The matching process on the Swedish labour market:

A regional analysis

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From a labour market policy perspective, it is of central importance to have an idea as to how the matching of the labour supply and labour demand works. Matching is also important to monetary policy since bottlenecks can lead to wage increases that fuel inflation. This article aims to describe the matching process in Sweden from a regional perspective. The results indicate that matching on the Swedish labour market varies between regions. On average, matching efficiency tends to be lower in more densely-populated regions compared with less densely-populated regions.

1. Introduction

During the whole of the 1970s and 1980s unemployment in Sweden was very low, in international terms. The 1990s began with an overheated labour market (with record-low levels of unemployment and very high labour force participation). During the crisis years 1992–1993 the number of unemployed increased rapidly and higher unemployment has to some extent been persistent, in spite of several years of improving economic growth. This suggests there may be structural problems in the labour market with, among other things, poorer matching between the unemployed and vacancies.

The labour market in Sweden currently displays a somewhat mixed picture, where demand for labour has risen rapidly at the same time as many are still outside the labour force. Unemployment has fallen but is still at a relatively high level. It is of central interest for labour market policy to have an idea of the matching between the labour supply and labour demand in order to create better conditions for labour market performance in the future. It is also important from a monetary policy perspective

to analyse how efficiently the matching between jobseekers and vacancies operates since recruitment difficulties can lead to bottlenecks and to wage increases that fuel inflation.

A common way of describing efficiency on the labour market is to use the so-called matching function, which describes how the number of matches (people who gain employment) is affected by the number of jobseekers and the number of vacancies. Internationally, there are a very large number of studies that analyse matching functions (see Petrongolo & Pissarides, 2001 for an overview). However, only a few studies have assessed matching functions based on Swedish data (see e.g., Edin & Holmlund (1991), Hallgren (1996) and Forslund & Johansson (2007)). Most studies of the matching function use aggregated time series data. It is then implicitly assumed that the search efficiency is the same in all regions in a country. Coles & Smith (1996) is one of the first studies that showed the importance of controlling for the existence of regional differences when estimating the matching function.

Given that regional differences exist on the Swedish labour market (e.g., in the composition of the labour supply and demand), it is important to control for these differences, since bottlenecks in the form of matching problems in certain regions can affect wage formation and curb employment growth in the country.

In this study the matching on the Swedish labour market is analysed. The analysis aims to estimate the matching function using Swedish data and to investigate whether there are regional differences in the matching efficiency. A regional panel data set is used in the analysis that allows for county variations in the matching efficiency.[1] The time period studied extends from January 1992 to September 2007.

The following section contains a description of the matching process and the matching function that will be applied. Section 3 describes the data set together with a general descriptive analysis. The econometric analysis is to be found in section 4 and a conclusion is provided in the final section.

2. The matching process

The most common method of illustrating the matching process is with the so-called Beveridge curve, which shows the relationship between the unemployment rate and the job vacancy rate. If the unemployment rate rises at the same time as there is a fall in the job vacancy rate, this may be

[1] Boeri & Burda (1996); Ilmakunnas & Pesola (2003); and Kano & Ohta (2005) are other studies that estimate matching functions using panel data.

interpreted as a fall in demand for labour in a cyclical downturn (a movement along the curve). If both vacancy rates and unemployment rates rise at the same time (the curve shifts outwards), this may, however, indicate structural changes in the labour market which impairs the efficiency of the matching process.

One problem with the Beveridge curve is that a shift may occur which is not linked to changes in the matching efficiency. Factors that may affect the matching process, and which can thus lead to a shift in the Beveridge curve, include changes in long-term unemployment, changes in geographical or professional mobility, the demographic composition of the jobseekers or the regulations covering unemployment benefit, for example. Matching functions, which also describe the matching process, are a more direct way of analysing efficiency on the labour market.

There are different theories about the way in which the matching of vacancies and jobseekers is done. These underlying matching theories affect how the matching function is specified. A common theory is that the matching process is assumed to be random (random matching). According to this theory, unemployed randomly choose from the stock of vacancies, regardless of how long they have been unemployed or how long the job has been vacant. Matching would thus only depend on the number of jobseekers and the number of vacancies over time.

According to a second theory, the jobseeker is well-informed as to which vacancies are suitable based on his or her education and experience. If no matching occurs between new jobseekers and the stock of vacancies, jobseekers will henceforth take an interest in the inflow of new vacancies. The stock of jobseekers is then, above all, matched with the inflow of new vacancies, (stock-flow matching).

