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Recruitment in Recovery

Mark Sanders
Riccardo Welters

Universiteit Utrecht

Utrecht School of Economics

Tjalling C. Koopmans Research Institute
Utrecht School of Economics
Utrecht University

Janskerkhof 12
3512 BL Utrecht
The Netherlands
telephone +31 30 253 9800
fax +31 30 253 7373
website www.koopmansinstitute.uu.nl

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How to reach the authors

Please direct all correspondence to the first author.

Mark Sanders
Utrecht University
Utrecht School of Economics
Janskerkhof 12
3512 BL Utrecht
The Netherlands.
E-mail: M.W.J.L.Sanders@uu.nl
Riccardo Welters
James Cook University
Townsville
4811 QLD, Australia
E-mail: riccardo.welters@jcu.edu.au.

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Mark Sanders[a]
Riccardo Welters[b]

[a]Utrecht School of Economics
Utrecht University

[b]James Cook University
Australia

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Abstract
Burgess (1993) finds that job finding rates for the unemployed do not move proportionately to changes in the overall hiring rate. Burgess hints at employed job seekers that start looking in tight conditions and crowd out the unemployed. But he leaves the search behaviour of firms unaddressed. Russo et al. (2000) and Russo et al. (2001), however, shows that firms switch their preferred recruitment channel in changing labour market conditions. We introduce recruitment channels in a search model and find an additional mechanism through which the unemployed obtain less than their 'fair share' of the job offers. We then test our model's predictions using panel data from the Netherlands and find support for this hypothesis

Keywords: employer search, job search, recruitment channels, tightness

JEL classification: J23, J64

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1 Introduction

Unemployment is back on the agenda. As many countries suffer the consequences of the global economic recession, unemployment is on the rise and is projected to remain high for the years to come. For the Netherlands a doubling of the unemployment rate between 2008 and 2010 is deemed likely.[4] And for many countries similar or worse projections have been made (OECD (2009)). As these job losses are hard or impossible to prevent, governments should now prepare to ensure that the recovery also benefits the unemployed. This is not self-evident as past recoveries have shown (OECD (2009)). Economic recovery does not automatically translate into job growth and job growth does not automatically translate into jobs for the unemployed. Burgess (1993) for example showed that in the 80s a one percent increase in the hiring rate on the British labour market only led to a 0.31 percent increase in the outflow rate for the unemployed. And CWI (2003) found similar results for the Netherlands in the late 90s. Economic recovery, even if it generates new jobs, does not mean it generates jobs for those who need them most.[5] To prevent these low outflow rates from recurring in the recovery one needs to understand what mechanism explains this counterintuitive finding.

Our paper aims to contribute to this understanding and is closely related to the literature on search models of the labour market in general and on-the-job search and firm recruitment behaviour in particular. To illustrate the basic mechanism we intend to highlight, we first build a matching model of the labour market in which on-the-job and unemployed job seekers compete for jobs offered by firms in an open (e.g. advertisements) and closed (e,g. the labour exchange office) recruitment channel. In the model the agent's decision on how hard to search in what channel depends on the actions of the other agents and the general economic conditions. We then test the predictions in a dataset for the Netherlands and find support for the mechanism we hypothesise. The analysis leads to some highly relevant policy implications. Employment prospects of the (long-term) unemployed hardly improve under improving labour market conditions and countercyclical labour market policies therefore need not be optimal. In a tightening labour market policy makers should be aware that the (long-term) unemployed may be tempted to switch out of the advertisement channel and thereby reduce their probability of finding a job.

The remainder of the paper is structured as follows. Section 2 discusses the key references and positions the paper in the literature to which it hopes to contribute. Section 3 outlines our model and discusses the decisions of the firm, the employed and the unemployed job seekers and analyses the equilibrium to which their interaction leads. Section 4 describes the data and tests our hypotheses. Section 5 then discusses policy implication and Section 6 concludes.

2 Search and recruitment behaviour

[4] CPB (2009) projects the unemployment rate to go from 3.9% in 2008 to 9.5% in 2010.
[5] In addition, Boeheim and Taylor show that if they are successful in finding a job it typically last shorter implying the quality of the match is lower.

The empirical literature on job search has confirmed the Burgess (1993) finding that the correlation between the hiring rate and the outflow rate out of unemployment is (much) less than one has provided several competing explanations. Most of these papers contend or hypothesise that there is a mismatch between in particular the unemployed job seekers and the jobs offered. The explanations, however, differ widely in the *type* of mismatch they explore.

A first part of this literature focuses on the poor competitive position of (long-term) unemployed job seekers, which makes them unlikely candidates to fill vacancies when invited. There are two main reasons: First, skill decay following persistent spells of unemployment lowers the likelihood of being selected for a job – see Bean (1994) or Blanchard and Diamond (1994). And second, employed job seekers provide tough competition for unemployed job seekers especially in tight labour market conditions, when on-the-job search typically takes place – see Barlevy (2002) and Krause and Lubik (2006). We might refer to this type as skill-mismatch as the skills of the unemployed make them less or unsuitable for the job on offer. There is some evidence to support this hypothesis. Burgess (1993) hints at the importance of on-the-job search. In such conditions the job offer rate is high and consequently the expected revenues from job search in terms of finding a new – better paying – job are higher. Therefore, Burgess argues that, although tightness leads to more job openings and falling aggregate unemployment rates, it also triggers on-the-job search and subsequently on-the-job seekers partially crowd out unemployed job seekers.[6] Other types of mismatch, however, may produce similar outcomes.

