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Job searchers, job matches and the elasticity of matching

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JOB SEARCHERS, JOB MATCHES
AND THE ELASTICITY OF MATCHING

by

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ABSTRACT

This paper stresses the importance of a specification of the matching function, where the measure of job matches as a dependent variable, corresponds to the stock of job searchers. In many empirical studies on the matching function this requirement has not been fulfilled because it is difficult to find information about the numbers of non-unemployed job searchers, that is employed job searchers and job searchers from outside the labour market. In this paper, we specify and estimate matching functions where in theory the flow corresponds to the correct stocks. Since we too lack information we use several aproximations for the stock of non-employed job searchers. We find that the estimation results are sensitive to the approximation we use. Our main conclusion is that we have to account for the behaviour of non-unemployed job searchers since otherwise the estimated parameters of the matching function may be seriously biased.

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1. INTRODUCTION

The most practised model of aggregate labour market flows is the matching or hiring function. The matching function describes the technology of how the flow of job matches is related to the stock of job searchers and the stock of available jobs, much as a standard production function describes the technological relation between the flow of products and the stocks of production factors. There have been numerous efforts to specify and estimate matching functions for a number of countries. Cf. Pissarides (1986), Blanchard and Diamond (1989), Layard *et al.* (1991), Van Ours (1991,1995), Burda and Wyplosz (1994).

In the theoretical matching literature, job vacancies and unemployed workers are matched, yielding the flow of matches, *i.e.* the flow of unemployed persons finding employment. See, *e.g.* Pissarides (1990).

One of the issues in theoretical and empirical research is the position of employed job searchers. In a lot of studies employed job searchers are ignored. In theoretical studies this is motivated by the mathematical complications involved (An important exception is Pissarides 1994). In many empirical studies employed job search is ignored because of a lack of suitable data. A different issue is whether a matching function has constant returns to scale. It is difficult to give an explanation for constant returns to scale. Pissarides (1990) argues that only constant returns to scale lead to a stable unemployment rate. Other explanations focus on the inadequate discrete time intervals which are used when estimating the continuous time function (Burdett et.al. (1994)). Both latter explanations suggest that in reality the matching function exhibits increasing returns to scale. Burgess (1993) claims that the exclusion of employed job searchers may lead to an underestimation of the returns to scale of the matching function.

Over the business cycle the composition of the flows to employment changes (Schettkat (1996)). In recessions the flow from unemployment to employment increases relative to the flow from job to job. Yet, in many empirical studies of the matching functions, job matches are approximated by the flow of persons out of unemployment. Also, while most of this outflow will involve the filling of a job, there may also be a number of unemployed who move out of the labour force. In order to counteract this flaw, in some studies only the flow of male unemployed is taken, under the assumption that the flow of unemployed moving out of the labour force mainly consists of women. Other studies use the total hires as an approximation for the number of matches. But hires not only include unemployed finding a job, also the flow of persons out of the labour force, like school-leavers, to a job and the flow of employed workers moving to another job, are included here. This means that no longer job vacancies and unemployed job searchers are matched, but instead vacancies and all job searchers. The same applies to the flow of filled vacancies, which sometimes is used to approximate the flow of matches. Vacancies are not necessarily filled by unemployed job searchers alone, they are open for any job searchers alike. So also in this case, the pool of unemployed job searchers in the matching function should be replaced by the pool of all job searchers. Despite all these different measures, in practically all studies job matches are related to the stock of unemployed and the stock of vacancies in the matching function. However, it is by now well-established that the workers moving from one job to another and not the unemployed constitute the larger part of the flow into employment. All these different measures for the flow of matches related to unemployment and vacancies, give different values for the elasticities in the matching function.

This paper shows that both in theory and in empirical research different measures of job matches and their corresponding stock of job searchers, result in different matching elasticities. In the theoretical part of the paper we show that if non-unemployed job searchers are ignored

the returns to scale of the matching function are downward biased. If only the flow from unemployment to employment is considered we find that the returns to scale are upward biased. We illustrate this theoretical finding using results from previous empirical studies. In the empirical part of the paper we analyze data from The Netherlands. We show the estimation results for a number of alternative specifications of the matching function. Our main conclusion is that the estimated parameters of the matching function depends very much on the way the numbers of non-unemployed job searchers are accounted for.

The paper is organized as follows. Section 2 presents a theoretical framework that stresses the importance of conformity of the stocks in the matching process and the flow of job matches. Section 3 discusses the results of previous research along the lines of the theoretical framework. Estimates of this matching function, using pooled cross-section data on six sectors in The Netherlands economy from 1988.2-1994.4, are presented Section 4. Section 5 concludes.

2. JOB SEARCHERS AND JOB MATCHES

The process of matching workers and jobs is not an instantaneous process. Each worker and firm are engaged in a time-consuming (stochastic) process of waiting for and looking for an appropriate match. The matching process is formalized by the matching function, which gives the flow of new hires from some pool of job searchers as a function of that same pool of job searchers and the pool of available job vacancies.

$$F = cM(S,V),$$ (1)

where F is the flow of job searchers being matched to a job, M is the matching function, S is the stock of job searchers, V is the stock of available job vacancies, and c is a scale parameter. For the sake of reasoning, we assume time to be continuous.