Random matching and stock-flow matching provide two different explanations for the frictions that can be observed on the labour market. If labour market matching is best described as random, inefficient matching is mainly explained by a lack of information. Jobseekers lack information about what vacant jobs are available and employers lack information about people with suitable qualifications. In the case of stock-flow matching, where the stock of jobseekers is mainly matched with new vacancies, an inefficient process is primarily explained by there being no suitable match at a given time (mismatch).

In a study of Swedish weekly data from August 1991 to October 2002, Forslund & Johansson (2007) have found that the matching on the Swedish labour market is better described by stock-flow matching than by random matching. The results of the study thus indicate that the newly unemployed search for jobs both in the stock and the inflow of job open-

ings, while people who have been unemployed for a long period of time mainly search among the inflow of vacant jobs.

Given that the matching on the Swedish labour market is best described by stock-flow matching, the regional matching function is specified as below:

$$(1) \qquad M_{it} = f_{it}(U_{it}, V_{it}, \dot{U}_{it}, \dot{V}_{it}) = A_{it} U_{it}^{\alpha_1} V_{it}^{\beta_1} \dot{U}_{it}^{\alpha_2} \dot{V}_{it}^{\beta_2},$$

where $i = 1, \ldots, N$ regions and $t = 1, \ldots, T$ periods of time. The number of matches (M_{it}) is a function of the stock of jobseekers (U_{it}), vacancies (V_{it}) and the inflow of jobseekers $(\dot{U}_{it})$ and new vacancies $(\dot{V}_{it})$.[2] The parameters α_2, β_1 and β_2 are matching elasticities with regard to stocks and flows of jobseekers and vacancies respectively. The scale parameter A_{it} (also called the mismatch parameter) measures the region-specific and the time-varied matching efficiency and is specified as below:

$$(2) \qquad A_{it} = A e^{\mu_i + \lambda_t + \varepsilon_{it}},$$

where μ_i are regional effects and λ_t are time effects.[3] The terms "number of jobseekers" and "the number of vacancies" during a given period are not clear-cut. One cannot employ the stocks at the end of each period of time (the end of the month), since these quantities depend on how many matchings have occurred during the period. In the data used in the analysis below, the number of jobseekers and vacancies at the end of each month is measured. It is therefore natural to estimate the size of the stocks at the start of a certain period using the size of the stocks at the end of the previous period.

After inserting equation (2) into equation (1) and logarithmation, we obtain:

$$(3) \qquad m_{it} = \alpha + \alpha_1 u_{it-1} + \beta_1 v_{it-1} + \alpha_2 \dot{u}_{it} + \beta_2 \dot{v}_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Equation (3) can be estimated as a so-called fixed effects model.[4]

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2 The function is assumed to be concave and increasing in U and V. The matching function is often assumed to be homogeneous of degree one (constant returns to scale).

3 The error term ε_{it} is assumed to have mean zero and constant variance.

4 The fixed effects model is recommended on the assumption that the region-specific factors are constant and correlated with the explanatory variables. On the assumption that the region-specific factor is not correlated with the explanatory variables, but is a random variable included in the error term component, the random effects model should be used. The difference between fixed and random effects is that in the first case the regional effects are treated as constant over time, while in the second case they are treated as purely random and the regions are thus assumed not to have any individual characteristic features that distinguish them from the average over time.

3. Data and descriptive analysis

Statistics from the Swedish Public Employment Service are used in this study.[5] The panel data set extends from January 1992 to September 2007 and contains information about inflows and outflows of unemployed and job openings as well as the stock of unemployed and job openings.[6] The stock of unemployed is defined as all jobseekers, that is, all unemployed including those on labour market programmes. The inflow of unemployed is termed all newly-registered/registered persons who report themselves/are reported unemployed with the offices of the Swedish Public Employment Service. The outflow of unemployed refers to those persons who have gone from unemployment to a job.[7]

Figure 1 below shows vacancies and outflows to jobs as well as the stock of jobseekers. The number of vacancies is positively correlated with economic activity over time, while the reverse applies for both the outflow and the stock of jobseekers. The number of jobseekers was clearly above the mean value (500 000) during the period 1993 to 1998 and was at its highest in 1994. From 2002 the number of jobseekers gradually rose up to the beginning of 2006 when levels fell once again. The outflow to jobs is highly correlated with the stock of jobseekers, but also co-varies with the inflow. This might indicate that the number of matches, measured as the outflow to jobs, can also be explained by the inflow of jobseekers (see the correlation matrix in the lower part of Table 1).
Figure 2 shows the average outflow of jobseekers, the stock of jobseekers and the stock of vacancies during three different periods of time (1992–1996, 1997–2001, and 2002–2007), as well as the average size of the population during the entire period of time (1992–2007), broken down into Swedish counties. At regional level jobseeker development has shown virtually the same trend for all Sweden's 21 counties. Both the outflow and stock of jobseekers has gradually declined between the three periods of time in all regions, at the same time as the stock of vacancies increased. Stockholm alone shows a peak in the number of vacancies between 1997 and 2001, in contrast to other regions where the stock of vacancies is at its highest in the more recent period (2002–2007).

