. However, if such an individual was selected into the control group, it was not noted that the UI recipient should not have participated in the experiment. We therefore rechecked the individuals in the control group in City 2 on the criteria for being Type I. This resulted in exclusion of a part of the control group from the data. However, it cannot be completely ruled out that there are still a few Type II unemployed workers left in the control group. Because on average Type II unemployed workers have worse labor market skills and therefore have longer expected spells of unemployment, the estimated effect of monitoring on the exit rate to work might be slightly upward biased.

3 Data

4 The data

4.1 Data description

The database contains administrative information on 393 individuals who participated in the experiment, i.e. who started to collect UI benefits between August 24 and December 2, 1998 in City 1 and City 2. All information on events is daily, i.e. we observe the exact day of inflow into and outflow out of UI.\(^4\)

C&M is a policy that only takes the first 6 months of collecting UI benefits. After this period C&M ends for the individuals in the treatment group. The individuals who are still unemployed after 6 months are thus all in the same regime. It is however unclear what this regime really involves, i.e. some individuals might enter alternative active labor market policies. Therefore, we right-censor all observations after 26 weeks of collecting UI benefits. In the group of UI recipients that received C&M 38.5\% of the unemployment

\(^4\)As mentioned in Subsection 2.1, UI recipients are not always full-time unemployed, i.e. they may have lost only part of their working hours and still work for the remaining hours. Therefore, the relevant events are the start of the period of collecting UI benefits and the end of this period. However, we simply refer to this period of collecting UI benefits as unemployment and to UI recipients as unemployed workers.
spells is censored and in the group that did not receive C&M this is 39.4%. Censoring can also occur if the exit destination differs from employment (illness, prison, not accepting suitable work, leaving the city). There is no systematic difference in how often these other exits occur in the treatment (receiving C&M) and the control (not receiving C&M) group. Because we have administrative data, the empirical analyses do not suffer from selective nonresponse or attrition from the database.

If an individual found work within 26 weeks, we observe the gross wage in the first job, the length of the first job spell, the destination state after the first job spell and the gross wage in the second job (if the destination state of the first job spell was work). The wages are deflated to obtain real weekly wages (measured in January 1999 euros). The gross minimum weekly wage is 245 euros. In our data about 5.8% of the observed wages are below the minimum wage and 52% below the observed benefits level. Furthermore, of the group of individuals with more than one observed wage, in 32% the second wage is below the first wage.

In the beginning of March 1999 a survey questionnaire was sent by mail to all participants. The response rate to this questionnaire was 33%. We have tried to match the survey respondents to the individuals in the administrative database. To match records, we used information on the month of birth, the city of residence, gender, treatment status, having collected UI benefits before, current labor market status, and day of starting collecting UI benefits. However, due to a large amount of item nonresponse on these variables, we only succeeded in matching 49 individuals in the treatment group and 55 individuals in the control group. Van den Berg and Van der Klaauw (2006) investigate if there was non-random nonresponse and concluded that this was not the case.

The survey includes questions on how the unemployed workers evaluate C&M and on which search channels they have used, in addition to subjective evaluations of satisfaction with aspects of the benefits and re-employment system. Van den Berg and Van der Klaauw (2006) use the answers to the survey to argue that the unemployed workers experience C&M more as controlling than advisory.

The main information we abstract from the survey is the use of job search channels. The individuals were asked to report from a list of possible job search channels which channels they had actually used during their spell of collecting UI benefits. We define as formal search channels the public employment offices / local UI agency, and (commercial) employment agencies. The informal search channels are open application letters and search through friends and relatives. We keep job advertisements in newspapers out of the analyses as in our opinion this can be either be the result of formal or informal search. It is not clear how the unemployed worker was attended to the advertisement. Furthermore, most unemployed workers indicate that the use job advertisements in newspaper.\(^5\)