This matching function is analogous to an aggregate production function. It shows that labour market flows generate delays in the finding of both jobs and workers, even when the matching process is very efficient. The efficiency of the matching process is represented by c in (1). Changes in the value of c capture changes in the geographic and skill characteristics of workers and jobs or other differences between the two, as well as differences in search behaviour between job searchers.

In this section we will show that different measures of matching, and hence different stocks of job searchers, imply quite different values for the elasticities of matching. Assume that in the labour market we have unemployed job searchers, decomposed into persons on unemployment insurance and on unemployment support, employed job searchers and job searchers not in the labour force. Figure 1 presents the flows between the different labour market states that are relevant in our study.

* Figure 1 somewhere here *

In Figure 1, the unemployed with an unemployment insurance benefit, U, and the unemployed on unemployment support, U_s, together build registered unemployment, UR. The job searchers not in the labour force, or non-participants, are labelled N. Only a certain proportion of this group searches for a job, mainly school-leavers and married women re-entering the labour market after raising their children. Finally, E are the employed persons.

Based on earlier arguments, a matching function based on F_{ue}, the flow of unemployed

on unemployment insurance, should contain U as stock of job searchers, whereas a matching function based on F should have S as stock of job searchers. We assume that all successful job searchers get a job by filling a vacancy.

The matching function (1) is usually specified in a Cobb-Douglas form

$$F = c\ (U+X)^{\alpha}\ V^{\beta} \tag{3}$$

where X is the stock of all job searchers except those with an unemployment insurance benefit. X consists of job searchers on unemployment support, employed job searchers and job searchers not in the labour force. Furthermore α (0,1) and β (0,1) are the elasticities of matching with respect to the stock of job searchers and the stock of vacancies. They show the effect of job matches to a change in S or V. Constant returns to scale implies that $\alpha+\beta=1$.

$$\alpha^* = \left(\frac{dauF}{F}\right) \Big/ \left(\frac{dauU}{U}\right) = \alpha \left(\frac{U}{U+X}\right) \left(1 + \left(\frac{dauX}{dauU}\right)\right)$$

Define the elasticity of the stock of non-unemployed job searchers as

$$\epsilon^x_u = \left(\frac{dauX}{dauU}\right) \cdot \left(\frac{U}{X}\right)$$

As indicated this elasticity is presumably smaller than 1. If unemployment goes up the stock of non-unemployed job searchers is expected to go up less than proportional. In fact one could imagine that the elasticity is smaller than 0. If unemployment goes up employed workers who are risk averse will stop or reduce their search activities. Furthermore, if unemployment goes up the job searchers who are as yet outside the labour market will also reduce or stop their search activities because of the discouraged worker effect.

Then we find

$$\alpha^* = \alpha \left(\frac{U + \epsilon^x_u X}{U+X}\right)$$

So:

$$\alpha^* < \alpha$$

So, if the stock of non-unemployed job searchers is ignored we underestimate the true value of the matching elasticity with respect to unemployment. Since the estimate of the matching elasticity with respect to vacancies is not affected we conclude that ignoring the stock of non-unemployed job searchers leads to an underestimation of the returns to scale of the matching function.

Now, we consider what happens if we use the flow from unemployed on unemployment insurance to a job as an indicator of the number of matches. We assume that this flow is proportional to the total flow to a job. The factors of proportionality are the stocks of unemployment and total job searchers. Furthermore, we allow for the possibility that there is a difference in the efficiency of search between unemployed and non-unemployed job searchers:

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$$\left(\frac{F_{ue}}{F}\right) = \left(\frac{c_1}{c}\right)\left(\frac{U}{S}\right)$$

where c_1/c indicates the relative search efficiency of the unemployed job searchers. From this it follows that

$$F_{ue} = c_1 \, U \, (S)^{\alpha-1} V^\beta \tag{3}$$

And therefore we find that

$$\alpha^{**} = \left(\frac{dauF_{ue}}{F_{ue}}\right) \Big/ \left(\frac{dauU}{U}\right) = 1 + (\alpha - 1)\left(\frac{U}{U+X}\right)\left(1 + \left(\frac{dauX}{dauU}\right)\right)$$

which leads to

$$\alpha^{**} = 1 + (\alpha - 1)\left(\frac{U + \epsilon^x_u X}{U+X}\right)$$

Therefore

$$\alpha^{**} > \alpha$$

So, if we ignore both the stock of non-unemployed job searchers and the flow from non-unemployment to employment we estimate the matching elasticity with respect to unemployment. All in all we find

$$\alpha^* < \alpha < \alpha^{**}$$

So, the true elasticity α of the matching function has a value that is in between the elasticities estimated if in the matching function the flow of filled vacancies and the stock of unemployment are used and a value that is estimated if in the matching function the flow of unemployed leaving unemployment and the stock of unemployment is used.

