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# REGIONAL MATCHING FRICTIONS AND AGGREGATE UNEMPLOYMENT*

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**Abstract:** This study demonstrates that a stochastic frontier approach applied to regional level data offers a convenient and interesting method to examine how regional differences in matching efficiency and structural factors contribute to aggregate unemployment. The study reveals notable and temporally stable differences in matching efficiency across travel-to-work areas in Finland. If all areas were as efficient as the most efficient one, the number of hirings would increase by about 40 per cent. This would reduce the aggregate unemployment rate from the current 8.5 per cent level to 6.0 per cent. If all the areas shared the same structural characteristics as the most favourable area, the aggregate unemployment rate would drop to 7.1 per cent.

**Key words: Efficiency, matching, aggregate unemployment, regional labour markets**

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**Tiivistelmä:** Tutkimuksessa tarkastellaan avointen työpaikkojen täyttymistä 19 suurimmalla työssäkäyntialueella Suomessa vuosina 1995 - 2003. Tutkimuksen mukaan työssäkäyntialueiden välillä on selkeitä ja ajassa vakaita eroja siinä, miten tehokkaasti työvoimatoimistoihin ilmoitetut työpaikat täyttyvät. Jos työpaikkojen täyttyminen olisi kaikkialla yhtä tehokasta kuin Turussa, työpaikkojen määrä lisääntyisi noin 40 prosenttia. Jos täyttyneet työpaikat olisivat pysyviä, koko maan työttömyysaste laskisi nykyisestä noin 8,5 prosentista noin 6 prosenttiin. Työnhakijoiden ominaisuudet vaikuttavat merkittävästi avointen työpaikkojen ja työnhakijoiden kohtaannon tehokkuuteen. Esimerkiksi Kuopion työssäkäyntialueen työnhakijarakenteella avoimia työpaikkoja täyttyisi koko maassa keskimäärin noin 21 prosenttia enemmän ja koko maan työttömyysaste laskisi nykyisestä 8,5 prosentista noin 7 prosenttiin. Tutkimus suoritettiin stokastisen rintaman analyysilla. Aineistona käytettiin työministeriön kuukausitason työnvälitysrekistereitä ja Tilastokeskuksen aineistoja.

**Asiasanat: Tehokkuus, kohtaanto, työttömyysaste, alueelliset työmarkkinat**

# Yhteenveto

Tutkimuksessa tarkastellaan avointen työpaikkojen täyttymistä 19 suurimmalla työssäkäyntialueella Suomessa vuosina 1995 - 2003. Tutkimuksen mukaan työssäkäyntialueiden välillä on selkeitä ja ajassa vakaita eroja siinä, miten tehokkaasti työvoimatoimistoihin ilmoitetut työpaikat täyttyvät.

Työpaikkojen täyttyminen oli tehokkainta Turun, Seinäjoen ja Kajaanin työvoimatoimistoissa. Heikointa se on Lahdessa ja Vaasassa. Jos työpaikkojen täyttyminen olisi kaikkialla yhtä tehokasta kuin Turussa, avointen työpaikkojen lukumäärä vähenisi noin 40 prosenttia. Jos täyttyneet työpaikat olisivat pysyviä, koko maan työttömyysaste laskisi nykyisestä noin 8,5 prosentista noin 6 prosenttiin.

Työnhakijoiden ominaisuudet, kuten pitkäaikaistyöttömyys, ikä ja työmarkkina-asema vaikuttavat merkittävästi avointen työpaikkojen ja työnhakijoiden kohtaannon tehokkuuteen. Esimerkiksi Kuopion työssäkäyntialueen työnhakijarakenteella avoimia työpaikkoja täyttyisi koko maassa keskimäärin noin 21 prosenttia enemmän ja koko maan työttömyysaste laskisi nykyisestä 8,5 prosentista noin 7 prosenttiin.

Avointen työpaikkojen täyttyminen on keskimääräistä tehottomampaa Helsingissä. Helsingin seudun matala työttömyysaste selittyykin voimakkaalla työvoiman kysynnällä, ei tehokkaalla kohtaannolla. Toisaalta hyvä kohtaanto ei takaa alhaista työttömyyttä. Kajaanin alue on tästä hyvä esimerkki.

Tutkimustuloksia voidaan hyödyntää työvoimapolitiikan toteutuksessa. Alueilla joilla kohtaanto on tehokasta mutta työvoiman kysyntä vähäistä, kohtaantoa parantaville aktiivitoimille ei ole tarvetta. Sen sijaan alueilla missä avointen työpaikkojen ja työnhakijoiden kohtaanto on heikko mutta työvoiman kysyntää on riittävästi, kohtaantoa parantavat politiikkatoimet alentaisivat työttömyyttä pysyvästi.

Tutkimus suoritettiin stokastisen rintaman analyysilla. Aineistona käytettiin työministeriön kuukausitason työnvälitysrekistereitä ja Tilastokeskuksen aineistoja. Aineisto kerättiin Helsingin, Turun, Hämeenlinnan, Lahden, Tampereen, Jyväskylän, Porin, Kuopion, Seinäjoen, Lappeenrannan, Kouvolan, Kotkan, Vaasan, Mikkelin, Joensuun, Kajaanin, Kokkolan, Oulun ja Rovaniemen alueelta.

# Contents

# 1. Introduction

Labour markets are characterised by a large number of job seekers searching for vacancies and a number of firms searching for new workers. The process of matching job seekers and vacancies involves frictions that are, to a certain extent, necessary to guarantee a high quality of matches. The best possible match typically requires a time-consuming search on both sides of the labour market. At worst, however, frictions delay the matching process reflecting, among other things, in high structural unemployment. Indeed, structural unemployment is high in Europe. In 2004, the aggregate EU unemployment rate was about 7.5 per cent and, according to OECD, a vast majority of this rate could be accounted for by structural factors.[1] It is therefore interesting and very important to explore the extent to which matching frictions contribute to aggregate unemployment.

Previous research has shown that the characteristics of the matching process determine unemployment less than aggregate demand shocks or productivity shocks (Shimer, 2005).[2] Nevertheless, the role of frictions may be substantial. For example, Yashiv (2004), who simulated the decline in unemployment following the implementation of different policy measures designed to affect frictions in the labour market, observed that hiring subsidies have substantial effects on labour market outcomes, including aggregate unemployment.