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\(^5\)The survey data also contain self-reported numbers of job applications. However, these data display
<table>
<thead>
<tr>
<th></th>
<th>Treatment group</th>
<th>Control group</th>
<th>p-value for similarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of individuals</td>
<td>205</td>
<td>188</td>
<td></td>
</tr>
<tr>
<td>Percentage female</td>
<td>38.5%</td>
<td>41.0%</td>
<td></td>
</tr>
<tr>
<td>Percentage living in City 2</td>
<td>62.0%</td>
<td>59.0%</td>
<td></td>
</tr>
<tr>
<td>Average age</td>
<td>35.8</td>
<td>36.7</td>
<td></td>
</tr>
<tr>
<td>Percentage collected UI before</td>
<td>22.4%</td>
<td>26.6%</td>
<td></td>
</tr>
<tr>
<td>Average weekly UI benefits</td>
<td>384</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>Formal search channels</td>
<td>0.79 (0.12)</td>
<td>0.52 (0.12)</td>
<td>0.446</td>
</tr>
<tr>
<td>Informal search channels</td>
<td>0.79 (0.15)</td>
<td>1.00 (0.14)</td>
<td>0.576</td>
</tr>
<tr>
<td>Hazard to first job</td>
<td>0.043 (0.004)</td>
<td>0.042 (0.004)</td>
<td>0.814</td>
</tr>
<tr>
<td>Wage in first job</td>
<td>413 (14)</td>
<td>424 (17)</td>
<td>0.621</td>
</tr>
<tr>
<td>Job separation hazard</td>
<td>0.0023 (0.0004)</td>
<td>0.0024 (0.0004)</td>
<td>0.864</td>
</tr>
<tr>
<td>Job-to-job hazard</td>
<td>0.0088 (0.0006)</td>
<td>0.0068 (0.0006)</td>
<td>0.026</td>
</tr>
<tr>
<td>Wage in second job</td>
<td>457 (25)</td>
<td>433 (23)</td>
<td>0.485</td>
</tr>
</tbody>
</table>

Explanatory note: Wages and benefits are before taxes and measured in euros on January 1, 1999.

Table 1: Summary statistics.
In Table 1 we provide summary statistics for the variables we use in our empirical analyses. There are slightly more individuals in the treatment group than in the control group, 205 individuals received C&M and 180 were excluded from C&M. The differences in the individual characteristics gender, the city in which they live, age and whether the collected UI benefits before are relatively small between both groups.

In the empirical analyses we use the values of the explanatory variables $x$ at the moment of inflow. Because the administrative database only contains variables that are needed by the UI agency, the number of variables in the database is limited. For example we do not have any information on the occupation and the level of education. In addition to the city of residence and the treatment indicator, we observe the standard personal characteristics, gender, age and household situation (being single or living together with a partner). In addition, we observe if the individual has ever received UI benefits before. Furthermore, we know the benefits level per day and the number of days per week the unemployed worker is eligible for collecting UI benefits. This latter variable is the original weekly working hours reduction divided by 8 (the number of working hours per day). Finally, we observe if the local UI agency imposed a sanction on the UI recipient. We do not have any information on the reason why the sanction was imposed or the size and the duration of the benefit reduction. In the database, the percentage of individuals who had a sanction imposed was less than 3%, among those who received C&M as well as among those who did not receive C&M.

Van den Berg and Van der Klaauw (2006) check the assignment of treatment and conclude that randomization is likely to hold.

5 Model

In this section we provide our structural model. The model is based on a standard job search model with endogenous search effort and on-the-job search (e.g. Mortensen, 1986). We extend the model by allowing job offers to arrive through formal as well as informal search channels, each with its own associated structural parameters and endogenous search intensity. The model mainly focusses on the effects of job search monitoring.

Consider an unemployed worker searching for a job. This individual can search along the formal and the informal channel, which are denoted by subscripts 1 and 2, respectively. An amount of search effort $s_i \geq 0$ is devoted to search along channel $i$. This variable $s_i$, which is also called the search intensity for channel $i$, is to be chosen optimally by the

an extremely large amount of dispersion. Estimates of count data models for these data are extremely sensitive with respect to the value at which high numbers are censored or truncated. Apparently there is a very large amount of measurement error in these data.
unemployed worker. Job offers along search channel $i$ arrive at the individual according to a Poisson process with rate $\lambda_i s_i$.