3. PREVIOUS RESEARCH

Most of the empirical studies of the matching function are hampered by the fact that the flow of persons moving to a job do not always originate from the pool of job searchers in the matching function. In almost all studies, the pool of job searchers equals the stock of unemployed. In that case, ideally, the flow of matches should equal the flow of hires from unemployment. However, some studies approximate the flow of matches by the total hires. In this case the matches include much more than just the flow from unemployment into employment. Many vacancies are filled by workers moving from one job to another. In addition, a substantial part of the vacancies are filled by the flow of persons out of the labour force to a job, mostly school-leavers. So in this case, the stock of job searchers is much larger than the stock of unemployed. On the other hand, the job being filled does not necessarily have to be a vacancy. It can be an

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idle job or the unemployed can start her own business, *etc*. So also the stock of available jobs is probably larger than the stock of vacancies. This latter argument does not apply when the flow of filled vacancies are used as an approximation of the flow of matches. Here, the pool of available jobs is indeed the stock of vacancies. However, a vacancy does not necessarily have to be filled by an unemployed job searcher. Employed job searchers and job searchers out of the labour force may equally well fill a vacancy. Hence, the pool of job searchers is, also in this case, much larger than just the stock of unemployed. Nevertheless, in all empirical studies, where matches are total hires or filled vacancies, unemployment is assumed to be sufficient to represent the job searchers in the matching function. Cf. Blanchard and Diamond (1989), Van Ours (1991), Gorter and Van Ours (1994).

Many other studies use the outflow out of unemployment to approximate the flow of matches. This means that the actual flow of job matches by unemployed is overestimated, because no account is being taken of the unemployed moving out of the labour force. Sometimes, one tries to prevent this flaw by applying only the male outflow out of unemployment, assuming that mostly female unemployed move out of the labour force. Cf. Pissarides (1986), Layard *et al*. (1991), Burda and Wyplosz (1994). Also in this case, the persons moving out of unemployment do not necessarily fill a vacancy. Unreported vacancies (idle jobs) and the fact that many unemployed may start-up their own business, means that the pool of available jobs is underestimated.

The fact that in many studies the measure of job matches on the one hand does not correspond to the origin of the workers filling the job and the origin of the available jobs on the other hand, may bias the elasticity of the matching process with respect to the pool of job searchers and vacancies. Table 1 presents a comparison of studies of the matching function for a number of countries and shows the relation between certain measures of job matches and the values of the matching elasticity. It presents the dependent variable in (1) and shows the range of measures used to represent this flow of matches. It also reports the frequency of the data and the elasticities of matching with respect to the stock of job searchers, usually unemployed, and vacancies.

Table 1 shows a dichotomy for the values of the matching elasticity with respect to unemployment, α, and the measure of job matches. When the dependent variable is the outflow of unemployed (UO) or the hires from unemployed (HU), the value of $\alpha > 0.5$. On the other hand, if the dependent variable is the total hires (H), the flow of filled vacancies (F) or the hires from employment (HE), we find $\alpha < 0.5$. The value of α for the flow from persons not in the labour force (HO) is ambiguous. In many studies the stock of unemployed serves to represent the relevant stock of job searchers.

* Table 1 somewhere here *

The flow of matches is in principle a continuous variable. The frequency of the data used to estimate the matching function should be of a high frequency in order to take account of this flow character. Therefore, in many studies monthly and quarterly data were used. However, for The Netherlands, only adequate annual data were available, so far. In particular, the annual flows of vacancies are large in proportion to the stock. The average vacancy duration is about two months. The duration of unemployment is about one year. In this light, it seems more appropriate to estimate the matching function with quarterly data than with annual data.

The quarterly data set we use has the advantage that the measures of job matches that are available, the flow of unemployed to a job and the flow of filled vacancies, can be linked to the correct stocks of job searchers and available jobs. We only need to assume that the unemployed find a job only by filling a vacancy. Hence, there is no job finding via idle jobs (unreported

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vacancies) or starting ones own business. Second, we assume that the total stock of job searchers, who are eligible to fill any vacancy, consists of unemployed job searchers and of job searchers with a job and job searchers not in the labour force. We distinguish unemployed job searchers who receive an unemployment insurance benefit and unemployed who are on unemployment support.

Another advantage of our data set is that it covers a period, 1988-1994, in which no major changes in the definition of the variables involved occurred. The final major change in definitions in unemployment, vacancies and unemployment outflow was in 1987. In that year the official vacancy statistics were collected based on a survey, which is argued also to take account of unreported vacancies, and there was a change in legislation with respect to the unemployment insurance act. For more details on our data set we refer to Appendix 1.