The present study augments that of Yashiv (2004) by providing evidence of the role of frictions and structural factors as determinants of one labour market outcome, namely aggregate unemployment. Rather than simulation methods, this study uses actual data and investigates the role of frictions as a determinant of matches by distinguishing the effects of structural factors from inefficiencies in the matching process. Structural factors are approximated by long-term unemployment, the age of the unemployed, the size of active labour market programs, and the type of job seekers (unemployed, employed or out-of-labour-force). Inefficiencies in the matching process are estimated by a stochastic frontier approach.[3] The paper will demonstrate that a stochastic frontier approach applied to regional level data offers a useful method to examine how regional

[1] OECD (2005). See also a recent study by Holden and Nymoen (2002), who estimate structural unemployment in Nordic countries.

[2] Blanchard and Diamond (1989, 1990) conclude that in the U.S. labour market short- and medium-term fluctuations in unemployment have mainly been due to aggregate activity shocks rather than due to changes in the degree of reallocation intensity related to the matching of jobs and workers. See also Albaek and Hansen (2004) for more recent findings.

[3] See Farrell (1957), Battese and Coelli (1995), Coelli et al. (1998), Kumbhakar and Lovell (2000) for estimation methods.

differences in matching efficiency and structural factors contribute to aggregate unemployment.[4]

The matching function is interpreted as a frontier that determines the upper boundary for matches that can possibly be produced by the given stocks of job seekers and vacancies. The estimated gross inefficiency (distance to the frontier) can be divided into the above-mentioned structural part and net technical inefficiency, the latter including the operation of the local employment agency and unobserved factors. Unobserved factors include cultural differences across investigated areas, such as attitudes towards unemployment and entrepreneurship. Using this methodology, Ibourk et al. (2004) observed that cross-regional differences in efficiencies are large in France, the net efficiency measures varying from 40 to 75 per cent. Fahr and Sunde (2005) also report wide efficiency differentials across German areas, where in the majority of regions the efficiency measure is between 50 and 80 percent. Ilmakunnas and Pesola (2003), in turn, found regional differences to be modest in Finland.

In the present study the matching efficiency is estimated with a high quality Finnish data set, which allows us to examine the matching process at monthly rather than lower (e.g. annual) frequency, thereby decreasing problems of time aggregation (Burdett et al., 1994). The data also allow us to divide the pool of job seekers into detailed sub-categories. We prefer the analysis of selected travel-to-work areas (TTWA) rather than administrative regions, as they are better descriptors than administrative regions of the job and worker search areas and they cover the jurisdiction of the Local Labour Force Office.[5]

The results of the study suggest that average gross efficiency improved by about 3 per cent annually and the matching technology progressed by about 1 per cent per annum over the investigation period, indicating decreasing matching frictions. The improvement in the gross efficiency is accounted for by changes in structural factors rather than better net efficiency. Without improvements in structural factors during the investigation period the current 8.5 per cent rate of unemployment would be about 1.0 percentage points higher. Improved matching technology, in turn, decreased the unemployment rate by about 0.7 percentage points over the same period. The main finding relating to the role of regional differences in the matching process is that there are notable and temporally stable differences in efficiency across travel-to work-areas. If all regions were as efficient as the most efficient one, the number of hirings would increase by about 40 per cent. This would decrease the aggregate unemployment rate from the

[4] The study does not try to explain underlying causes of efficiency differences between regions. We simply assess how much efficiency differences and differences in labour input affect aggregate unemployment.

[5] Monthly data include 19 travel-to-work areas between 1995 and 2003. An earlier Finnish study by Ilmakunnas and Pesola (2003) uses annual data and 15 administrative regions over the period 1988-1997.

current 8.5 per cent level by 2.5 percentage points. On the other hand, if all the areas shared the same job seeker characteristics as the most favourable TTWA, the aggregate unemployment rate would drop by 1.4 percentage points.

The rest of this paper is organised as follows. Chapter 2 introduces the stochastic frontier approach to the matching function and specifies the models. The modelling follows that of Battese and Coelli (1995). Chapter 3 describes the data set, which comprises the monthly outflow from unemployment to employment registered unemployed job seekers at the end of month, and registered vacant jobs at the end of month over nine years. Chapters 4 and 5 discuss the results of the efficiency analysis. The chapter includes a discussion of the determinants of matching efficiency as well as gross and net efficiencies. This is followed by an analysis of the quantitative effects of efficiency differences on matches and aggregate unemployment. Chapter 6 concludes the paper.

# 2. Model

We specify our empirical model as a stochastic production frontier, which allows us to concentrate on the technical efficiency of the matching process. We estimate how far the observed matching outcomes are from the efficiency frontier and examine the factors that contribute to these inefficiencies. Our matching function takes the well-known Cobb-Douglas form. The output of the production process is hirings during a month as function of unemployment and vacancy stocks at the beginning of the month, H = h(U, V). It is assumed that the function is concave and increasing in both U and V, and h(0, V) = 0 and h(U, 0) = 0. The stochastic production frontier model takes the following form, defined by Battese and Coelli (1995):

$$\ln H_{i,t} = [\alpha + \beta_1 \ln U_{i,t-1} + \beta_2 \ln V_{i,t-1}] + \omega_{i,t} - \upsilon_{i,t} \qquad (1)$$

The expression in square brackets forms the matching frontier that gives the maximum number of outputs, i.e. matches, that can be achieved for the given number of production inputs, i.e. job seekers and vacancies. U and V are lagged by one period, as these stocks are measured at the end of each month. The error terms $\omega_{i,t}$ are iid and follow the $N(0, \sigma_\omega^2)$ distribution. The term $\upsilon i,t$ is a non-negative variable, which is assumed to account for technical inefficiency in production and to follow the $N(Z_{i,t}\delta, \sigma_\upsilon^2)$ distribution truncated at zero (Coelli 1997).

This kind of specification assumes that "environmental" factors that might increase or decrease the efficiency of production directly influence the degree of technical inefficiency, not the shape of the production technology (Coelli et al. 1999). The $Z_{i,t}$ vector, which can change both in time and space, includes these inefficiency regressors. The term $\upsilon_{i,t}$ can be expressed as $\upsilon_{i,t} = Z_{i,t}\delta + \varepsilon_{i,t}$, where the random variable $\varepsilon_{i,t}$ is defined by the truncation of the normal distribution with zero mean and variance $\sigma_\upsilon^2$ such that the point of truncation is $- Z_{i,t}\delta$, i.e. $\varepsilon_{i,t} \geq - Z_{i,t}\delta$. These assumptions are consistent with $\upsilon_{i,t}$ being non-negative truncations of the $N(Z_{i,t}\delta, \sigma_\upsilon^2)$ distribution (Battese and Coelli 1995).