A job offer is characterized by a random drawing from the wage offer distribution $F$. Arrival times and wage offers are independent across channels, and given the channel they are independent across time. For ease of exposition, we assume that $F$ is continuous with a connected support stretching to infinity, on which the density is positive. If a job offer arrives, the individual has to decide immediately whether to accept it or to reject it and continue searching. We do not allow for the possibility to reconsider job offers at a later stage. Furthermore, for ease of exposition, we assume that once a job is accepted, it will be kept forever, at the same wage. We thus exclude on-the-job-search and job loss. However, our results are robust with respect to this.

The costs of search are expressed by the function $c(s_1, s_2)$. We require $c$ to be increasing and convex in its arguments, with $c(0, 0) = 0$. Moreover, we require $\partial^2 c / (\partial s_1 \partial s_2) \geq 0$ for $s_1, s_2 > 0$, to capture that the efforts along the two channels are relatively similar activities compared to most other ways to spend time and money, and to capture that a certain fraction of vacancies may be found along either channel. In the literature on search models with endogenous search effort $s$ and a single search channel, the arrival rate and the search costs are generally taken to be proportional to $s$ and $s^2$, respectively (see the survey by Mortensen and Pissarides, 1999). We require that our specification for $c$ reduces to such a quadratic specification in case only one channel is used, or in case both channels are equivalent. So, our function $c$ has to be such that $c(s, 0), c(0, s)$ and $c(s, s)$ are quadratic in $s$. We take the following specification,

$$c(s_1, s_2) = (a_1 s_1^\gamma + a_2 s_2^\gamma)^{2/\gamma}.$$  

It is readily verified that this satisfies the above requirements if $a_i > 0$ and $0 < \gamma \leq 2$.

While being unemployed a worker received benefits $b$. The instantaneous utility of income is given by $u(w) = w$. Individuals maximize their expected discounted income over an infinite time horizon. The expected discounted income (or “value of search”) and the discount rate are denoted by $R$ and $\rho$, respectively.

While being employed, individuals can search on-the-job. Since our interest in mainly on the period of unemployment, we keep the on-the-job search part fairly straightforward. While being employed, workers receive job offers with rate $\lambda$ and lose their job with rate $\delta$. A job offer is drawn from the same wage offer distribution $F(w)$ as while being unemployed. An individual losing her job believes that the state at which she enters unemployment is equivalent to the unemployment state she left. This implies that workers who received monitoring prior to employment, believe that they will receive this again and similar for workers who did not receive monitoring.

The optimal behavior of an employed worker is to accept all job offers with a wage
higher than the current wage. This implies that the Bellman’s equation for an employed worker with wage $w$ equals

$$\rho R(w) = w + \delta(R_a - R(w)) + \lambda \int_w^\infty (R(x) - R(w))dF(x)$$

For an unemployed person the Bellman’s equation is

$$\rho R_u = \max_{s_1, s_2 \geq 0} b - (c_1 s_1^\gamma + c_2 s_2^\gamma)^{2/\gamma} + (\lambda_1 s_1 + \lambda_2 s_2) \int_{\phi}^\infty (R(w) - R_u)dF(w)$$

The optimal strategy of an unemployed person is a reservation wage strategy. An unemployed worker accepts any job offer with a wage above the reservation wage $\phi$. The reservation wage follows from $R(\phi) = R_u$. The optimal search effort is given by

$$s_i = \frac{\lambda_i}{2c_i} \left( ci + cj \left( \frac{\lambda_j}{\lambda_i c_j} \right)^{\gamma^{-1}} \right)^{1-2/\gamma} \int_{\phi}^\infty (R(w) - R_u)dF(w) \quad i \neq j$$

We assume that the monitoring in C&M concerns the formal job search effort $s_1$ but not the informal search effort $s_2$. The local UI agency can check the number of times the UI recipient responds on a job advertisement, the number of application letters written, subscription at public employment offices, etc. It is for the local UI agency much more difficult to measure how often an individual asks friends and relatives about job openings. When providing C&M the monitoring effort of the local UI agency therefore focuses on search along the formal channel. Specifically, the agency imposes a minimum search effort (or threshold value) devoted to formal job search denoted by $s_1^*$. Full compliance can be achieved by perfect monitoring of formal job search effort or by a sufficiently severe punishment of noncompliance. In practice, the most common punishment in case of noncompliance is a sanction, which is a temporary benefit reduction (see Abbring, Van den Berg and Van Ours, 2005). The data show that sanctions are virtually absent among individuals who receive C&M. We therefore simply assume that there is no noncompliance.