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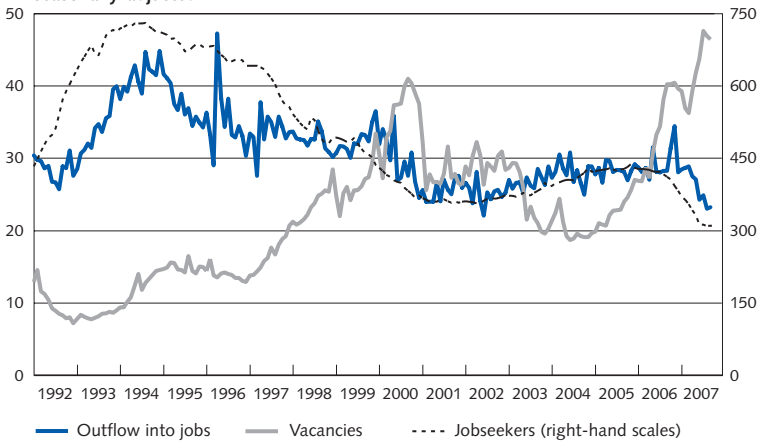
[5] Using the number of job vacancies, according to the Swedish Public Employment Service, as a measure of vacancies is not without problems. For example, the number of vacancies has been overestimated recently due to duplicated registration of job openings. Moreover, the statistics do not cover the entire labour market since far from all vacancies are reported to the Swedish Public Employment Service. The Employment Service's market share of job openings has varied between a maximum of almost 45 per cent at the beginning of 1990 and a minimum of 27 per cent in 1997. Recently, the share has increased and is now around 41 per cent (see the Swedish Public Employment Service's Arbetsmarknadsrapport 2007:1). This market share also varies across regions.

[6] 3969 observations are used in the panel data set where the number of months is 189 and the number of regions is 21.

[7] The outflow to a job is only one part of the total outflow of jobseekers over time.

Figure 1. Outflow into jobs, jobseekers (stock) and vacancies (stock) (thousands), seasonally-adjusted



Source: The Swedish Public Employment Service.

Table 1: Descriptive statistics of the aggregated variables (thousands). A total of 189 observations

	Outflow into jobs	Jobseekers	Vacancies	Inflow of jobseekers	Inflow of vacancies
Mean value	31	500	22	80	34
Standard deviation	5	131	10	18	12
Variation coefficient[8]	0.16	0.26	0.43	0.23	0.34
Max value	47	730	47	118	81
Min value	22	309	7	35	18

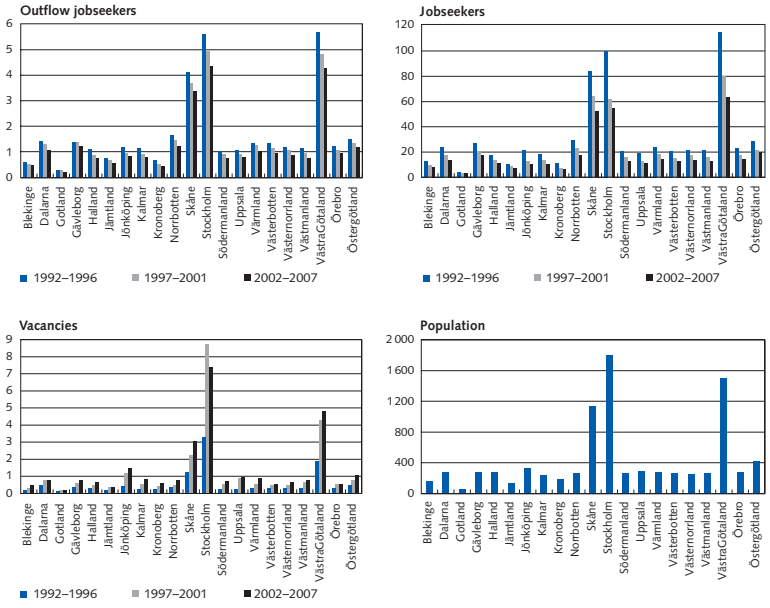
Correlation matrix

	Outflow into jobs	Jobseekers	Vacancies	Inflow of jobseekers	Inflow of vacancies
Outflow into jobs	1.00				
Jobseekers	0.82	1.00			
Vacancies	–0.51	–0.79	1.00		
Inflow of jobseekers	0.76	0.87	–0.71	1.00	
Inflow of vacancies	–0.38	–0.64	0.89	–0.72	1.00