Time effects can be modelled by including them either in the production function or the efficiency term. If time effects are located in the production function, the assumption is that they capture changes in technology. If the time effects are in the efficiency term, then they capture the average change of the TTWAs with respect to the time invariant frontier. The empirical section attempts to model time effects in different ways.

The parameters of the stochastic frontier and the efficiency term can be jointly estimated by maximising the log-likelihood of the model (Coelli 1997, Coelli et al. 1998). The conditional estimates of the efficiency coefficients $TE_{i,t}$ are computed as:

$$TE_{i,t} = [\exp(-\upsilon^*_{i,t}) | H, U, V, Z] = E[\exp(-(Z_{i,t}\delta^* + \varepsilon_{i,t}^*) | H, U, V, Z] \qquad (2)$$

Since the likelihood of the model can be expressed as $\sigma^2 = \sigma_\omega^2 + \sigma_\upsilon^2$, $\gamma = \sigma_\upsilon^2 / \sigma^2$ summarises the relative importance of the residual associated with the inefficiency term. $\sigma^2$ and $\gamma$ are used as parameters to be estimated instead of $\sigma_\omega^2$ and $\sigma_\upsilon^2$. The efficiency measure has the property $TE_{i,t,} = 1$ when actual hirings H lie on the matching frontier; otherwise $TE_{i,t} < 1$.

Technical efficiency of this kind is output-oriented. For given stocks of vacant jobs and job seekers, the behaviour of job seekers and firms mainly determines the number of successful matches: job seekers and firms choose how intensively they search for a successful match, and the co-ordinator between the parties can affect these intensities by its own activity. The optimal search intensity that the matching parties choose can vary between regions due to the different conditions under which the matching process is taking place. As a consequence, the level of output can vary between regions in the matching process for given levels of inputs. In this context, output-oriented efficiency measures how much higher the output could be when the number of inputs cannot be chosen.

# 3. Data

The data comprise 108 months (from January 1995 to December 2003) and the 19 largest travel-to-work areas (TTWAs) in Finland, yielding more than 2 000 observations.[6] Data sources are the Ministry of Labour and Statistics Finland. The registers of the Ministry of Labour include all job seekers, vacancies and matches recorded at Local Labour Force Offices.[7] The dependent variable (matches) is the outflow from unemployment to employment (excluding outflow to subsidised jobs) during a month. Registered unemployed job seekers (excluding those participating in active labour market programmes) and registered vacant jobs are measured at the end of each month.

Following earlier literature we introduce explanatory variables that capture certain characteristics of the behaviour of job seekers and firms, thus providing evidence on the role of frictions in the matching process. Four groups of variables are used in the empirical analysis. First, we use the proportions of young unemployed (<25) and old unemployed (>55) from the whole unemployment stock to control for the effect of the age structure of the unemployment pool on matching efficiency. Second, the share of long-term unemployed job seekers (over one year) is a control for the differences in search intensities among the job seekers and the firms' hiring attitudes towards the loss of skills among job seekers. In addition, we assume that the proportion of employed job seekers and job seekers out of the labour force in the unemployment stock controls for the job competition in the labour market.

Third, the flow of unemployed to active labour market programmes (ALMPs) relative to the unemployment stock captures the effect of ALMPs on the structure of the unemployment pool. Although hirings from ALMPs or job seekers among these programmes are not included in the matching function, it is assumed that ALMPs have a positive effect on matching efficiency, since persons participating in these programmes are those whose employment on the open labour market tends to be most difficult (Ibourk et al., 2004; Hämäläinen and Ollikainen, 2005). Hence, ALMPs positively affect the composition of the unemployment stock. Fourthly, the size of the population captures the effect of the size and the dynamics of the labour market as well as the size of social networks (Wahba and Zenou 2003). The variable for the size of the population is a yearly value, whereas other inefficiency regressors are monthly averages taken for every year.

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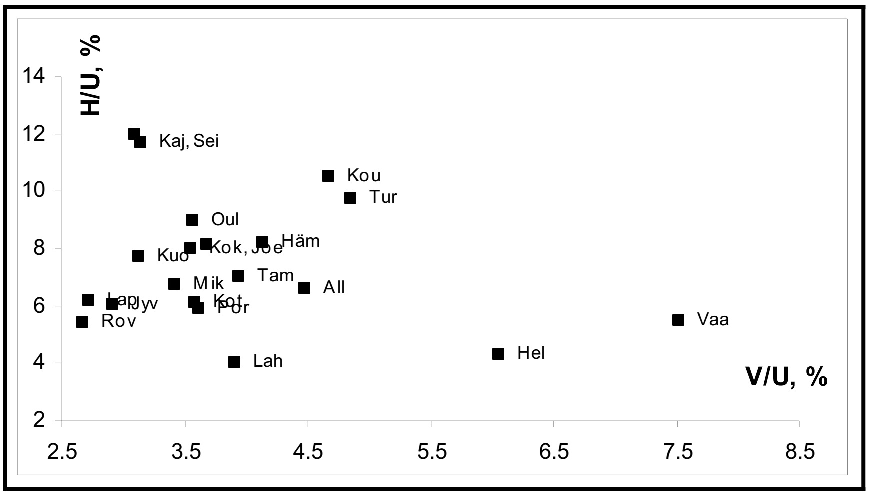
[6] The size is measured by the number of unemployed. However, one large TTWA, Rauma, was excluded from the analysis. Due to ship building and the nuclear energy industry there was a huge and abrupt increase in the number of hirings from 1999 to 2000 with the number of unemployed and vacancies remaining stable. We think that these changes are not typical of regional labour markets.

[7] There are more than 150 Local Labour Offices in Finland. The market share of the offices is about 60 % of all hirings in Finland (Kangasharju et al., 2005).

Appendix 1 summarises the descriptive statistics of the data according to the region. There are 247 432 unemployed job seekers searching for jobs together with 11 106 vacant jobs needing workers during an average month. The proportion of hirings from among the unemployed is only 7.5 per cent, the highest value being 11.9 and the lowest 4 per cent. A large share of the unemployment pool is of the long-term type, being 28.7 per cent on average. Thus, almost one third of those registered as unemployed in the public employment agency are those whose employment in the open labour market is difficult. By age, about one third of the unemployed are over 55 years old and about 15 per cent are younger than 25 years. The number of other than unemployed job seekers as a proportion of the unemployment pool is over 50 per cent, but the fraction of the flow to the ALMP is only 4.3 per cent. The unemployment rate varies from 10.8 per cent in the capital region of Helsinki to 21.4 per cent in Rovaniemi in Lapland. Differences in the size of the population are wide: Helsinki is clearly the most important labour market in Finland.