4. EMPIRICAL RESULTS

In order to get an operational specification for (7) and (8), we use a log-linear form. Furthermore, we ignore indices for time and industry, hence

$$\log(F/V) \; = \; \xi \; + \; \alpha \log(U+X) \; + \; (\beta-1)\log V \tag{9}$$

$$\log(F_{ue}/U) \; = \; \varphi \; + \; (\alpha-1)\log(U+X) \; + \; (\beta)\log U, \tag{10}$$

where $\xi=\log(c)$ and $\varphi=\log(c_l)$. As indicated before, these two intercept terms reflect the concept that the efficiency of matching differs when the total flow of filled vacancies represents matches, or when the flow of unemployed job searchers to job represents matches.

These two specifications are applied to quarterly sectoral data for The Netherlands on outflow of persons with an unemployment insurance benefit to a job, as F_{ue}, and the flow of filled vacancies, F. An important assumption we have to make, in order to get the stocks and flows in the same line, is that the unemployed find a job by filling a vacancy and not by other means, like informal application or starting ones own business. For unemployed job searchers this is not too restrictive. The reference period covers 1989.1 through 1994.4. We include six sectors: agriculture, manufacturing, construction, commercial services 1 (*i.e.* trade, hotels, restaurants, banks, insurance, etc.), commercial services 2 (*i.e.* transport, storage and communication) and non-commercial services.

One of the problems in the estimation of matching functions is that there is hardly any information on the numbers of non-unemployed job searchers. We investigate the sensitivity of the estimation results by analyzing the effects of different assumptions with respect to the stock of non-unemployed job searchers.

In our first estimates we assume that X=0, which is equivalent to the assumption that the the elasticity $\varepsilon^x_u=1$, or in other words: the stock of non-unemployed job searchers changes proportional to the changes in the stock of unemployed job searchers. When estimating both equations separately we find the following coefficients (t-values)[1]:

We used pooled times series on the six sectors for 1989.1-1994.4 and included fixed effects for each of the six sectors.

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Dependent variable	α	β
$Log(F_{ue}/U)$	0.55 (14.2)	0.01 (0.5)
$Log(F/V)$	-0.08 (1.0)	0.47 (10.6)

In the equation with the outflow from unemployment as dependent variable the match elasticity with respect to unemployment is 0.55, while the match elasticity w.r.t. vacancies does not differ significantly from zero. In the equation with the total flow of vacancies as the dependent variable the estimation results are very different. Here we find that the match elasticity w.r.t. unemployment does not differ significantly from zero, while the match elasticity w.r.t. vacancies is 0.47. So, as predicted in Section 2 the elasticity of the matches with respect to unemployment is higher if the matches concern the outflow from unemployment in stead of the total flow of filled vacancies.

If we impose the matching elasticities to be the same in both equations and estimate the model using iterative seemingly unrelated regression as estimation technique we find that the matching coeffcients are about equal with a value of about 0.25. The estimation results are shown in Table 2.

* Table 2 somewhere here *

These results have several implications. First, we find that the matching function, for filled vacancies, is characterised by decreasing returns to scale. The Wald test on the null hypothesis of $\alpha+\beta=1$ equals $\chi^2(1)=$, which cannot be accepted at any reasonable significance level. In other words, an 1 percentage point increase in the stock of vacancies or unemployment leads to a less than 1 percentage point increase in employment inflow.

In our second estimation we assumed that the number of non-unemployed job searchers is equal to the sum of specific shares of the employed workers, the workers collecting welfare benefits and the non-participants.

$$X_{it} = 0.1\, E_{it} + 0.5\, B_{it} + 0.07\, N_i$$

MOTIVATIE VOOR DE COEFFICIENTEN (LOURENS). Note that we assume that the workers outside the labour market have no preference as to which sector they are searching. In the context of the matching function the actual number of non-unemployed job searchers is not very important. What is important is the way this number covaries with the number of unemployed workers. Specified in this way we find that the simple correlation between X and U is equal to -0.67 (LOURENS: althans zo groot was de correlatie toen B nog niet mee deed). The average elasticity of the stock of non-unemployed job searchers with respect to the number of unemployed turns out to be -0.12 (see Appendix 2 for a description of the estimation procedure and results)[1]. So, the total number of job searchers increases less than proportional with the number of unemployed workers. Therefore, ignoring the non-unemployed job searchers will give too low an estimate of the supply side effect of the matching function.
* Table 3 somewhere here *

Table 3 that gives the estimation results of the matching model with this specification of X

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[1] LOURENS: Als aparte appendix overnemen oude table 2, van het februari 1996 research memo. Wel aanpassen aan de nieuwe definitie van X.

confirms this. The elasticity of the matches w.r.t. the number of vacancies is hardly affected, but the elasticity of the matches w.r.t. the number of job searchers increases to 0.74. The sum of the two elasticities equals 0.90. The Wald test on constant returns to scale equals .... Therefore....

Finally, we estimated a model in which the number of non-unemployed job searchers is specified as a function of the number of employed and the number of unemployed. In our third estimates we assume that X can be written in a Cobb-Douglas form,

$$X = U^{\gamma} E^{\delta},$$ (4)

where presumably $\gamma = \varepsilon^x_u < 0$ and $\delta > 0$. This enables us to estimate the elasticity of the number of non-unemployed job searchers w.r.t. the number of unemployed within the context of a matching model. Table 4 presents the estimation results.