For example, another strand of the literature focuses on the lower likelihood that (long-term) unemployed job seekers even meet the employers who post vacancies. First, employers may neglect unemployed job seekers in application procedures outright, *i.e.* stigmatise the (long-term) unemployed – see Riach and Rich (2002), Eriksson and Lagerstrom (2006) and Oberholzer-Gee (2008). We could refer to this as perceived skill mismatch and it is a source of mismatch that originates in the behaviour of firms. Second, continuous application rejections may demoralise the unemployed job seeker to continue searching for a job, which reduces his job find chances – see Layard *et al.* (1991) and Lindsay *et al.* (2003). That may give rise to search intensity mismatch that originates in job seeker behaviour. Then institutional settings may adversely affect the search effectiveness of the unemployed – see Roed and Zhang (2003), Van den Berg *et al.* (2004), Abbring *et al.* (2005) and Bloemen (2007), causing search effectiveness mismatch, which does not originate in behaviour like spatial mismatch. That is, unemployed job seekers may simply be spatially separated from the job opportunities through agglomeration effects – see Wheeler (2001), Coulson *et al.* (2003) and Holzer and Stoll (2003). All these sources of mismatch have in common that there is no objective worker or job characteristics that would prevent a successful match. But these sources of mismatch also either rely on the psychology of one of the searching parties or

[6] Our paper is – like Burgess (1993) – on (unemployment) flows; not on stocks. One could argue that whenever an employed job seekers accepts a job, he also 'produces' a vacancy (*i.e.* the job he leaves), which would leave the aggregate employment outcome unchanged. However, as Burgess already demonstrates, employed job seekers lengthen the jobless spell of the unemployed. Since we will be discussing timing issues of labour market policy, analysing the job search is relevant for our purpose.

on the exogenously given geographical or institutional circumstances the parties find themselves in.

In this paper we offer an additional source of mismatch that emerges when (unemployed) job seekers and employers (inter)act rationally in their search behaviour and that explains Burgess' (1993) finding. To do so we focus on the recruitment channel choice of employers, which we contend is sensitive to the business cycle because of the cyclicality of on-the-job search. Consequently, the search channel choice of unemployed job seekers becomes conditional on the employer's recruitment channel choice, which implies it is business cycle sensitive as well. Subsequently, the unemployed job seeker faces a trade-off. Either mimic the recruitment channel choice behaviour of employers, which – in tight conditions – implies compete with employed job seekers, or alternatively, not mimic employer search channel behaviour, which will lead to search channel mismatch, *i.e.* a reduced likelihood of meeting recruiting employers in tight conditions.

There is some important evidence on the choice of search and recruitment channels that supports our general assumptions and claims. The employer search literature, for example, shows that such recruitment channel switches over the business cycle are important. Russo *et al.* (2000, 2001) show that firms switch from recruitment through the labour exchange office to using advertisements as the prime recruitment channel as the labour market tightens. Since advertisements generate more applicants, such a recruitment channel switch enables the recruiting employer to smooth the arrival rate of applicants over the business cycle. CWI (2003) provides more detailed information for the Dutch case. They show that between 1991 and 2003, a period covering about one full economic cycle, the use of advertisements is indeed negatively correlated with the use of the labour exchange office and moves pro cyclically.[7]

Moreover, Russo *et al.* (2000, 2001) show that advertisements yield a higher average quality pool of applicants than recruiting via the labour exchange office. CWI (2003) also confirms this finding. It is shown that in loosening labour market conditions as in 2002-2003 the effectiveness, which is defined as the number of hires through a channel over the number of vacancies posted in that channel, falls for advertisements (49% to 36%) and increases (8% to 11%) for the labour exchange office.

Overall CWI (2003) concludes that the advertisement is the most frequently used recruitment channel in tight conditions; in loose conditions the labour exchange office and in particular informal contact become more important. This conclusion sets the stage for the unemployed job seeker who will face a search channel choice dilemma when the labour market tightens. Before conducting an empirical analysis of the way the unemployed job seeker negotiates this dilemma, we first derive the main hypotheses in a formal model that endogenises the search and recruitment activity of job seekers and firms when more than one channel is available.[8]

[7] In addition they show a rising importance of the Internet and informal channels such as open job applications.

[8] In this paper we restrict the analysis to two recruitment (or search) channels: advertisements and the labour exchange office. Of course there are more recruitment strategies. Employed job seekers also use informal channels – see Lindeboom *et al.* (1994). However, extending the number of recruitment channels complicates the analysis, without enriching it. Crucial for our argumentation is that employed job seekers do not use the labour exchange office as a recruitment channel but different channels like advertisements.

We will show that in our model employers shift search effort towards the more expensive advertisement channel when the labour market tightens, not (only) to keep up application rates – as Russo *et al.* (2001) suggest – but because the relative probability of filling a vacancy through that channel increases. This relative probability essentially increases because employed job seekers intensify their job search through the advertisement channel in tight conditions. Instead we use the fact that employed job seekers primarily search via advertisements to find a new job – see Russo *et al.* (2000, 2001) and CWI (2003), to explain why firms may switch to and unemployed job seekers may switch away from the advertisement channel in tightening conditions.

Those unemployed job seekers that do shift towards the advertised vacancies face competition of employed job seekers, which reduces the probability of finding a job, even if they are equally qualified and employers do not discriminate. Continuing search via the labour exchange office is no lucrative alternative as (effective) vacancy supply through that channel declines. In the end, both effects turn out to be mutually reinforcing and policies to aid the (long-term) unemployed should therefore be pro-cyclical.