Figure 1 provides preliminary information on regional differences by tabulating hiring probabilities (H/U) and labour market tightness (V/U) across regions. There are four TTWAs in the data set that differ considerably from the others. In Helsinki and Vaasa the hiring probabilities are much lower and the labour market tension rates are higher than on average. Seinäjoki and Kajaani, in turn, exhibit higher than average hiring rates with an average labour market tension rate. Excluding these four TTWAs, the positive relationship between the hiring probability and the labour market tightness is clear. However, this simple analysis excludes factors that may affect matching efficiency and it does not allow for time series information. This will be done in the next sections.

*Figure 1. Hiring probabilities and labour market tension rates*



# 4. Results

## 4.1 Specification tests

Table 1 reports the results of the stochastic frontier estimations. The estimated coefficients for the two main inputs of the matching function, U and V, are robust across specifications and in line with earlier international (Petrongolo and Pissarides, 2001) as well as Finnish (Kangasharju et al. 2005, Ilmakunnas and Pesola, 2003) studies.[8] To summarise, the results support the idea of constant returns to scale such that the role of vacant jobs in the matching process is notably smaller than that of unemployed job seekers, the elasticity of hirings with respect to unemployed job seekers varying between 0.74 and 0.79 and with respect to vacant jobs between 0.09 and 0.11.

For the sake of comparison, the model was estimated first without inefficiency regressors (specification 1). Then the inefficiency regressors were included and the model was estimated with three different kinds of linear time trend: a model with a time trend both in the matching function and in technical efficiency, a model with a trend in technical efficiency only and, finally, a model with a trend in the matching function only.[9] Specifications including the time trend only in one part of the model result in quantitatively similar effects. The third specification implies a one per cent improvement per annum in the position of the TTWAs with respect to the time invariant efficiency frontier over the research period (12 months times 0.001).[10] Specification 4, in turn, indicates an inward shift of the Beveridge curve by one per cent per annum. The specification with a time trend in both the function and technical efficiency (specification 2) implies a significant positive trend in the matching technology (4 per cent per annum) together with a considerable negative trend in matching efficiency (5 per cent per annum). As above, the total impact is close to one per cent per annum. Now, however, the combined impact on the matching performance is negative.

There is no clear-cut answer or solid test results to discriminate between the trend alternatives. In specification 2, however, the parameter estimates for the trend variables and their standard errors suggest the non-rejection of the hypothesis that their joint impact is zero. A similar remark also applies to specification 3, where the estimate for the trend variable is significant only at the 15 per cent level. Thus, only specification 4 contains a statistically significant trend variable. The plausibility of this specification, which treats the time trend as a technology

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[8] The estimations have been carried out using the program Frontier 4.1 (Coelli 1997).

[9] As the analysed time period only covers an economic upturn with a positive trend in hirings and vacancies, we consider that the use of time trend rather than time dummies is adequate and parsimonious.

[10] For inefficiency regressors, a positive coefficient means a negative effect on efficiency and a negative coefficient a positive effect on efficiency.

parameter in the matching function, can be further supported by evidence of the increasing use of information technology in public employment agencies over the investigation period.[11] Hence, the subsequent discussion and calculations will be based on specification 4.[12]

Finally, the $\gamma$ coefficient, which corresponds to the estimated share of the inefficiency term in the variance of the composed error term, is 0.55 and statistically significant. The rest of the variation, 0.45, is due to random errors. In addition, the LR test of one-sided error rejects the hypothesis that the inefficiency part of the error is equal to zero. The frontier is, however, clearly stochastic, not deterministic, since the random error also has a significant role in the variation of the composed error term.

## 4.2 Hirings elasticities

According to the literature, the search intensity of job seekers and the ranking behaviour of firms are crucial determinants of matching frictions (e.g. Pissarides, 1992; Anderson and Burgess, 2000; Burgess and Turon, 2003). Our results suggest that this also holds in Finland. The matching efficiency goes down by about 8 per cent with a one percentage point increase in the group of long-term unemployed, the group with lowest search effort and with a stigma effect among employers (Table 1). This is further supported by the result that an increase in the flow to the ALMP has a positive effect on matching efficiency, indicating that a decrease in the relative proportion of those who are extremely difficult to employ in the unemployment pool decreases matching frictions. The contribution of a percentage point increase in the ALMP variable to technical efficiency is about 10 per cent.

A relative increase in employed and out-of-the-labour-force job seekers decreases the matching efficiency. The impact of this variable is, however, only about one-tenth of the impact of the long-term unemployment variable. The ranking of job seekers according to their labour market position and differences in the search intensity seems to cause additional frictions in the matching of unemployed job seekers and vacancies when there are also other job seekers competing for jobs in the market. Hence, notable employability differences occur between unemployed and other job seekers, as well as between the unemployed with long and short unemployment spells.

[11] See Räsänen (2005), who discusses structural changes in public employment agencies. The changes are related to the expanded use of information technology, including the increased use of vacancy announcements and job searching methods via the Internet.

[12] It is worth noting that otherwise the results of specifications 3 and 4 are qualitatively and quantitatively similar. Furthermore, these results differ significantly from those of specification 2 only in one respect, the impact of the ALMP variable on the matching efficiency being about 50 per cent lower in the latter case.

The age structure of the job seeker stock also matters: older and younger job seekers contribute positively to matching efficiency relative to the middle-aged. Both variables obtain a robust estimate of around 2.5. The results suggest that the long-term unemployment variable seems to capture the negative effect of those older job seekers who are difficult to employ, and therefore older age itself has a positive effect on efficiency. The finding may reflect the better work morale of older job seekers as well as the educational requirements of the job offers: vacant jobs reported in the public employment agency often require only low education and the education level of older job seekers makes them suitable for these jobs. The efficiency-enhancing effect of young job seekers, in turn, suggests that they are flexible and willing to accept low-paid and part-time jobs: their search effort is high and reservation wages low.

A larger population size increases matching efficiency, although the effect is rather modest. A ten per cent increase in the size of the population of a TTWA leads to an efficiency increase of about 0.6 per cent. Growing regions tend to be more dynamic and therefore economic activity in them is livelier and more diversified than elsewhere, which also makes the matching process efficient.