It is clear that if optimal formal job search effort $s_1$ in the unrestricted case lies above the threshold value $S_1^*$, then the individual will not change his behavior, so monitoring does not have any effect. We focus on the more interesting case in which the required effort is higher than the effort in the absence of monitoring. In this case, the optimal strategy can be summarized merely by $\phi$ and $s_2$.

Given the reservation wage the optimal search effort along informal job search satisfies the first-order condition

$$2c_2(c_1 s_1^* + c_2 s_2^*)^{2/\gamma-1} s_2^{-1} = \lambda_2 \int_{\phi}^\infty (R(w) - R_u)dF_u(w)$$
This equation does not have a closed-form solution. There are however two interesting cases to consider. First, in case of perfect substitution ($\gamma = 1$), then

$$s_2 = -\frac{c_1}{c_2} s_1^* + \frac{\lambda_2}{2c_2^2} \int_{\phi}^{\infty} (R(w) - R_u) dF_u(w)$$

and there is thus is linear relation between optimal informal job search effort and formal search requirements. Increased monitoring is ineffective due to effort substitution.\(^6\) Second, if $\gamma = 2$, then

$$s_2 = \frac{\lambda_2}{2c_2} \int_{\phi}^{\infty} (R(w) - R_u) dF_u(w)$$

and the optimal amount of informal search does not depend on formal search requirement. This implies that there is no substitution effect. It should be noted that both equations are conditional on the reservation wage $\phi$. So even though when $\gamma = 2$ there is no direct substitution effect, there may be an ”income” effect via a decrease in the reservation wage which increases the optimal $s_2$.

The optimal reservation wage $\phi$ follows from equation (??), where the right-hand side is now maximized over $s_2$ while $s_1$ is fixed at $s_1^*$. Note that the marginal returns to formal job search effort are now lower than the marginal costs. The optimal reservation wage is decreasing in the binding minimum required formal search effort level. Unemployed workers are forced to behave sub-optimally, so being unemployed becomes less attractive, and therefore they are willing to accept jobs with lower wages. For essentially the same reason, unemployed workers would not participate voluntarily in a monitoring scheme with a binding minimum search effort.\(^7\) Of course, the advantages of monitoring are outside of the individual’s decision problem. The agency may want to reduce the total payment of UI (i.e., to increase $\theta$ by way of monitoring) because it believes that the advantages of this outweigh the reduction of the unemployed worker’s present value. We return to this issue when performing policy simulations using the estimated model.

### 5.1 Identification

Identification suffers from the recoverability problem, i.e. cannot identify the wage offer distribution $F(w)$ below the reservation wage $\phi$ (see Flinn and Heckman, 1982).

---

\(^6\)Keeley and Robins (1985) also mention the possibility of substitution of search effort in response to monitoring of the formal search channel. They do not provide a formal theoretical analysis.

\(^7\)They may participate voluntarily in a counseling scheme that increases $\lambda_1$, because this increases the expected present value of being unemployed. A combination of the two schemes may be attractive to the unemployed workers, depending on the parameter values.
5.2 parametrization

The unknown model parameters are the job search efficiency parameters $\lambda_1$ and $\lambda_2$, the costs function of search effort $c(s_1, s_2)$, the wage offer distribution $F(w)$, the minimal formal search effort under monitoring $s_1^{\ast}$, the job offer arrival rate $\lambda$ of employed workers, the job separation rate $\delta$ and the discount rate $\rho$. The discount rate $\rho$ equals 3% per year. We allow for observed heterogeneity in both job search efficiency parameters, the wage offer distribution and the minimum required formal search effort under monitoring. The other structural model parameters are the same for all individuals. Let $x$ denote the vector of individual characteristics

The job search efficiency parameters $\lambda_i$ are specified as $\lambda_i = \exp(\alpha_i + x\beta)$. Both search efficiency parameters thus have different intercepts, but the effects of covariates $x$ are the same in both search channels.