* Table 4 somewhere here *

From this table we draw several conclusions. First, the elasticity of the matches w.r.t. the number of vacancies again is hardly affected. The elasticity of the matches w.r.t. the number of job searchers increases to 1.12, but is not significantly larger than 1. However the sum of the two elasticities of the matching functions now equals 1.30. The Wald test on constant returns to scale equals .... Therefore, we cannot reject the hypothesis that the matching function has increasing returns to scale.

Second, the results imply a negative impact on unemployment insurance benefit recipients, U, on the stock of all other job searchers, X. The coefficient $\gamma = -0.54$ is significantly negative. This corroborates our earlier premise of the pro-cyclical character of X. The effect of employment on the stock X is positive and quite large, as $\delta = 1.30$. Third, also the matching efficiencies are in agreement with intuition. The fixed effects of the model for both F and F_{ue} shows that the efficiency of matching in agriculture is relatively high in both equations; the same applies to construction, whereas it is much more difficult to find a job in manufacturing and in the services sectors. For unemployed it is relatively more difficult to get a job in commercial services 1, while in commercial services 2 and non-commercial services it is relatively more easy. This implies that agriculture and construction are more efficient in matching jobs to job searchers than other sectors and that unemployed job searchers are relatively difficult to match to jobs in commercial services 1, like trade, banks, etc.

5. CONCLUDING REMARKS

This paper studies the properties of the matching function, where the measure of job matches and the pool of job searchers are consistent with each other. We have constructed a simultaneous matching model for all job searchers and for unemployed job searchers only.
Our study stresses the importance of other job searchers in the matching process than unemployed workers. Burgess (1993,1994) already pointed out that employed job searchers build the largest flow into employment and affect the standard matching approach substantially. We argue that in a standard matching function, the stock of job searchers should correspond to the origin of the flow of job matches. In many studies, only the stock of unemployed job searchers is used.

Different measures of job matches and their corresponding stock of job searchers, result in different matching elasticities. In the theoretical part of the paper we show that if non-unemployed job searchers are ignored the returns to scale of the matching function are

downward biased. If only the flow from unemployment to employment is considered we find that the returns to scale are upward biased. As we show this finding is confirmed in previous studies. The studies that use the flow from unemployment to a job as an indicator of the number of matches find a substantially higher matching elasticity with respect to unemployment than the studies that are based on the total inflow into a job.

The crucial parameter is the elasticity of the number of non-unemployed job searchers with respect to the number of unemployed job searchers (ε^x_u). We started our empirical analysis with the assumption that $\varepsilon^x_u=1$, which is similar to ignoring non-unemployed job searchers since this number is proportional to the number of unemployed workers. Under this assumption we find that the matching function has decreasing returns to scale. In our second estimation we assumed that the number of non-unemployed job searchers is equal to the sum of shares of the numbers of employed workers non-participating workers and workers on welfare benefits. Then, on average $\varepsilon^x_u=-0.1$. Under this assumption we find that the matching function has constant return to scale. Finally we estimated ε^x_u directly within the matching model framework finding a value of -0.5. Then, we find that the matching function has increasing returns to scale.

All in all, we conclude that it is very important to account for the effect of non-unemployed job searchers on the matching process. Whether or not a matching function has decreasing, constant or increasing returns to scale depends very much on the way the non-unemployed job searchers have been accounted for. This finding has important policy implications for aggregate unemployed and the labour market position of individual unemployed. If indeed the matching elasticity with respect to unemployment is close to 1 the individual exit probabilities are not affected by the total number of unemployed.

REFERENCES

Albæk, K. and H. Hansen, 1995, 'Estimating Aggregate Labor Market Relations, mimeo, University of Copenhagen.

Anderson, J.M. and S.M. Burgess, 1994, 'Empirical Matching Functions: Estimation and Interpretati on Using Disaggregate Data', mimeo, Dartmouth College and NBER.

Antolin, P., 1994, 'Unemployment Flows and Vacancies in Spain', mimeo, Nuffield College Oxford.

Blanchard, P. and O. Blanchard, 1989, 'The Beveridge Curve', *Brookings Papers on Economic Activity*, 1, 1-76.

Boeri, T., 1995, 'On the Job Search and Unemployment Duration', Working Paper No. 38, European University Institute, Badia Fiesolana, Italy.

Burda, M. and C. Wyplosz, 1994, 'Gross Worker and Job Flows in Europe' *European Economic Review*, 38, 1287-1315.

Broersma, L., 1997, 'Competition Between Employed and Unemployed Job Searchers: is there a Difference Between UK and The Netherlands', *Applied Economics Letters*, 4, 199-203.

Burdett, K., M. Coles and J.C. van Ours, 1994, 'Temporal Aggregation Bias in Stock-Flow Models', *CEPR Discussion paper* no. 967.

Burgess, S.M., 1993, 'A Model of Competition Between Unemployed and Employed Job Searchers: An Application to the Unemployment Outflow Rate in the UK', *Economic Journal*, 108, 1190 -1204.