*Table 1. Parameter estimates*

| **Dependent variable:** ln(hirings from unemployment) | Specification 1 | Specification 2 | Specification 3 | Specification 4 |
|---|---|---|---|---|
| Constant | -0.367 (-2.6) | -0.873 (-4.6) | -0.804 (-4) | -0.828 (-4.1) |
| ln (Ut-1) | 0.736 (36.2) | 0.778 (33.7) | 0.787 (30.4) | 0.782 (31) |
| ln (Vt-1) | 0.089 (6.5) | 0.107 (8.9) | 0.105 (8.6) | 0.104 (8.5) |
| t | 0.004 (11.6) | 0.004 (3.5) | | 0.001 (2.2) |
| **Inefficiency regressors** | | | | |
| t | | 0.005 (3.2) | -0.001 (-1) | |
| Constant | 0.502 (9.5) | -1.122 (-2.4) | 0.131 (0.3) | 0.02 (0.06) |
| Young/all unemployed | | -1.042 (1.3) | -2.666 (-3.1) | -2.556 (-3.2) |
| Old/all unemployed | | -2.653 (-6.7) | -2.934 (7.7) | -2.767 (-6.9) |
| Long-term/all unemployed | | 8.361 (19.1) | 7.842 (19.4) | 7.956 (19.8) |
| (Employed+out of the labour force)/unemployed | | 0.743 (4.9) | 0.75 (4.8) | 0.829 (5) |
| (Flow to ALMP)/unemployed | | -4.175 (-1.6) | -9.318 (-3.6) | -10.182 (-3.7) |
| ln (size of population) | | -0.029 (-1.3) | -0.058 (-2.6) | -0.06 (2.8) |
| sigma-squared | 0.199 (14.4) | 0.112 (20.8) | 0.107 (20.1) | 0.109 (18.9) |
| gamma | 0.893 (39.6) | 0.727 (9.7) | 0.538 (5.5) | 0.554 (5.7) |
| log likelihood | -878.5 | -451.7 | -458.4 | -456.3 |
| LR test of one-sided error | 79.8*** | 931.8*** | 1079*** | 924.2*** |
| Returns to scale | 0.83 | 0.89 | 0.89 | 0.89 |
| Number of observations | 2 052 | 2 052 | 2 052 | 2 052 |

Note: Specification 4 is the preferred one. The estimation method in all specifications is maximum likelihood. t-statistics are reported in parentheses. *** Rejection of the hypothesis on one-sided error at the 0.01% level.

## 4.3 Gross vs. net efficiency

The technical efficiency measures can be divided into two types: *gross efficiency* and *net efficiency* (see Coelli et al. 1999; Ibourk et al. 2004). The *gross efficiency* is the technical efficiency when all inefficiency regressors take their actual values in all regions in all periods. Hence, it measures the technical efficiency when the explanatory variables are allowed to affect the matching performance as they in reality do. The *net efficiency*, in turn, measures the technical efficiency when effects of the inefficiency regressors are removed from the model. This is done by setting the values of the explanatory variables to be equal in all regions. Thus, it measures the part of the technical efficiency that is independent of the environment of the matching process. It can partly be derived from the functioning of the employment agency and partly from unobserved factors related, for instance, to cultural factors in a particular region. These may include factors such as attitudes towards unemployment and entrepreneurship.

The gross and net efficiency scores of separate TTWAs are reported in Table 2 (columns 1 and 2).[13] The highest gross (net) scores are about 75-88 (73-79) per cent of the maximum. The lowest gross efficiency score is 0.40 and the lowest net score 0.36. The average gross and net scores across the period and TTWAs are 0.65 and 0.58. Columns 3 and 4 report the difference between the score of the TTWA and the area with the highest net efficiency score (Turku). As a whole, our results are similar to those reported for France by Ibourk et al. (2004) and for Germany by Fahr and Sunde (2005). Both studies report that cross-regional differences in efficiencies are considerable. In France, the net efficiency measures vary from 40 to 75 per cent. In Germany, for the majority of regions the efficiency measure is between 50 and 80 per cent. Ilmakunnas and Pesola (2003), in turn, report less sizeable differences for Finland.[14]

The difference between gross and net efficiency scores is determined by environmental factors. They can affect the performance of the matching process either positively or negatively. In our data the Spearman rank correlation coefficient between the gross and the net efficiency scores is 0.94. This implies that the differences in net efficiency, not the differences in the matching environment, determine the efficiency ranking of the regions. In addition, the ranking of the TTWAs according to their net efficiency score is stable over the research period. The Spearman rank correlation between the estimates in 1995

[13] The net efficiency scores are calculated by replacing the real values of inefficiency regressors by average values of the inefficiency regressors over all TTWAs and the whole 108 months. Net efficiency scores may still differ from one region to another because the value of the conditional expectation of the random term $\varepsilon_{i,t}$ may differ.

[14] Their estimates vary between 0.69 and 0.93 for the period 1988-95. It should be noted that Ilmakunnas and Pesola (2003) use annual data based on a different area classification (15 administrative regions).

and 2003 is 0.77. The same TTWAs are on the top (bottom) of the distribution in both data points.[15]

*Table 2. Gross and net efficiency according to region (average over time)*

| | Mean values<br>Efficiency, gross | Efficiency, net | Turku's gross-own gross | Turku's net-own net |
|---|---|---|---|---|
| **Turku** | 0.777 | 0.799 | | |
| **Seinäjoki** | 0.887 | 0.787 | -0.110 | 0.012 |
| **Kajaani** | 0.833 | 0.779 | -0.056 | 0.020 |
| **Kouvola** | 0.821 | 0.754 | -0.044 | 0.045 |
| **Oulu** | 0.756 | 0.732 | 0.021 | 0.067 |
| **Tampere** | 0.698 | 0.659 | 0.079 | 0.140 |
| **Joensuu** | 0.762 | 0.633 | 0.015 | 0.166 |
| **Kuopio** | 0.777 | 0.611 | 0.000 | 0.188 |
| **Hämeenlinna** | 0.626 | 0.599 | 0.151 | 0.200 |
| **Kokkola** | 0.715 | 0.576 | 0.062 | 0.223 |
| **Pori** | 0.641 | 0.568 | 0.136 | 0.231 |
| **Jyväskylä** | 0.544 | 0.519 | 0.233 | 0.280 |
| **Lappeenranta** | 0.612 | 0.495 | 0.165 | 0.304 |
| **Helsinki** | 0.494 | 0.486 | 0.283 | 0.313 |
| **Kotka** | 0.528 | 0.481 | 0.249 | 0.318 |
| **Mikkeli** | 0.480 | 0.435 | 0.297 | 0.364 |
| **Rovaniemi** | 0.527 | 0.427 | 0.250 | 0.372 |
| **Vaasa** | 0.487 | 0.385 | 0.290 | 0.414 |
| **Lahti** | 0.408 | 0.364 | 0.369 | 0.435 |
| **All, on average** | 0.651 | 0.584 | 0.133 | 0.227 |
| **Sum, all regions** | | | | |
| **Rank correlation with unemployment** | -0.09 | -0.21 | | |
| **Rank correlation between gross and net efficiency** | 0.94*** | | | |