We assume that wage offers always exceed the minimum wage $w_{\text{min}}$. The wage offer distribution follows an exponential distribution with

$$F(w) = 1 - \exp(-\mu(w - w_{\text{min}})) \quad w \geq w_{\text{min}}$$

The expected wage offer is thus $w_{\text{min}} + \frac{1}{\mu}$, where we parameterize $\mu$ as $\exp(\mu_0 + x\mu_1)$.

Finally, the minimum formal effort required under monitoring equals $s_1^{\ast} = \delta_0 + x\delta_1$.

Finally, we estimate the benefits level $b$.

5.3 Solving the model

As is shown in the previous section, there are some computational problems involved in solving the model. In particular, we should obtain for those individuals who were randomized out of the monitoring scheme the optimal reservation wage $\phi$. For these individuals the optimal search effort follows from equation ???. The main problem is to determine $R(w)$.

[initialize] Impose some value for $R_u$

[Step 1] Assume that above wage $\bar{w}$ no one changes jobs anymore. This implies that

$$R_e(\bar{w}) = \frac{\bar{w}}{\rho + \delta} + \frac{\delta}{\rho + \delta} R_u$$

and

$$Q(\bar{w}) = \int_{\bar{w}}^{\infty} R_e(x) - R_e(\bar{w})dF_e(x) = \frac{1}{\rho + \delta} \left( \bar{w} + \frac{1}{\mu} - \rho R_u \right) \exp\left( -\mu(\bar{w} - w_{\text{min}}) \right)$$

For a given value of $R_u$ we can thus determine $R_e(\bar{w})$. Set $w = \bar{w}$. 

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[Step 2] It should be noted that

$$\frac{\partial R_e(w)}{\partial w} = \frac{1}{\rho + \delta - \lambda(1 - F(w))}$$

So for a small $\Delta$ we can approximate

$$R_e(w - \Delta) \approx R_e(w) - \frac{\Delta}{\rho + \delta - \lambda(1 - F(w))}$$

and

$$Q(w - \Delta) = Q(w) + \frac{\Delta}{2} (R_e(w)\mu \exp(-\mu(w - w_{\text{min}})) + R_e(w - \Delta)\mu \exp(-\mu(w - \Delta - w_{\text{min}})))$$

$$- R_u (\exp(-\mu(w - \Delta - w_{\text{min}})) - \exp(-\mu(w - w_{\text{min}})))$$

set $w = \bar{w}$.

[Step 3] Next compute

$$s_i = \frac{\lambda_i}{2c_i} \left( c_i + c_j \left( \frac{c_i \lambda_j}{\lambda_i c_j} \right)^{\gamma - 1} \right)^{1 - 2/\gamma} \int_\phi^\infty Q(w)$$

and

$$R_u = b \rho - \frac{(c_1 s_1^\gamma + c_2 s_2^\gamma)^{2/\gamma}}{\rho} + \frac{(\lambda_1 s_1 + \lambda_2 s_2)Q(w)}{\rho}$$

If $R_u < R_e(w)$ go to step 1. If $R_u \leq R_e(w)$, then go back to the initialization step with a new value of $R_u$. Repeat this until $R_u$ does not change anymore, this will provide the reservation wage $\phi = w$ and the optimal $s_1$ and $s_2$.

We take $\bar{w} = 3000$, while highest observed wage is 1459 euro and $\Delta = 1$.

Also for the individuals who were subject to monitoring we should determine the unrestricted $s_1$, $s_2$ and $\phi$.

5.4 Likelihood function

Below we provide some intuition for the loglikelihood function. We suppress covariates $x$ and indicators for individuals.

We assume that formal and informal search effort are observed with measurement error, according to $\tilde{s}_i = s_i + \varepsilon_i$ (with $\varepsilon_i$ normally distributed with mean 0 and variance $\sigma_i^2$). This implies the likelihood contribution of search effort

$$\frac{1}{\sqrt{2\pi\sigma_i}} \exp \left( -\frac{1}{2} \left( \frac{\tilde{s}_i - s_i}{\sigma_i^2} \right) \right)$$
For unemployed workers the reemployment hazard equals

$$\theta = (\lambda_1 s_1 + \lambda_2 s_2) \exp(-\mu(\phi - w_{\text{min}}))$$

which implies the likelihood contribution of a spell of length $t_1$

$$\theta^{d_1} \exp(-\theta t_1)$$

where $d_1$ indicates if exit to work is observed.