3 Modelling search and recruitment behaviour

Standard matching models operate a linearly homogeneous matching function, which contains two arguments: the number of job seekers and the number of vacancies. The matching rate is positive in both arguments. We follow Pissarides (2000) in introducing search effectiveness on both sides of the labour market. Increasing search effort of the firm, s^f, improves the likelihood to fill the vacancy; increasing search effort of unemployed job seekers, s^u, or employed job seekers, s^e, increases the likelihood of finding a job. Effectively, introducing search effort translates the number of vacancies and job seekers into efficiency units.

We also assume that firms and job seekers set their respective search effort to maximise the value of their current state in the labour market and that firms and the unemployed and employed job seekers are identical, which enables us to derive aggregate results for unemployment and vacancy rates that in turn affect the decisions made at the micro-level. By assuming symmetry across job seekers and firms the aggregate average search intensity is equal to the search effort the individual agent would choose given the search behaviour of other firms and job seekers in the market. Before we turn to the individual decision problems, however, it is useful to introduce some notation and the basic framework.

In our model the employer can post a vacancy in two distinct recruitment channels. In general there are obviously more – see *e.g.* Rees (1966), but for simplicity we here distinguish a channel that is relatively cheap and only accessible to the unemployed (labour exchange offices) and a relatively expensive one in which both employed and unemployed job seekers may apply (advertisements). The model can be generalised in this direction but that would add little explanation and a lot of complication. As we distinguish two channels for recruitment and have barred employed job seekers from one of them, we have two matching functions that are assumed to be given by:

$$\begin{aligned} m_1 L &= m(s_1^u uL, s_1^f v_1 L) \\ m_2 L &= m(s_2^u uL + s_2^e (1-u)L, s_2^f v_2 L) \end{aligned} \tag{1}$$

Where subscripts 1 and 2 refer to the labour exchange office and advertisement channels respectively. The matching function, as usual is positive and concave in both arguments. Aggregate search effort of unemployed job seekers through the labour exchange office, s^u_1, through advertisements, s^u_2 and of employed job seekers through advertisements, s^e_2, augments the effectiveness of job seekers in producing matches. Similarly search effort by firms, $s^f_{1,2}$ augments the effectiveness of vacancies. The overall unemployment, u, and channel specific vacancy rates, v_1 and v_2 respectively, will all be endogenised below. Equation 1 defines the number of matches per unit of time but we have suppressed time subscripts to save on notation. Time, however, will be treated discretely in what follows. The linear homogeneity assumption of the matching function enables us to eliminate L – the labour force – and write both matching rates in terms of effective unemployment and vacancy rates only.

By assuming symmetry we know that all k firms must search at the average aggregate intensity that still may differ between the channels. We obtain $s^f_{i1,2}=s^f_{j1,2}= s^f_{1,2}$ for all $i \neq j$ $i, j \in k$. By furthermore randomly assigning matches over firms we obtain the result that the probability a vacancy is filled, φ, through recruitment channels 1 and 2 respectively is equal for all firms and given by the number of matches over the number of vacancies posted in that channel which reduces to a function of aggregate search efforts and channel specific market tightness ($v_{1,2} / u$), $\theta_{1,2}$:

$$\begin{aligned} &\varphi_1(s^f{}_1, s^u{}_1/\theta_1) = m_1/v_1 = m(s^u{}_1 u/v_1, s^f{}_1) \\ &\varphi_2((s^u{}_2/\theta_2, s^e{}_2(1/v_2 - 1/\theta_2), s^f{}_2) = m_2/v_2 = m(s^u{}_2 u/v_2 + s^e{}_2(1-u)/v_2, s^f{}_2) \end{aligned} \tag{2}$$

where $\theta_{1,2}$ is tightness in channels 1 and 2 respectively. These probabilities are positive in total number and average search effort of the job seekers. Obviously these probabilities are also positive in the search effort of firms and negative in the number of vacancies.[9] Assuming firms are identical and set the same (average) search effort in both channels, implies that the probabilities above are the probability that a firm will fill its vacancy in a given discrete period of time in channel 1 and 2. The probability that an individual unemployed job seeker finds a job in that discrete period of time, ψ^u, is then given by:

$$\psi^u = \frac{s^u{}_{i1} v_1}{s^u{}_1 u}\varphi_1 + \frac{s^u{}_{i2} v_2}{s^u{}_2 u + s^e{}_2(1-u)}\varphi_2 - \frac{s^u{}_{i1} s^u{}_{i2} v_1 v_2}{s^u{}_1 u\left[s^u{}_2 u + s^e{}_2(1-u)\right]}\varphi_1\varphi_2 \tag{3}$$

Note that these job finding probabilities *ceteris paribus* depend positively on individual search effort in both channels, s^u_{i1} and $s^u_{i2,}$ but negatively on average search effort in channels 1 and 2, s^u_1 and $us^u_2 + (1 - u)s^e_2$, respectively.[10] Also note that aggregate unemployment and vacancy rates affect the marginal effect of effort on-the-job finding

[9] Although in the disaggregated case the firm would face a probability that is positive in his own search effort and negative in the average search effort of other firms. As we are only interested in the choice of channel and not the intensity of search we simply abstract from that.