## 4.4 Temporal patterns of efficiency

Figure 2 describes how the gross and net efficiencies have developed over time at the aggregate level. The basic finding is that the gap between the two efficiency scores has enlarged continuously over the period. This development is due to the continuous improvement in gross efficiency over the investigation period, and particularly in 1989 and 2000. The average net efficiency score, in turn, has been stable, showing modest cyclical variation from year to year. The last three

[15] It is interesting to note that our ranking of TTWAs is consistent with certain measures of the performance of the labour offices. For example, the correlation between our ranking and a ranking that measures the share of unemployed job seekers with a personalised job search plan in labour offices is statistically significant (0.3). A closer analysis that relates our efficiency ranking to information on the characteristics and performance of labour offices is, however, left for a further study. Lillrank (2005) provides an interesting basis for such an analysis.

observations, however, indicate an intensifying pattern of divergence: the average gross efficiency increases whereas there is a considerable decrease in the average net efficiency.

Our results indicate that the gross efficiency improved by about 18 percentage points over the investigation period, the average score rising from about 55 to 73 per cent of the maximum. This corresponds to an annual increase of about 3 per cent. The major improvements took place in 1998 and 2003 (see Figure 2). Long-term unemployment has especially decreased, notably at the end of the research period, which has significantly contributed to the gross efficiency.[16] The second main determinant of the gross efficiency, the volume of ALMPs, has also continuously increased during the period. The increase has not been substantial, but due to its large coefficient, about –10, even small changes contribute significantly to the efficiency.

## 4.5 TTWA heterogeneity

Figures 3 and 4 describe two interesting cases among the regions. In Kuopio, the difference between gross and net efficiency estimates is one of the largest among the TTWAs, i.e. the positive contribution of environmental factors is very strong (see Figure 3). In particular, the relative proportion of long-term unemployment, the volume of the ALMPs and proportion of young unemployed job seekers have been favourable (see Appendix 2). From 1997 onwards there has been a marked increase in gross efficiency together with a clear decrease in net efficiency. The divergence strengthened further at the beginning of the 2000s, due to a notable decline in net efficiency. The efficiency related to the performance of the matching process deteriorated from about 66 per cent of the maximum in 2000 to only about 50 per cent in 2003. At the same time the gross efficiency reached 80 per cent of the maximum due to the counterbalancing effect of improved environmental factors.

The development in Turku has been different (Figure 4). Contrary to Kuopio, the gap between the efficiency measures has been very small and the measures move in the same direction over the investigation period (except years 2001 and 2002). The net efficiency was higher than the gross measure until 2001, when the gross measure exceeded it. Hence, the environment also improved in Turku. Similarly to the average aggregate-level case, the net efficiency declined at the beginning of the 2000s, recovering slightly again in 2003.

It is worth noting that the development of the biggest TTWA in Finland (Helsinki, Figure 5) follows quite closely that of Turku. Similarly to Turku, the gap between the efficiency measures is small (10 percentage points on average) and they move in the same direction over the period. The net efficiency was

[16] See Appendix 2 for differences in the control variables over time and across regions.

higher than the gross efficiency until 1999. Similarly to the aggregate development, the net efficiency declined at the beginning of the 2000s and then recovered in 2003.