Burgess, S.M., 1994, 'Matching Models and Labour Market Flows', *European Economic Review*, 38, 809-816.

Eriksson, T. and J. Pehkonen, 1995, 'The Unemployment Outflow in Finland 1969-1994', mimeo, Aarhus School of Business, Denmark.

Gorter, C. and J.C. van Ours, 1994, 'Matching Unemployment and Vacancies in Regional Labour Markets: An Empirical Analysis for The Netherlands', *Papers in Regional Science*, 73, 153-167.

Layard, R., S. Nickell and R. Jackman, 1991, *Unemployment*, Oxford University Press.

Mumford, K. and P. Smith, 1995, 'Labour Market Flows, Cycles and Hiring in Australia', mimeo, University of York.

Pissarides, C.A., 1986, 'Unemployment and Vacancies in Britain', *Economic Policy*, 3, 499-559.

Pissarides, C.A., 1990, *Equilibrium Unemployment Theory*, Basil Blackwell.

Pissarides, C.A., 1994, 'Search Unemployment with On-the-Job Search, *Review of Economic Studies*, 1994, 61, 457-475.

Schettkat, R., 1993, 'Matching Functions: The Flow Approach', mimeo Wissenschaftszentrum Berlin.

Schettkat, R., 1996, 'Labor Market Flows Over the Business Cycle: An Asymmetric Hiring Cost Explanation, *Journal of Institutional and Theoretical Economics*, 152, 641-653.

Van Ours, J.C., 1991, 'The Efficiency of the Dutch Labour Market in Matching Unemployment and Vacancies', *De Economist*, 139, 358-378.

Van Ours, J.C., 1994, 'Matching Unemployment and Vacancies at the Public Employment Office', *Empirical Economics*, 19, 37-54.

Van Ours, J.C., 1995, 'An Empirical Note On Employed and Unemployed Job Search' *Economics Letters*, 49, 447-452.

Table 1. An International Comparison of Matching Elasticities.

Dependent variable	Authors	Country	Data	Elasticity V	U
Total flow into a job					
H	Blanchard and Diamond (1989)	USA	monthly	0.6	0.4
H	Schettkat (1993)	Germany	annual	0.2	0.0
H	Anderson and Burgess (1994)	USA	annual/panel	0.8	0.4
H	Mumford and Smith (1995)	Australia	monthly	0.3	0.3
F	Van Ours (1991)	Netherlands	annual	0.6	0.4
F	Van Ours (1994)	Netherlands	annual	0.6	0.4
F	Gorter and Van Ours (1994)	Netherlands	annual	0.7	0.3
Unemployment outflow into a job					
HU	Blanchard and Diamond (1989)	USA	monthly	0.2	0.6
HU	Schettkat (1993)	Germany	annual	0.2	0.7
HU	Mumford and Smith (1995)	Australia	monthly	0.1	0.6
HU	Van Ours (1995)	Netherlands	annual	0.3	0.7
UO	Pissarides (1986)	UK	quarterly	0.3	0.7
UO	Layard *et al.* (1991)	UK	quarterly	0.3	0.7
UO	Burgess (1993)	UK	quarterly	0.4	0.6
UO	Burda and Wyplosz (1994)	France	monthly	0.3	0.7
UO	Burda and Wyplosz (1994)	Germany	monthly	0.3	0.7
UO	Burda and Wyplosz (1994)	Spain	monthly	0.2	0.8
UO	Burda and Wyplosz (1994)	UK	monthly	0.3	0.7
UO	Broersma (1994)	Netherlands	annual	0.3	0.7
UO	Antolin (1994)	Spain	annual	0.2	0.8
UO	Eriksson and Pehkonen (1995)	Finland	quarterly	0.2	0.8
Hires from outside the labour force					
HO	Blanchard and Diamond (1989)	USA	monthly	0.2	0.6
HO	Mumford and Smith (1995)	Australia	monthly	0.4	-0.3
Hires from non-employment					
HN	Anderson and Burgess (1994)	USA	annual/panel	0.7	0.3
HN	Albæk and Hansen (1995)	Denmark	quarterly	0.3	0.7
Hires from employment					
HE	Anderson and Burgess (1994)	USA	annual/panel	1.0	0.7
HE	Van Ours (1995)	Netherlands	annual	0.7	0.3

Explanation: UO is unemployment outflow (in some cases only males), H is total hires, HU is hires from unemployment, HO hires from out of the labour force, F is filled vacancies, HN is hires from non-employment, HE is hires from employment.