If an individual is observed to find work $d_1 = 1$, then we observed the first wage. Assume measurement errors in observed wages $\tilde{w} = w + \epsilon$, with $\epsilon$ normally distributed with mean 0 and variance $\sigma^2$. This implies that $\tilde{w}_1$ is drawn from

$$\Phi\left(\frac{\tilde{w}_1 - \phi - \mu \sigma^2}{\sigma}\right) \mu \exp\left(-\mu(\tilde{w}_1 - \phi) + \frac{\mu^2 \sigma^2}{2}\right)$$

After accepting the first job the hazard to accepting a second job is

$$\theta_w = \lambda \exp(-\mu(w_1 - w_{\text{min}}))$$

the lay-off rate is

$$\theta_u = \delta$$

This implies that the likelihood contribution of the second spell is

$$\theta_w^{d_w} \theta_u^{d_u} \exp(- (\theta_w + \theta_u) t_2)$$

where $d_w$ indicates exit an on-the-job transition and $d_u$ indicates a lay-off. If the individual accepted a second job, the likelihood contribution of the wage $w_2$ in this second job is

$$\Phi\left(\frac{\tilde{w}_2 - w_1 - \mu \sigma^2}{\sigma}\right) \mu \exp\left(-\mu(\tilde{w}_2 - w_1) + \frac{\mu^2 \sigma^2}{2}\right)$$

This implies the overall likelihood contribution

$$\frac{1}{\sqrt{2\pi} \sigma_i} \exp\left(-\frac{1}{2} \frac{(\tilde{s}_i - s_i)^2}{\sigma_i^2}\right) \int_{-\infty}^{\infty} dw_1$$

We can concentrate out the variance of the measurement error in search effort.
6 Estimation results

6.1 parameter estimates

In Table 2 we provide the parameter estimates of the structural model. The search efficiency parameter of formal search is slightly higher. This implies that one unit of formal search is more likely to generate a job offer than one unit of informal search. The difference is however not significant. Women younger workers and those living in City 1 have significant higher $\lambda_1$ and $\lambda_2$ than their counterparts. The expected wage offer is given by $1/\mu$. This implies that women, younger workers and those living in City 2 receive significant lower wage offers.

The minimum search requirements for those individuals exposed to the job search monitoring are lower for women and older individuals. In City 2 the monitoring scheme is somewhat stricter than in City 1. Although, it should be noted that the covariate effects are not significant. Furthermore, the search requirements are binding for 189 individuals out of the 205 individuals in the treatment group. This implies that for 16 workers their unrestricted formal search effort is already above the minimum requirements.

The formal search channel is more costly than the informal search channel. It should however be noted that standard errors are substantial. The parameter $\gamma$ equals 1.26. It differs significantly from 2, so we can reject that the costs of both search channels are independent. Since $\gamma$ is not significantly different from 1, we cannot rule out that in the costs function formal and informal search effort are perfect substitutes.

Finally, on-the-job workers get on average a job offer about every 56 weeks, while they lose their job on average every 500 weeks. The latter indicates that the individuals in our data are indeed the less disadvantaged in the inflow into unemployment.

We have tried a number of extensions: (1) add unobserved heterogeneity both in the costs function of job search effort and the unemployment benefits, (2) allowed wage offer distribution to be different for formal and informal job search and (3) tried different wage offer distributions for unemployed and employed individuals.