[10] We also assume symmetry within groups of job seekers and across them in all but one aspect, the options for search. Therefore we now have to address the decentralised decision process as we have asymmetry within the group of job seekers and their behaviour depends on that of the other group. The third factor on the right hand side of equation 3 corrects for the possibility that a job seeker simultaneously finds a job in channel 1 and 2. Since $0 < \varphi_1, \varphi_2 < 1$, the suggested qualitative effects of the various search efforts do not change.

probability. This will later on drive the allocation of job search effort over both channels. Likewise, the employed job seeker's job finding probability, ψ_e, depends positively on his individual search effort on-the-job and negatively on the average effort of his competitors:

$$\psi^e = \frac{s^e{}_{i2} v_2}{s^u{}_2 u + s^e{}_2 (1-u)} \varphi_2 \tag{4}$$

With all unemployed job seekers assumed identical, average and individual effort levels are equal within that group. To close this model we assume an exogenous lay-off rate, λ, such that in every period $\lambda(1 - u)L$ people become unemployed. In equilibrium this inflow must equal the per period outflow from unemployment, which equals the number of unemployed in equilibrium, $U = uL$ times the transition probability of the average unemployed given by:

$$\psi^u = \theta_1 \varphi_1 + \frac{s^u{}_2 v_2}{s^u{}_2 u + s^e{}_2 (1-u)} \varphi_2 - \frac{s^u{}_2 v_2}{s^u{}_2 u + s^e{}_2 (1-u)} \theta_1 \varphi_1 \varphi_2 \tag{5}$$

Equivalently, the matching rate must equal the sum of job finding rate on-the-job plus the outflow rate of unemployment.[11] We now turn to the decision problems faced by individual employers, employed job seekers and the unemployed.

3.1 Decision process of employers

It is common in search and matching models to regard the posting of a vacancy as the purchase of an asset, the option to fill it and start producing. In equilibrium the return on that vacancy must therefore equal the return on alternative assets, r.[12] Since all firms are assumed to be equal, they will all choose the average level of effort and this yields the standard Bellman-equation:[13]

$$rV_c = -c_c s^f{}_c + \varphi_c (s^{\overset{+}{u}}{}_c u / v_c, s^{\overset{+}{f}}{}_c)(J - V_c) \tag{6}$$

where J is the value of a match for the employers, φ_c is the (flow) probability a vacancy is filled in the next period, c_c are the flow costs to keep a vacancy open in channel c per unit of time and search intensity, s^f_c, which is chosen by firms to maximise the value of vacancies in channel c. Solving (6) for V_c and differentiating with respect to s^f_c yields the first order conditions for the employers:

$$\frac{Jr}{c_c} = \frac{r + \varphi_c}{\varphi'_c} - s^f{}_c \tag{7}$$

[11] Obviously when all rates are defined relative to the total labour force.

[12] Here we assume risk neutrality or equivalently treat r as the return on equally risky assets.

[13] Signs above arguments indicate the sign of the (partial) derivative. In fact, as firms do not take into consideration the impact their search has on the other firms' probability of success, the average search intensity in channel c should enter with a negative sign. Firms will over invest in search and impose an externality on each other. However, this is not relevant for the purpose of this paper and does not change its key results.

By the properties of φ_c ($0 < \varphi_c < 1$, $\varphi'_c > 0$, $\varphi''_c < 0$) it can be verified that optimal search effort in channel c is negative in flow costs and positive in the interest rate and value of a job. Figure 1 below shows the left and right hand side of equation 7 as a function of search effort.[14] Increasing for example the flow costs of posting a vacancy at the labour exchange office would shift the left hand side down, while not affecting the right hand side, thus reducing the optimal search effort of firms in that channel.

Figure 1: Optimal search effort of the firm

In equilibrium all profit opportunities from new jobs are exploited, which drives the rents from a vacancy down to zero. Hence, vacancies are posted until $V_{jc} = 0$ holds at the individual and aggregate level for both channels. The assumption that the recruitment channel has no effect on the value of the job then implies:

$$J = \frac{c_1}{\varphi'_1} = \frac{c_2}{\varphi'_2} \tag{8}$$

This assumption implies that recruitment is pure friction and different channels cannot be used to attract higher quality applicants, a feature that is perhaps not realistic but allows us to focus on the mechanism we intend to uncover here.[15] Equation 8 implicitly determines the number of vacancies in both channels as a function of costs and the value of a job. By the fact that the marginal probability of filling a vacancy is, *ceteris paribus*, decreasing in the vacancy rate in both channels, vacancies are posted until the condition in (8) is met. Higher costs reduce the optimal number of vacancies; higher job value increases the optimal vacancy rate.

Now consider the value of a job to the firm. A job or match can also be regarded as an asset. As long as the match exists, the flow of surplus equals, after appropriately normalising units, the unit price minus the unit wage costs. That flow of surplus is lost when there is a lay-off or when the worker finds a better job and quits, at which time the entire surplus is lost. We obtain the Bellman-equation:

$$rJ = p - w - (\lambda + \psi^e)J \tag{9}$$

And consequently the value of a(ny) job is given by:

$$J = \frac{p - w}{r + \lambda + \psi^e} \tag{10}$$

[14] In this graph the right hand side is drawn as a convex curve. In fact it can be both convex and concave. All that the assumptions imply is that it is upward sloping over its entire domain and has a positive intercept. We assume $r/\varphi'_c < Jr/c_c$.

[15] Note that Burgess (1993) did suggest that employed job seekers would be of higher quality to the firm. Although this is part of the explanation for the less than proportional effect of hiring on outflow rates, it is not part of the model in this paper.