Table 2. Estimation results of the matching model assuming X=0, 1989.1-1994.4 (alleen de waarden van α en β zijn nog maar ingevuld want de resultaten hebben betrekking op de gepoolde schatting en niet op SURE)

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Model specification

$$\log(F_t/V_{t-1}) = \xi_0 + \xi_1 D_{man} + \xi_2 D_{con} + \xi_3 D_{cs1} + \xi_4 D_{cs2} + \xi_5 D_{ncs} + \alpha \log(U_{t-1}) + (\beta - 1)\log V_{t-1}$$

$$\log(F_{ue,t}/U_{t-1}) = \phi_0 + \phi_1 D_{man} + \phi_2 D_{con} + \phi_3 D_{cs1} + \phi_4 D_{cs2} + \phi_5 D_{ncs} + \beta \log(V_{t-1}) + (\alpha + - 1)\log U_{t-1}$$

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Estimation method: iterative seemingly unrelated regression estimation

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Fixed effects

parameter	value	*t* value		parameter	value	*t* value
ξ_0	-4.089	(-7.757)		ϕ_0	-1.613	(-4.779)
ξ_1	-1.446	(-4.550)		ϕ_1	-1.505	(-10.96)
ξ_2	-0.949	(-5.233)		ϕ_2	-0.703	(-8.298)
ξ_3	-1.205	(-3.108)		ϕ_3	-2.069	(-11.97)
ξ_4	-1.658	(-8.788)		ϕ_4	-1.320	(-12.41)
ξ_5	-2.613	(-6.593)		ϕ_5	-1.893	(-9.204)

Joint effects

	parameters	value	*t* value
	α	0.23	(2.5)
	β	0.24	(4.8)

R^2	0.757			0.957
σ	0.185			0.094
N×T	144			144

___

Table 3. Estimation results of the matching model, second specification, 1989.1-1994.4
(alleen de waarden van α and β zijn nog maar ingevuld)

Model specification

$$\log(F_t/V_{t-1}) = \xi_0 + \xi_1 D_{man} + \xi_2 D_{con} + \xi_3 D_{cs1} + \xi_4 D_{cs2} + \xi_5 D_{ncs} +$$
$$+ \alpha \log(U_{t-1} + X_{t-1}) + (\beta - 1)\log V_{t-1}$$

$$\log(F_{ue,t}/U_{t-1}) = \phi_0 + \phi_1 D_{man} + \phi_2 D_{con} + \phi_3 D_{cs1} + \phi_4 D_{cs2} + \phi_5 D_{ncs} +$$
$$(\alpha - 1)\log(U_{t-1} + X_{t-1}) + (\beta)\log V_{t-1}$$

where X = 0.1 E + 0.5 B + 0.07 N, with B=UR-U

Estimation method: iterative seemingly unrelated regression estimation

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Fixed effects

parameter	value	t value		parameter	value	t value
ξ_0	-4.089	(-7.757)		ϕ_0	-1.613	(-4.779)
ξ_1	-1.446	(-4.550)		ϕ_1	-1.505	(-10.96)
ξ_2	-0.949	(-5.233)		ϕ_2	-0.703	(-8.298)
ξ_3	-1.205	(-3.108)		ϕ_3	-2.069	(-11.97)
ξ_4	-1.658	(-8.788)		ϕ_4	-1.320	(-12.41)
ξ_5	-2.613	(-6.593)		ϕ_5	-1.893	(-9.204)

Joint effects

	parameters	value	t value
	α	0.74	(20.1)
	β	0.16	(8.6)

R^2	0.757			0.957
σ	0.185			0.094
N×T	144			144

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Table 4. Estimation results of matching model third specification, 1989.1-1994.4 (helemaal ingevuld)

Model specification

$$\log\left(\frac{F_t}{V_{t-1}}\right) = \xi_0 + \xi_1 D_{man} + \xi_2 D_{con} + \xi_3 D_{cs1} + \xi_4 D_{cs2} + \xi_5 D_{ncs} +$$

$$\alpha \log(U_{t-1} + U_{t-1}^{\gamma} E_{t-1}^{\delta}) + (\beta - 1)\log V_{t-1}$$

$$\log\left(\frac{F_{ue,t}}{U_{t-1}}\right) = \phi_0 + \phi_1 D_{man} + \phi_2 D_{con} + \phi_3 D_{cs1} + \phi_4 D_{cs2} + \phi_5 D_{ncs} +$$

$$+ (\alpha - 1)\log(U_{t-1} + U_{t-1}^{\gamma} E_{t-1}^{\delta}) + (\beta)\log U_{t-1}$$

Estimation method: iterative seemingly unrelated regression estimation

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Fixed effects

parameter	value	t value		parameter	value	t value
ξ_0	-4.089	(-7.757)		ϕ_0	-1.613	(-4.779)
ξ_1	-1.446	(-4.550)		ϕ_1	-1.505	(-10.96)
ξ_2	-0.949	(-5.233)		ϕ_2	-0.703	(-8.298)
ξ_3	-1.205	(-3.108)		ϕ_3	-2.069	(-11.97)
ξ_4	-1.658	(-8.788)		ϕ_4	-1.320	(-12.41)
ξ_5	-2.613	(-6.593)		ϕ_5	-1.893	(-9.204)

Joint effects

parameters	value	t value
α	1.120	(16.63)
β	0.183	(9.353)
γ	-0.537	(-7.841)
δ	1.296	(16.59)