6.2 Fit of the model

Table 3 shows the fit of the model. In almost all dimensions the fit of the model seems good. We can also use the estimated variances of the measurement errors as measure for the goodness-of-fit of the model. Compare the variance of the measurement error in wages with the variance in observed wages shows that only 24.7% of all variance in observed wages is due to measurement errors. Figure 1 shows a kernel estimate of the density of observed first wages and the predicted density of observed wages.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data Predictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept formal search $\lambda_1$</td>
<td>-2.873 (0.481)</td>
</tr>
<tr>
<td>Intercept informal search $\lambda_2$</td>
<td>-3.071 (0.482)</td>
</tr>
<tr>
<td>Female</td>
<td>0.239 (0.101)</td>
</tr>
<tr>
<td>Age (divided by 10)</td>
<td>-0.167 (0.046)</td>
</tr>
<tr>
<td>City 2</td>
<td>-0.189 (0.089)</td>
</tr>
<tr>
<td>Intercept wage offers $\mu$</td>
<td>-4.436 (0.244)</td>
</tr>
<tr>
<td>Female</td>
<td>0.693 (0.090)</td>
</tr>
<tr>
<td>Age (divided by 10)</td>
<td>-0.209 (0.062)</td>
</tr>
<tr>
<td>City 2</td>
<td>-0.181 (0.080)</td>
</tr>
<tr>
<td>$\sigma_\varepsilon$ (measurement error wages)</td>
<td>99.442 (5.892)</td>
</tr>
<tr>
<td>Minimum search requirement</td>
<td>1.377 (0.580)</td>
</tr>
<tr>
<td>Female</td>
<td>-0.310 (0.244)</td>
</tr>
<tr>
<td>Age (divided by 10)</td>
<td>-0.160 (0.156)</td>
</tr>
<tr>
<td>City 2</td>
<td>0.238 (0.287)</td>
</tr>
<tr>
<td>Costs formal search $c_1$</td>
<td>40.609 (49.535)</td>
</tr>
<tr>
<td>Costs informal search $c_2$</td>
<td>27.749 (27.033)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>1.260 (0.284)</td>
</tr>
<tr>
<td>$\lambda$ (on-the-job)</td>
<td>0.018 (0.001)</td>
</tr>
<tr>
<td>$\delta$ (job destruction rate)</td>
<td>0.002 (0.000)</td>
</tr>
<tr>
<td>Benefits $b$</td>
<td>107.35 (186.46)</td>
</tr>
</tbody>
</table>

Table 2: Estimation results for the structural model.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data Predictions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td>Formal search channels</td>
<td>0.79</td>
</tr>
<tr>
<td>Informal search channels</td>
<td>0.79</td>
</tr>
<tr>
<td>Re-employment hazard</td>
<td>0.043</td>
</tr>
<tr>
<td>First (weakly) wage</td>
<td>413</td>
</tr>
<tr>
<td>Reservation wage</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Fit of the model.
<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal search channels</td>
<td>0.503</td>
<td>0.826</td>
<td>3</td>
<td>0.550</td>
<td>0.553</td>
</tr>
<tr>
<td>Informal search channels</td>
<td>1.017</td>
<td>0.767</td>
<td>0.063</td>
<td>1.114</td>
<td>1.119</td>
</tr>
<tr>
<td>Re-employment hazard</td>
<td>0.0405</td>
<td>0.0443</td>
<td>0.0945</td>
<td>0.0446</td>
<td>0.0449</td>
</tr>
<tr>
<td>First (weakly) wage</td>
<td>411.02</td>
<td>410.47</td>
<td>410.46</td>
<td>410.95</td>
<td>410.91</td>
</tr>
<tr>
<td>Reservation wage</td>
<td>245.56</td>
<td>245.01</td>
<td>245.00</td>
<td>245.50</td>
<td>245.36</td>
</tr>
<tr>
<td>Value of search ( R_u )</td>
<td>1,147,108.8</td>
<td>1,146,952.8</td>
<td>1,146,950.4</td>
<td>1,147,203.6</td>
<td>1,147,198.4</td>
</tr>
<tr>
<td>Search costs</td>
<td>436.72</td>
<td>546.14</td>
<td>3250.80</td>
<td>519.73</td>
<td>524.47</td>
</tr>
<tr>
<td>Monitoring binding</td>
<td>0</td>
<td>364</td>
<td>393</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Costs</td>
<td>61.62</td>
<td>152.46</td>
<td>152.46</td>
<td>161.57</td>
<td>234.85</td>
</tr>
<tr>
<td>Exit rate within 26 weeks</td>
<td>0.6526</td>
<td>0.6842</td>
<td>0.9122</td>
<td>0.6772</td>
<td>0.6772</td>
</tr>
</tbody>
</table>

Benefits payments

Benefits payments in 26 weeks

Explanatory note:
1. No monitoring.
2. All monitoring.
3. Extreme monitoring \( s^*_1 = 3 \).
4. Reemployment bonus 150 euros (effort, hazard and reservation wage in first week reported).
5. Decreasing reemployment bonus (start 260 euros, 10 euros decrease per week).