*Figure 2. The development of technical efficiency at the aggregate level*

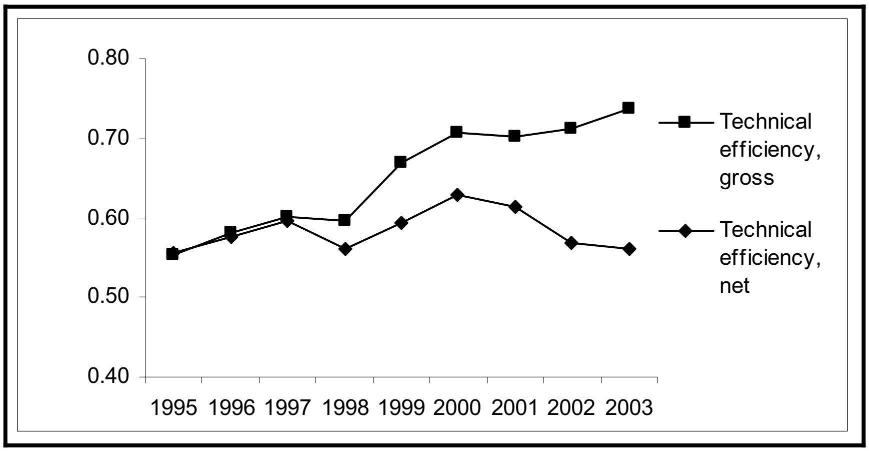



*Figure 3. The development of technical efficiency in Kuopio*

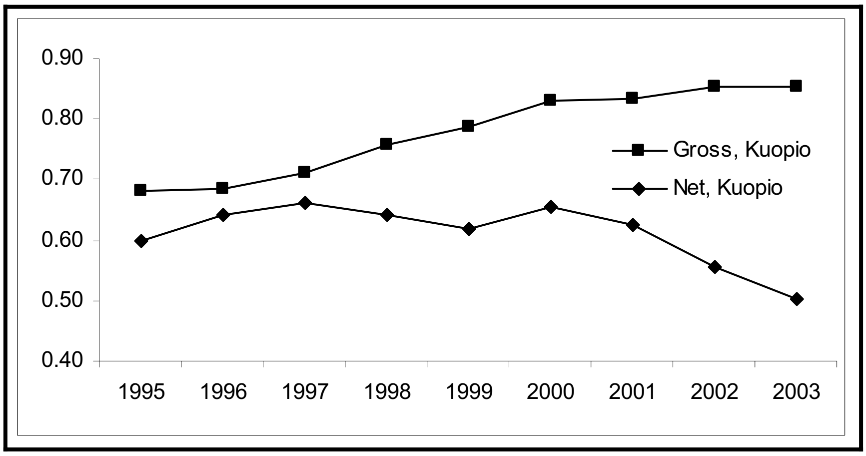


*Figure 4. The development of technical efficiency in Turku*

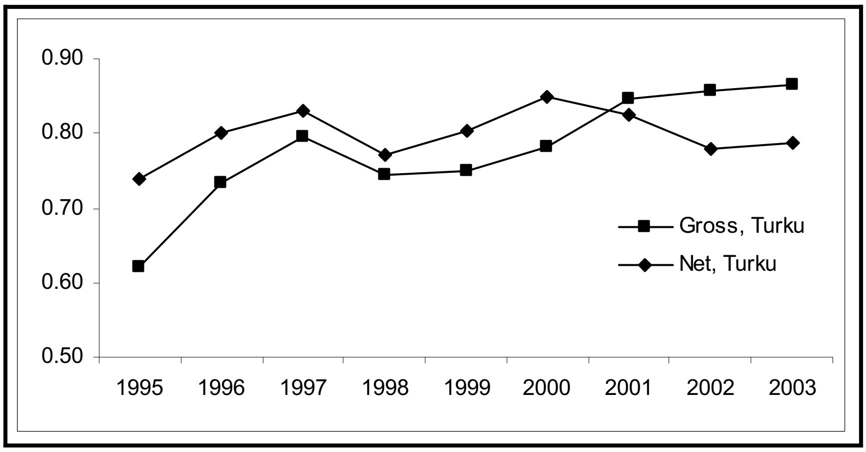
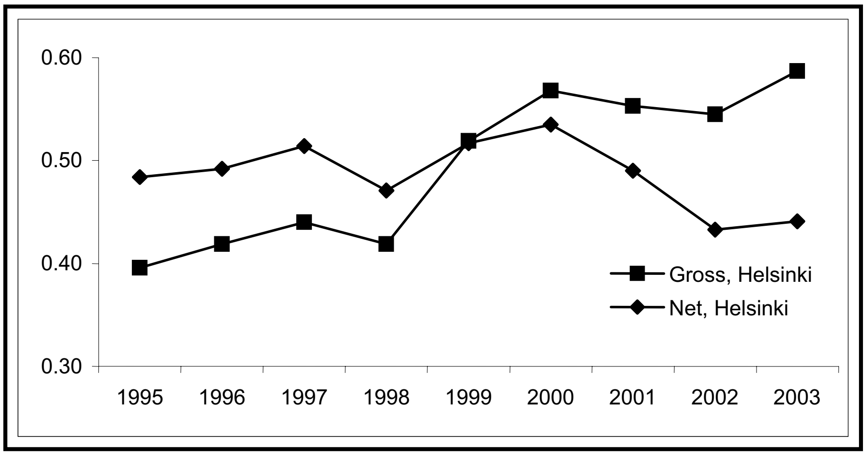



*Figure 5. The development of technical efficiency in Helsinki*



# 5. Effect of inefficiency and environmental factors on aggregate unemployment

## 5.1 Inefficiency and aggregate unemployment

Next we compare the number of matches achieved to the hypothetical number of matches that could be achieved if all regions had the highest possible technical efficiency. The highest average net technical efficiency is obtained in Turku, where the average efficiency score is about 80 per cent of the maximum.[17]

The use of net efficiency means that we estimate a hypothetical number of hirings in a situation where all TTWAs perform as efficiently as Turku. In order to concentrate on the performance of the area in question, we keep constant the effect of environmental factors on the matching efficiency. Turku's matching outcome with the net efficiency is on average about 23 percentage points nearer the efficiency frontier than that of other areas, whereas the difference in the gross measure is about 13 percentage points (see Table 2, columns 3 and 4, on average).

To shed light on the quantitative effect of the efficiency differences on hirings, we first calculate the estimated number of successful hirings separately in every region by using coefficients from specification 4 (Table 2), the mean values of vacancies and job seekers in a region, and with the region's own net technical efficiency. In the second phase we replace the values of the net efficiency estimates that for Turku, 0.799, and compare the difference in the number of hirings between these two cases. The numbers for this exercise are reported in columns 3-5 of Table 2.

The results indicate that the percentage increase in hirings would be highest in Lahti, about 120 per cent, and lowest in Seinäjoki, 1.5 per cent. On average, the hirings would rise by about 36 per cent (see column 3) and the average increase in hirings would be about 300 persons per TTWA per month (see column 2). The most important change applying to the aggregate labour market would occur in the capital region, Helsinki, where hirings would increase by about 2 200 persons. This accounts for about 36 per cent of the total increase, due to the large stocks of job seekers and vacancies in the Helsinki TTWA. This shows how even relatively small changes in the matching efficiency in the capital region can notably improve the macro-level situation in the Finnish labour market.

[17] This is calculated as an average over 108 months.

*Table 3. Effects according to region*

| | Hirings, own eff. | Hirings, Turku's eff. | Increase in hirings | Increase in hirings (%) | Share of the total increase (%) |
|---|---|---|---|---|---|
| **Turku** | 1 848 | 1 848 | 0 | 0.0 | 0.0 |
| **Seinäjoki** | 521 | 529 | 8 | 1.5 | 0.1 |
| **Kajaani** | 419 | 429 | 11 | 2.6 | 0.2 |
| **Kouvola** | 723 | 766 | 43 | 6.0 | 0.7 |
| **Oulu** | 1 231 | 1 344 | 113 | 9.2 | 1.8 |
| **Tampere** | 1 880 | 2 279 | 399 | 21.2 | 6.5 |
| **Joensuu** | 625 | 789 | 164 | 26.2 | 2.7 |
| **Kuopio** | 625 | 817 | 192 | 30.8 | 3.1 |
| **Hämeenlinna** | 450 | 600 | 150 | 33.4 | 2.4 |
| **Kokkola** | 337 | 468 | 131 | 38.7 | 2.1 |
| **Pori** | 775 | 1 091 | 315 | 40.7 | 5.1 |
| **Jyväskylä** | 758 | 1 167 | 409 | 53.9 | 6.7 |
| **Lappeenranta** | 415 | 670 | 255 | 61.4 | 4.1 |
| **Helsinki** | 3 425 | 5 631 | 2 206 | 64.4 | 35.9 |
| **Kotka** | 415 | 690 | 275 | 66.1 | 4.5 |
| **Mikkeli** | 262 | 482 | 219 | 83.7 | 3.6 |
| **Rovaniemi** | 302 | 566 | 263 | 87.1 | 4.3 |
| **Vaasa** | 267 | 554 | 287 | 107.5 | 4.7 |
| **Lahti** | 590 | 1 294 | 705 | 119.5 | 11.5 |
| **All, on average** | 893 | 1 222 | 329 | 36.8 | |
| **Sum, all regions** | 15 868 | 22 013 | 6 145 | 38.7 | |

Note: Hirings with a region's own efficiency have been calculated using estimated coefficients from specification 4 in Table 2, average variable values in a region, and the region's own average net efficiency value from Table 4. In hirings with Turku's efficiency, the efficiency estimate has been replaced by Turku's average efficiency, 0.799. The increase in hirings is the difference between these two numbers of hirings. The share of the whole increase is the increase in a region's hirings as a proportion of the total increase.