What does mainly differ between the regions is the level for jobseekers and vacancies. One interesting note is that the regional differences in the levels (both for jobseekers and vacancies) have endured over time. The number of jobseekers, vacancies and the outflow of jobseekers is greatest in the most densely-populated counties, such as Stockholm, Skåne and Västra Götaland. In order to detect the regional differences in matching efficiency it is therefore important to normalise the variables when estimating the regional matching function. In the empirical analysis, all variables have been normalised with the respective regions' population size.

[8] Variation coefficient = standard deviation/mean value.

Figure 2. Jobseekers (outflow and stock), vacancies (stock) and population broken down into regions (thousands)



Note. The population is calculated on the average for the entire period of time (1992–2007).
Sources: The Swedish Public Employment Service and Statistics Sweden.

4. Econometric analysis

In this section the results of the estimated model (equation 3) are presented. The equation is estimated with and without regional dummies (columns 1 and 2 respectively) in order to control for regional differences in matching efficiency. Annual and seasonal effects are included in both specifications. The results indicate that the effect from the stock of jobseekers is greater than the effect of the stock of vacancies. The number of jobseekers thus tends to influence matching to a greater extent than the number of vacancies. Flow variables also influence the number of matchings positively and the results indicate that the inflow of vacancies has a greater effect than the stock of vacancies.

This is a relatively common result in academic research. Gregg & Petrongolo (2005) show that the flows may have a more significant impact than the stocks when estimating the matching function and, in a study based on British data, Coles & Smith (1998) have found that the inflow of new vacancies alone, not the stock, has a positive effect on the probability for the long-term unemployed to get a job. Forslund & Johansson (2007) also find that matching on the Swedish labour market is best described by stock-flow matching, where the inflow of new jobseekers is matched relatively quickly and persons who have been unemployed a longer period of time mainly search among the inflow of vacancies.

In both models the hypothesis of constant returns to scale is rejected. Constant returns to scale entails that a two-fold increase in the number of jobseekers and vacancies leads to a two-fold increase in the number of matches.[9] Aggregated time series studies often find support for constant returns to scale. The empirical support for constant returns to scale is, however, less clear when disaggregated data is used (see e.g., Kangasharju, Pehkonen & Pekkala (2005)).

The matching functions that are shown in column 2 have been estimated with fixed regional effects.[10] The results indicate that there are significant regional differences in the matching efficiency. This means that the matching efficiency is not the same within the Swedish labour market, which is implicitly assumed when estimating the matching function without controlling for the existence of the regional differences.

TABLE 2: REGRESSION RESULTS

	1	2
Stock of jobseekers, *t-1*	0.69(0.02)*	0.66(0,03)*
Stock of vacancies, *t-1*	0.05(0.01)*	0.02(0.01)*
Inflow of jobseekers, *t*	0.24(0.02)*	0.05(0.02)*
Inflow of vacancies, *t*	0.13(0.01)*	0.12(0.01)*
Dummy region		Yes*
Dummy year	Yes*	Yes*
Dummy season	Yes*	Yes*
Scale elasticity	1.10	0.86
(*P-value, H_0: constant scale elasticity*	(0.00)	(0.00)
Breusch-Pagan LM		15873
(*P-value, H_0: Var(°) = 0*)		(0.00)
Hausman χ^2		19
(*P-value, H_0: $E(°_i X_{it})=0$*)		(0.00)
R-squared	0.80	0.85
Observations	3948	3948

Note. White's robust standard error in brackets. An * indicates a significance level of 5% All variables in the models are normalised with the respective regions' population size

4.1 REGIONAL MATCHING EFFICIENCY

Figure 3 illustrates the estimated matching efficiency in Swedish counties, based on the specification in column 2 (Table 2). The estimated regional matching efficiency, μ_i, in Figure 3 is normalised in the following way (see also Kano & Ohta (2005)):[11]