R^2	0.757		0.957
σ	0.185		0.094
N×T	144		144

Figure 1. Flows into employment.
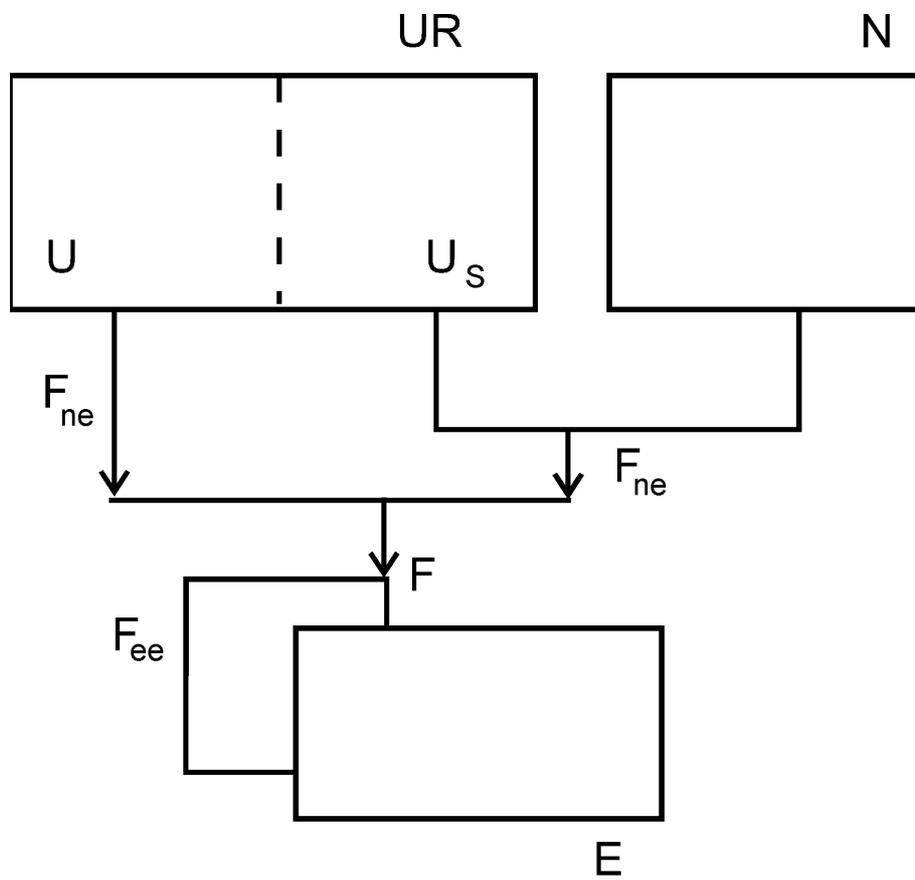
APPENDIX 1. DATA: SOURCES AND DEFINITIONS

$F_{ue,i}$ Flow of persons with unemployment insurance benefit to a job, for sector i.
source: Sociale verzekeringsraad, *Het beroep op de Werkloosheidswet, omvang en ontwikkeling*.

F_i Flow of filled vacancies for sector i
source: Central Bureau of Statistics, *Sociaal-economische maandstatistiek*.

U_i Number of persons receiving unemployment insurance benefit, for sector i.
source: Sociale verzekeringsraad, *Het beroep op de Werkloosheidswet, omvang en ontwikkeling*.

S_i Total number of job searchers, consisting of unemployed and employed job searchers and job searchers not in the labour force: $UR + \phi_1 E_i + \phi_2 N$. Size of this stock is unknown

X_i Total number of job searchers, excluding those with an unemployment insurance benefit. Size of this stock is unknown.

UR_i Registered unemployment, composed of both persons with an unemployment insurance benefit and persons on unemployment support.
source: Central Bureau of Statistics, *Sociaal-economische maandstatistiek*.

E_i Number of jobs in sector i.
source: Central Bureau of Statistics, *Sociaal-economische maandstatistiek*.

V_i Number of vacancies for sector i.
source: Central Bureau of Statistics, *Sociaal-economische maandstatistiek*.

N   Number of non-partcipants.
source: ....

All relevant data, used for estimation, are from 1988.4-1994.

APPENDIX 2. SECTORAL CLASSIFICATION

This Appendix describes the classification of the sectors we distinguish in terms of the SBI-index in The Netherlands (similar to the SIC-classification). SBI 1, mining, and SBI 4, public utility, have been omitted. The first is very small in The Netherlands and the latter is also small and more or less constant over the period 1989-1994.

We have chosen this classification, because it corresponds to the classification used for the outflow of unemployed to a job, $F_{ue,i}$.

Sector	SBI	Description
Agriculture	0	Agriculture, fishery
Manufacturing	2/3	Manufacturing
Construction	5	Construction and installation
Commercial services 1	6 and 8	Hotels, restaurants, wholesale and retail trade, Banks, real estate and insurance companies
Commercial services 2	7	Transport, storage and communication
Non-commercial services	9	Other (non-commercial) services, government