Now substituting for the value of a job into (8) yields a first order condition for posting vacancies in terms of aggregate variables only. Substituting into equation 7 yields the first order condition for setting optimal search effort in both channels, also in terms of aggregate variables only.

$$\frac{p-w}{r+\lambda+\psi^{e}}=\frac{c_1}{\varphi'_1}=\frac{c_2}{\varphi'_2}=\frac{c_1}{r}\left(\frac{r+\varphi_1}{\varphi'_1}-s^{f}{}_1\right)=\frac{c_2}{r}\left(\frac{r+\varphi_2}{\varphi'_2}-s^{f}{}_2\right) \tag{11}$$

which implicitly and endogenously determines the number of vacancies posted in either channel, given the unit price, unit wage costs, the exogenous separation rate, the flow costs of posting a vacancy and the various (marginal) probabilities that in turn depend on the behaviour of unemployed and employed job seekers and aggregate labour market tightness.

It can be verified that effort and vacancies in one channel depend positively on the aggregate marginal probability that a vacancy is filled and negatively on the flow costs of keeping vacancies open in that channel. This implies that tightness in one particular channel will cause employers to shift their attention towards the other channel. However, Russo *et al.* (2000) demonstrate that employers will switch to channel 2, the advertisements, when labour markets as a whole tighten. *Ceteris paribus* the increase in overall tightness would affect the allocation of effort over the two channels as the probability of filling a vacancy drops relatively faster in channel 1. This is the case because at decreasing unemployment rates the number of employed job seekers increases, increasing the relative probability in channel 2. However, it is shown below that the results are strengthened by also taking into account the response of job seekers.

3.2 Decision process of unemployed job seekers

Unemployed job seekers must allocate their time between searching in either of the two search channels available to them or not searching at all, in which case we assume they enjoy their outside option *z*. Their unemployed status can thus be regarded as an asset that yields the outside option and the expected value of finding a job. Again we can write the Bellman equation:

$$rU = z+\psi^{u}(W-U) \tag{12}$$

where *W* is the value of a job to the worker, *U* the value of being unemployed and ψ^{μ} the flow probability that an unemployed worker finds a job. The individual outflow probability of the unemployed, given in (3) is a function of individual search effort in both channels. Hence unemployed job seekers set search effort to maximise the value of being unemployed. This yields the first order conditions:

$$\begin{aligned}\frac{dU}{ds^{u}{}_1}&=\frac{\psi'^{u}{}_{s^{u}i1}(s^{u}{}_1,s^{u}{}_2,s^{e}{}_2,u,v_1,v_2)(rW-z)}{\left(r+\psi^{u}(s^{u}{}_1,s^{u}{}_2,s^{e}{}_2,u,v_1,v_2)\right)^2}=0\\ \frac{dU}{ds^{u}{}_2}&=\frac{\psi'^{u}{}_{s^{u}i2}(s^{u}{}_1,s^{u}{}_2,s^{e}{}_2,u,v_1,v_2)(rW-z)}{\left(r+\psi^{u}(s^{u}{}_1,s^{u}{}_2,s^{e}{}_2,u,v_1,v_2)\right)^2}=0\end{aligned} \tag{13}$$

which yields:

$$\frac{\left(\psi'^{u}_{s^{u}i1}(s^{u}1, s^{u}2, s^{e}2, u, v_1, v_2) - \psi'^{u}_{s^{u}i2}(s^{u}1, s^{u}2, s^{e}2, u, v_1, v_2)\right)(rW - z)}{\left(r + \psi^{u}(s^{u}1, s^{u}2, s^{e}2, u, v_1, v_2)\right)^2} = 0 \qquad (14)$$

which, by the strict positivity of ψ^{μ}, yields the result that $s^{u}1$ and $s^{u}2$ are chosen such that the partial derivatives or marginal probabilities are equal in both search channels.

The partial derivative with respect to search efforts $s^{u}i1$ and $s^{u}i2$ are obviously positive. By the assumption of diminishing returns to effort and the fact that probabilities cannot exceed 1 the second order partial derivative must be negative. In addition the (marginal) probability of finding a job in channel 1 is hardly affected by search effort $s^{e}2$ (only through the cross-term in equation 3), whereas that in channel 2 is negatively affected by it (see equation 3). The marginal probability in both channels is positively affected by the number of vacancies posted in that channel and negatively by the total number of unemployed. However, as only the unemployed search through channel 1, the effect of the same increase in unemployment is larger in that channel and job seekers will switch towards advertisements (or withdraw altogether enjoying *z*, the outside option).

Equation 14 thus reveals that the relative search effort of individual unemployed workers in channels 1 and 2 depends only on their marginal outflow probabilities. Assuming all unemployed job seekers are identical one can thus derive that optimal average search effort in channel 2 is positive in vacancy rates and firm search effort and negative in the employed job seekers search effort and the unemployment rate. In channel 1 the effects are the same except that higher search effort by employed job seekers increases optimal search effort in that channel. Note that the conditions in equation 13 make the level of overall effort a positive function of the difference between the flow return on having a job, *rW* and the outside option *z*, as well as a negative function of the effective discount rate, which makes intuitive sense.