Table 4: Policy simulations.

6.3 Policy simulations

We use the estimated structural model for policy simulations. Recall that the main identification problem is that it is not possible to identify the wage offer distribution below the reservation wage. This recoverability problem might not be so relevant in our setting as many unemployed workers have a reservation wage, which is approximately equal to the legal minimum wage. Since employers cannot offer wages below the minimum wage, we have actually identified the full wage offer distribution. We can thus also investigate policy changes that might lower reservation wages.

In Table 4 we provide the results of some policy simulations. First, we consider the situation in which the UI agency does not impose any job search requirements. Without job search monitoring the UI agency checks every four weeks if the unemployed workers is still eligible for collecting benefits, which costs 17.52 euro per check. We mainly focus on the first 26 weeks after starting collecting UI. Without job search requirements about 65.3% of the individuals have started working. The expected costs of the eligibility checks
during the first six months are about 61.62 euro.

In column (2) we consider the case that all workers are subject to job search monitoring. It should be noted that the monitoring is only binding for 364 individuals in our sample. The remaining 29 workers have unrestricted formal search effort above the minimum requirements. Compared to the situation without job search monitoring formal search effort is much higher and informal search effort is lower. The reemployment hazard slightly increases, which also means that after 26 the fraction of individuals finding work increases from 65.3% to 68.4%. Because the reservation wage slightly drops also the expected first wage is slightly lower. It should be noted that due to the monitoring weekly job search costs increase from 436 euro to 546 euro. Finally, the costs of providing job search monitoring are 152.46 euro per individual entering unemployment.

Column (3) provides the results of more intense monitoring, every individual is subject to the formal search effort requirement $s^*_i = 3$. Because of the high formal search individuals reduce informal search effort almost to 0. The change in search effort causes both search effort and the reemployment hazard to increase substantially. Due to this extreme monitoring about 91.2% of individuals finds work within 26 weeks of unemployment.

In column (4) we consider the case where job search monitoring is replaced by promising reemployment bonuses. In particular, a worker who starts working within 26 weeks of unemployment receives an one-time bonus of 150 euros. Promising the reemployment bonus increases search effort and very modestly reduces the reservation wage. Due to the reemployment bonus the fraction of workers who finds work within 26 weeks increases from 65.3% to 67.7%. It should be noted that providing reemployment bonuses is slightly more expensive than job search monitoring, but re-employment within 6 months is slightly lower.

In the second bonus experiments individuals can earn 260 euros for finding work within 1 week and every week the bonus decreases with 10 euros. So the bonus is 0 after 26 weeks of unemployment. After 26 weeks reemployment is the same as in the previous bonus scheme. Although it should be noted that in the first few weeks reemployment rates are higher and towards the end of the first 26 weeks of unemployment, reemployment rates decreases. This implies that overall benefits payments are lower, while it could be seen column (5) that the bonus payments are higher.

### 6.4 Optimal policy

When looking at optimal policy we should also take into account the benefits payments. Since for both bonus experiments the model become nonstationary (during the first 26 weeks), we cannot directly infer expected benefits costs from the reemployment hazard.

We can use two different measures to define optimal policy. First, we can look at welfare, implying that we should consider the value of search of the individuals and benefits and
policy costs of the UI agency. This approach ignores the surplus of firms, which we cannot compute as we do not have productivity measures. Second, we can take the perspective of the UI agency and try to minimize the sum of benefits payments and policy costs.

6.5 Counterfactual conditions

The effects of the counseling and monitoring scheme are modest. It would be interesting to consider variations in the structural parameters $\lambda$ and $\mu$ to investigate how the effects of counseling and monitoring are for individuals with different structural parameters. Since the unemployed workers in our data are considered to be the less disadvantaged workers, it would be most interesting to consider lower values of $\lambda$ and higher values of $\mu$. This might also be most relevant as the experiment was conducted in a period of relatively good economic conditions.

7 Conclusions

References


Micklewright, J. and G. Nagy (2005), Job search monitoring and unemployment duration in Hungary: evidence from a randomised control trial, Mimeo, University of Southampton.


Figure 1: Observed and predicted first wages.