[9] Scale elasticity is obtained by summing the matching elasticity with respect to jobseekers and vacancies.
[10] Breush-Pagan's LM test and Hausman's test indicate that the fixed effect model is the most suitable one.
[11] In this case $\min(\hat{\mu}_i)$ corresponds to Blekinge county's matching efficiency.

$$(4) \qquad \mu_i^* = \hat{\mu}_i - \min(\hat{\mu}_j),\ i, j = 1 \ldots N$$

The figure shows that matching on the Swedish labour market varies quite significantly between the regions. Blekinge county demonstrates the lowest matching efficiency, closely followed by Skåne. Matching efficiency is highest in Jämtland county (on average 0.3 times higher than in Blekinge). One interesting observation is that the most densely-populated counties, such as Stockholm, Skåne and Västra Götaland tend, on average, to have a lower matching efficiency compared with the less densely-populated areas.[12]

Earlier studies (see e.g., Coles & Smith (1996)) often argue in favour of a higher matching efficiency in more densely-populated regions, since not as much effort is required in a tight labour market to find the right match (i.e. low search cost) as jobseekers are close to the vacancies. However, this view is not supported in this study.

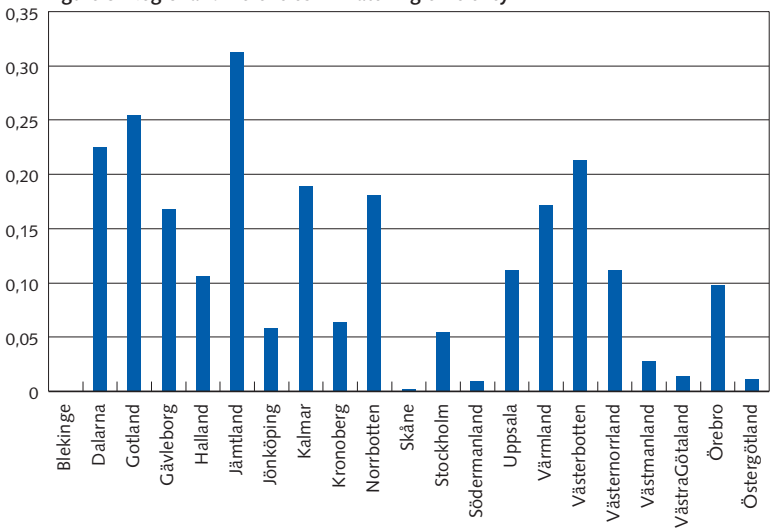
The result may be due to regional differences in the distribution of heterogeneous employers and employees. For example, less densely-populated regions may be more homogeneous in the composition of the labour supply and the demand for labour. Matching works well therefore, as the qualifications on offer on the market are also those that are in demand. In more densely-populated regions, the labour supply and the demand for labour can differ more with regard to qualifications, for example. This could make the matching process more difficult since there will not always be a suitable matching, given the same level of jobseekers and vacancies as in the less densely-populated regions. Kano & Ohta (2005) also find support for this hypothesis; the estimated matching efficiency in Japanese regions is negatively correlated with population density and per capita income.

5. Conclusions

In this study we have analysed the matching on the Swedish labour market with the help of the so-called matching function. A regional panel data set has been used to control for observable and non-observable differences between Sweden's counties. The matching function was estimated in accordance with a stock-flow specification where both stocks and inflows of jobseekers and vacancies, are assumed to influence the matching process. Both the stocks and the inflow of jobseekers and vacancies had a significant positive effect on the number of matches. It was primarily the inflow of vacancies that affected the number of matches positively

[12] Specifications that allow region-specific coefficients (α_i och β_i) produce similar conclusions.

Figure 3. Regional differencies in matching efficiency



and not the stock, which is a relatively common result in academic research.

This study also finds support for matching efficiency varying over regions (significant regional effects). The results indicate that matching efficiency is highest in Jämtland county, while Blekinge county displays the lowest matching efficiency. Coles & Smith's (1996) view that matching between jobseekers and vacancies should function more efficiently in more densely-populated regions does not appear to apply to the Swedish labour market. The most densely-populated counties, such as Stockholm, Skåne and Västra Götaland tend, on average, to have a lower matching efficiency than the less densely-populated areas. One explanation for this result might be that the new jobs that emerge (in demand) in more densely-populated (expanding) regions differ from the skills on offer in these regions. The bottlenecks that then arise (in these regions), in the form of matching problems, can thus affect wage formation and curb employment growth in the whole country.

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