3.3 Decision process of employed job seekers

The employed job seekers hold a job. The value of that job to the worker was denoted *W* above. It depends positively on the wage but holding a job also implies the worker faces the risk of losing it at flow probability λ whereas he also has the option to search and find a better job.[16] Again we can write down the Bellman equation:

$$rW = w(1 - s^{e}i2) - \lambda(W - U) + \psi^{e}\mu w \qquad (15)$$

where it is assumed that the gain from switching jobs is to obtain a mark-up over the current wage, *w* of μ and the flow costs of search are set equal to $s^{e}2w$, so proportional to

[16] Here we slightly deviate from Burgess (1993). Burgess assumes all workers to be identical except for their wage. Since workers start looking for an alternative job whenever the value of search (which is among others positive in tightness) exceeds their reservation wage, not all employees start looking at the same time, though their number is positive in tightness. In our model all employees start earning the same wage. The incentive to start on-the-job search comes from the mark-up, μ. This mark-up is equal to all employees, hence all employees take the same decision regarding search. Increasing tightness raises the probability to find a job, which makes search more profitable. Though, the number of employed job seekers is independent of tightness, their search effort is, implying that the effective number of employed job seekers is positive in tightness, leading to the same effects as Burgess finds.

effort and current wages. Solving (15) for W and setting s^e_{i2} to maximise the value of a job yields the first order condition:

$$\psi'^{e}_{s^e_{i2}} = \frac{1}{\mu} \tag{16}$$

Again the assumption of identical employed job seekers and the properties of ψ^e allow us to derive the result that employed job seeker search effort is positive in the mark-up as the second order partial derivative with respect to search effort is negative. In addition the marginal probability on the left hand side is negative in search effort of the unemployed in channel 2 and in unemployment in general. It is positive in the vacancy rate for channel 2 and, through the matching probability in channel 2, also positive in aggregate firm search efforts in that channel. Hence the optimal search effort of employed workers will increase in tighter labour markets. Note also that the actual wage level has no role to play in the search effort for employed workers. This is the result of our assumption that both search costs and benefits are proportional to the current wage level.

Still, as the wage level does determine the value of a job and thereby the aggregate search effort of unemployed job seekers, the model is only closed when wages are determined. Assuming employers and employees bargain over the wage to divide the surplus of a job, standard bargaining theory predicts that the wage will maximise:

$$w^* = \arg\max_{w} \left(W(w) - U(W(w))\right)^{\beta} \left(J(w) - V(J(w))\right)^{1-\beta} \tag{17}$$

where β represents the bargaining power of the employees. By the fact that free entry ensures that the value of a vacancy equals 0, the Nash-maximand above can be simplified and using (15), (12) and (10) and a simple price setting rule $p=w/\alpha$, where prices are a mark-up over labour costs, we obtain:

$$w^* = \frac{(1-\beta)z}{1 - s^e{}_2 + \mu\psi^e} \tag{18}$$

Where it can be verified that equilibrium wages are positive in the fall-back option for the unemployed, z, the bargaining power of the employers, $1-\beta$, and the average on-the-job effort in searching for jobs in channel 2, $s^e{}_2$ and negative in the mark-up on-the-job seekers can obtain, μ, and the flow probability of obtaining that mark-up, ψ^e. Only the second partial derivative is troubling as higher wages compensate for higher search intensity and substitute for higher mark-up and transition probability, but the positive dependence on employer bargaining power is a result of assuming market power and price setting. The price setting rule implies the surplus to the employer is proportional to the wage. The downward wage-pressure in this model is exerted by the unemployed who increase search intensity and therefore (more than) offset the increase in the value of jobs as wages increase.

Having shown the model has an equilibrium solution we can now summarise its properties in three testable predictions or hypotheses regarding recruitment and search behaviour.

Hypothesis I: In tight labour markets on-the-job search increases, improving the quality and quantity of applicants per vacancy in channel 2, advertising.

Hypothesis II: In tight labour markets employers switch to advertising to attract more and qualitatively higher applicants.

Hypothesis III: In tight labour markets unemployed job seekers face tougher competition in the open channel. Only the high skilled and recently unemployed will continue to search in the open channel, the long-term low skilled unemployed withdraw to the exclusive channel, even though their chances of finding a job there may decline.

4 Testing the model

To test the predictions of the model we use information from labour demand and supply panel surveys for the Netherlands, collected bi-annually by the Institute of Labour Studies (OSA). We employ the 1986 to 2006 labour supply panels and the 1991 and 2005 labour demand panels.

The OSA labour panels contain labour related themes among samples of households and firms in the Netherlands. The panels cover a broad range of work and life course related, and business environment related items. The labour demand panel is fielded in rotation to the labour supply panel. The latter is comparable to the German Socio-Economic Panel (SOEP) and the British Household Panel Survey (BHPS), though the Dutch panel survey is smaller in terms of sample size. The relatively small sample size (and consequently the small number of unemployed in the data set) and high separation rates of respondents (both in the supply and demand panels) constrain us in exploiting the panel characteristics of the data to the full extent, which we will explain below.

4.1 Tightness and On-the-Job Search

The validity of our first hypothesis is crucial to our model since it will initiate the chain of results that we expect. That is, if on-the-job search is pro-cyclical, the quality of job seekers in the ads channel and subsequently the attractiveness of that recruitment channel to employers increases when the labour market tightens.

We use eleven panels to test Hypothesis I. However, we opt not to conduct a fully fledged panel analysis, since the labour supply panels are not rich enough to allow such analyses for unemployed job seekers (Hypothesis III). Studying employed job search in a panel context is possible using the OSA labour supply panels, but to preserve consistency in our analysis we refrain from doing it. Instead we pool the eleven labour supply panels, which implies we have to control for dependence between dependent variables (respondents potentially enter our pooled data set eleven times) which will bias the standard errors. To this end we apply cluster technique (cluster in respondent number), which allows observations which are dependent within a cluster (although they must be independent between clusters), which ensures robust standard errors.

Given the binary nature of on-the-job search (OJS), we employ a clustered logit regression, which is specified as follows.

$$OJS[0,1]_{it} = \alpha + \beta\theta_t + \boldsymbol{\gamma}\mathbf{X}_{it} + \upsilon_{it} \qquad (19)$$

Equation 19 contains a tightness variable, θ_t, and a vector of control variables, X_{it}. To proxy labour market tightness, we use the vacancy rate (vacancy to employment ratio) for the years 1986 through to 2006. Labour market tightness fluctuated substantially in this

time frame. Vector X_{it} consists of the educational level of employees, job security, sector of employment, and a spatial variable. The latter variable is included to detect any regional differences in job search behaviour. We expect job security to relate negatively to on-the-job search, because a secure job reduces the immediacy to search for alternative employment.

Table 1 provides the results. The results confirm our expectations. An increase in the vacancy rate increases on-the-job search. We find that employees with a permanent job search significantly less than employees on a fixed term contract regardless whether there is a view to a permanent contract. Moreover, on-the-job search is positively related to educational levels.

Table 1 about here

This evidence supports hypothesis 1 and confirms earlier results in the empirical literature.

4.2 Employer Recruitment Behaviour and Tightness

Having shown that on-the-job search takes place in tight conditions and bearing in mind that on-the-job search takes place through the ads channel, we expect employers to switch to the ads channel in an attempt to fill their vacancies when the labour market tightens. This is the core of our second hypothesis.

To test Hypothesis II, we turn to the OSA labour demand panels. Each panel contains information about labour market conditions in the period between two panels. We will use information on the intensity at which various recruitment channels have been used by employers. We are interested in the intensity at which firms use the ads channel (both in newspaper and online). The intensity is measured on a four point Licker scale (make: never / sometimes / often / always use of the ads channel for recruiting purposes). We link this information to labour market conditions the firm faces. We construct two proxies for labour market tightness: the 'vacancy – employment ratio' and the 'difficult to fill vacancies – employment ratio'. Since we have firm level data, these tightness proxies are firm / sector specific. We expect both tightness proxies to correlate positively with the firm's recruitment intensity in the ads channel. Furthermore we include several control variables, notably categorical variables measuring the share of the workforce whose highest obtained degree is 'lower general secondary education' (MAVO) or lower, firm size and sector.

Since the dependent variable is an ordinal construct we need to apply ordinal logistical regressions. The regression specification looks as follows:

$$Open_i^* = \boldsymbol{\beta}\boldsymbol{\theta}_\mathbf{i} + \boldsymbol{\gamma}\mathbf{X}_\mathbf{i} + \upsilon_i \tag{20}$$

$$Open_i = \begin{cases} 1 & if \quad Open_i^* \le \mu_1 \\ 2 & if \quad \mu_1 < Open_i^* \le \mu_2 \\ 3 & if \quad \mu_2 < Open_i^* \le \mu_3 \\ 4 & if \quad Open_i^* > \mu_4 \end{cases}$$

where, $Open^*_i$ is an unobserved continuous variable representing the intensity at which firm i uses the open (*i.e.* ads) channel to recruit personnel; $Open_i$ is the observed ordered estimate of *Open*, which we retrieve from the data set; θ_t measures tightness; X_i is a vector of control variables and μ_i are threshold parameters.

The results of the two regressions are summarised in Table 2.[17]

Table 2 about here

We observe that a tight labour market (for both tightness specifications) induces firms to intensify recruitment activities in the open channel, which we interpret as evidence that the chain reaction, which on-the-job seekers initiated by starting searching for a job in the ads channel in tight labour market conditions, is followed up on by employers who intensify their search through the ads channel in tight conditions.

The control variables show that large firms and firms employing high educated employees search more intensively through the ads channel.

However, the results in Table 2 do not provide conclusive evidence that employers switch away from the public channel in tight labour market conditions. Therefore we explore the relationship between the preferred recruitment channel of employers (public channel versus ads channel) and labour market tightness. We use the same independent variables as in equation 20. Table 3 presents the results of this logit specification.

Table 3 about here

We find a statistically significant negative link between the employer's preference of the public channel for recruitment purposes and tightness on the labour market. That is, employers indeed switch away from the public channel in favour of the open channel in tightening labour market conditions, which confirms our second hypothesis.

[17] We decide to present coefficients in Table 2, though this is technically not correct. The coefficients in an ordinal regression are hard to interpret – see Green (2002). To be correct, marginal effects should be presented. However, since we have four ordinal categories and two regressions in Table 2 (and Table 3), presenting marginal effects would lead to 10 columns. To keep the table(s) legible, we do not present marginal effects but instead present coefficients. We did run marginal effects. The interpretation of the coefficients does not differ from those findings.

4.3 The Unemployed Job Seeker's Dilemma

Now that Hypotheses I and II are confirmed, we know that unemployed job seekers face a dilemma in tight conditions: continue searching in the public channel where competition is low, like the rate of posted vacancies, or alternatively, switch to the open channel where competition is fierce, though the posted vacancy rate is high.

In testing Hypothesis III we return to the labour supply survey. OSA only collects data on search channels for unemployed job seekers. This implies that we basically face a two stage problem. The probabilities of using one channel or another are conditional on the probability of being unemployed. Still, as Hypothesis III is formulated also in these conditional terms, we can test it in a single stage estimation framework. We distinguish three types of search channels: two formal channels (ads and the labour exchange office) and one rest category within the informal channels (including open applications, network of friends, and temp agencies). We focus on the unemployed job seeker's use of the two formal channels.

Hypothesis III stipulates that only the most confident unemployed job seekers (arguably, the short-term unemployed and highly educated among the unemployed) will switch towards the ads channel once firms make that switch in tight labour market conditions. To test this hypothesis we use the unemployed's preferred search channel (ads versus labour exchange office) as a dependent variable. Equation 21 gives the logit specification.

$$Open[0,1]_{it} = \alpha + \beta\theta_t + \boldsymbol{\gamma}\mathbf{X}_{it} + \upsilon_{it} \qquad (21)$$

Where θ_t is the tightness indicator, which is the aggregate vacancy rate that varies only over time (vacancies to employment ratio). Table 4 presents the results of this regression. We have two different specification. In the left column vector X_{it} includes dummy variables for long-term unemployment (an uncompleted spell of unemployment of one year is the threshold), for place of birth and a categorical variable indicating the unemployed's confidence to find a job. In the right column vector X_{it} includes dummy variables for long-term unemployment, for place of birth and a categorical variable indicating educational attainments. As in Table 1, we have pooled the data and clustered on respondent number to obtain robust standard errors.

First we note that labour market tightness does not induce the unemployed to switch search channel. That is, unemployed job seekers persevere in their job search channel choice. Given the line of our argument so far that is particularly problematic for those who decide to use the labour exchange office as their preferred job search channel, as the vacancy arrival rate through that channel decreases in an economic upturn. Table 4 reveals that these unemployed are the ones who either have very low confidence in finding a new job or who have very low educational attainments, *i.e.* the most disadvantaged unemployed job seekers.

Table 4 about here

Summarizing the analysis of the data we conclude that on-the-job search indeed increases in tighter labour markets and therefore firms do switch to the open recruitment channels

leaving the unemployed seekers the choice between the ineffective labour exchange office and tough competition in open channels. We find that the most disadvantaged unemployed job seekers are more likely to use the labour exchange office as their preferred recruitment channel and they do not switch away from it in tightening conditions. This implies that they trap themselves in unemployment in times when the economy recovers and ideally they should be finding employment through the open recruitment channels that employers are searching in.

5 Policy implications

The enrichment of the Burgess (1993) analysis – by including recruitment channel choice – also provides insights into the effectiveness of the labour exchange office as an instrument in labour market policy. Labour market conditions influence on-the-job search, which subsequently influences the firm's recruitment channel choice. That is, in tight conditions firms switch away from the labour exchange office, making job search through that channel relatively ineffective.

The relative ineffectiveness of the labour exchange office as a channel through which the unemployed find a job in tight conditions provides an explanation for structural mismatch on the labour market. That is, if the unemployed persist in searching via the labour exchange office in prosperous times, the structural co-existence of vacancies and unemployment can be explained, as firms post vacancies through the advertisement channel and the unemployed look for jobs through the labour exchange office.

Our analysis leads to some interesting repercussions for the use of the labour exchange office as an instrument in labour market policy. In slack conditions the labour exchange office is relatively productive in matching vacancies to job seekers. In such conditions the labour exchange office should not concentrate on administrative tasks measuring how many unemployed have registered, but on matching. In tight conditions, labour exchange offices should persuade unemployed job seekers to search through alternative channels like advertisements. Or alternatively, if the government decides to implement active labour market policies like wage subsidy schemes, our analysis unorthodoxly suggests that such schemes should be procyclical. Moreover procyclical implementation of wage subsidy schemes has the additional advantage that it leads to less subsidy wastage as Welters and Muysken (2006) point out, which makes this policy instrument more effective.

6 Concluding remarks

In tightening labour market conditions both the number and the search effort of employed job seekers increases. Since employed job seekers search for jobs through advertisements and not through the labour exchange office, this raises the probability to fill a vacancy through the former channel relative to using the latter. Subsequently in tight conditions firms shift recruitment channel towards advertisements. Not to keep up the arrival rate of job seekers in tight conditions – like Russo *et al.* (2000, 2001) claim – but simply to exploit the relative superiority of using advertisements to fill vacancies in tight conditions.

Unemployed job seekers now face a dilemma. Also switch search channel towards advertisements, where competition is strong. Or remain searching for jobs through the labour exchange office where competition is less strong, but where job offers are few and far apart. The second option is novel to the existing analysis introduced by Burgess (1993) and reinforces his results: unemployed job seekers only partly benefit from tight labour market conditions.

Our findings yield some unorthodox policy implications. The effectiveness of guiding the (long-term) unemployed to employment via the labour exchange office depends on labour market conditions. In slack conditions job search via the labour exchange office is more effective than in tight conditions, as a consequence of the firm's recruitment strategies. If the labour exchange office is an important instrument in a government's labour market policy it should be used when it is most effective: in slack conditions. Perhaps counter-intuitively, additional labour market policies should be implemented pro-cyclically, to help long-term unemployed compete in the more open channels when labour markets tighten.

Of course our findings are limited in many ways and a lot of research need to be done. We would like to see our hypotheses confirmed in other datasets for different countries and different time periods to check the robustness and generality of our findings. Furthermore, as there are several competing explanations for Burgess' (1993) findings, we would like to generalize the model to include these alternatives and identify how they can be distinguished empirically. We set that ambitious agenda for future research in the hope that others may join it.

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