If all the TTWAs performed as efficiently as Turku, the number of hirings from among the unemployed would increase at the aggregate level by about 6 000 per month (Table 6, column 3). Remarkably, this would be equivalent to a 39 per cent increase. Consequently, the aggregate unemployment rate would drop from the current 8.5 per cent level to 6.0 per cent, providing that the new matches would yield permanent contracts (6,145 more matches in 12 months would shift about 74,000 unemployed to the pool of employed). It is worth emphasising that we obtain virtually the same estimate by applying the method of Ilmakunnas and Pesola (2003). When equation 1 is evaluated in equilibrium with constant unemployment rate, constant returns to scale, and all variables divided by the labour force; the efficiency term, $-\upsilon_{it}$, affects the unemployment rate by $1/\beta_1$. Since $\beta_1 = 0.782$ (from specification 4 in Table 2), the unemployment rate would drop from 8.5 to 6.0 per cent.

## 5.2 Environmental factors and aggregate unemployment

As reported above, environmental factors have been most favourable in Kuopio. If all the TTWAs shared the same job seeker characteristics as Kuopio, the aggregate unemployment rate would drop to 7.1 per cent. This suggests that the elimination of regional differences in environmental factors would not matter as much as the equalisation of regional differences in inefficiencies across the TTWAs. This does not, however, imply that structural factors affecting matching efficiency are unimportant. This can be demonstrated by a simple calculation. For example, an elimination of long-term unemployment from the current average level of 28 per cent would increase matches by one third. This equals to a drop in the unemployment rate from 8.5 to 6.3 per cent. In other words, the magnitude of the effect of eliminating long term unemployment would be comparable to that of eliminating inefficiency.

It is useful to compare these estimates with those implied by the change in matching technology (about 1 per cent per annum) and the change in the average gross efficiency (about three per cent per annum). A one per cent increase in matches per annum due to better matching technology has lowered the unemployment rate by about 0.7 percentage points over the eight year examination period. The improvement in gross efficiency from the average score of about 55 in 1998 to about 75 in 2003 stems from enhanced structural factors, not better net efficiency. Improvements in structural factors over time have lowered unemployment by about 1.0 percentage points during the period 1995-2003.

Finally, the study points out some policy implications which also merit attention. According to the results the unemployment rates of the five most efficient regions are below the average level, excluding Kajaani, where the unemployment rate is the second highest in the data set (see Appendix 1). The results for the TTWA of Kajaani suggest that the inefficiency of the matching process is not the primary cause for the area’s high unemployment. Consequently, in such a case ALMP measures directed to the supply side of the labour market might prove rather ineffective.

In the case of inefficient regions, including the capital region of Helsinki, difficulties in employing unemployed job seekers cannot be solved only by demand stimulus that attracts more inputs, since there are inefficiencies that disturb the matching of production. In addition to the low net efficiency in matching in Helsinki, the region also suffers from adverse structural factors: over 32 per cent of unemployment pool consists of long-term unemployed. In addition, the volume of ALMPs is the smallest of all regions, being only 3 per cent. It is thus not a surprise that the proportion of hirings from among the unemployed is only about 4 per cent in the Helsinki TTWA, while it is about 12 per cent in the Kajaani TTWA.[18]

[18] Ibourk et al (2004), using French data, reports a negative relationship between the matching efficiency of a region and its unemployment rate. Ilmakunnas and Pesola (2003), using Finnish data, in turn report a positive relationship between these variables. Our finding is closer to the results of Ibourk than those of Ilmakunnas and Pesola. In our data the rank correlation coefficient for region's net efficiency and unemployment rate is –0.21.

# 6. Conclusions

This paper examined the process of matching unemployed job seekers and vacant jobs in regional labour markets, taking a stochastic frontier approach. This approach proved to be productive when the focus is on the frictions that cause delays in the matching process and on differences between regions in their ability to produce successful matches. The paper demonstrates that a stochastic frontier approach applied to regional level data offers a convenient and interesting method to investigate how regional differences in matching efficiency and structural factors contribute to aggregate unemployment.

The empirical study provided a number of interesting results. First, average gross efficiency improved annually by more than 3 per cent and matching technology progressed by about 1 per cent per annum over the investigation period, indicating decreasing matching frictions over time. Our estimates indicated that improvements in structural factors over time have lowered unemployment by about 1.0 percentage points during the period 1995-2003. Improved matching technology has, in turn, lowered unemployment by about 0.7 percentage points over this period. We assumed that the expanding use of information technology has accounted for a part of the improvement in matching technology.

Second, there were notable and temporally stable differences in matching efficiency across travel-to-work-areas. If all regions were as efficient as the most efficient one, the number of hirings would increase by about 40 per cent. This would decrease the aggregate unemployment rate by about 2.5 percentage points, from the current 8.5 per cent level to 6.0 per cent. On the other hand, if all the areas shared the same job seeker characteristics as the most favourable TTWA, the aggregate unemployment rate would drop by 1.4 percentage points. These estimates suggested that the elimination of regional differences in structural factors would not matter as much as the equalisation of regional differences in inefficiencies across the TTWAs. This does not, however, imply that structural factors affecting matching efficiency were unimportant. This was demonstrated by simple calculations on the effects of structural factors on aggregate unemployment. For example, the total elimination of long-term unemployment from the current 28 per cent level would increase matches by one third, which would yield to a 2.2 percentage point drop in the aggregate unemployment rate. The size of this effect is comparable to that caused by the elimination of inefficiency.

Third, our results suggested that the matching efficiency in dynamic labour markets can be low, such as in the capital region of Helsinki, where the unemployment rate is low. Low unemployment in these areas stems from more from favourable circumstances related to the aggregate demand rather than the efficient operation of the matching process. On the other hand, a high matching efficiency, such as that observed in the TTWA of Kajaani, does not guarantee low unemployment.

These findings create challenges for policy makers. When the matching process is efficient but the demand is low, further investments in measures decreasing frictions, such as supply-based ALMPs, are useless. Inefficiencies in large and dynamic regions complicate policy design even further. In low unemployment areas, the unemployment status may cause more negative stigma effects than elsewhere, resulting in lower employability in such areas than in areas of high unemployment. This may generate separated labour markets: those who already are employed or come from outside of the labour force can get a new job more easily than their unemployed counterparts. In this case, well-designed activation measures of ALMP directed to the supply side might work.

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## *Appendix 1. Descriptive statistics according to region (average over time)*

| | Mean values | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hirings | Unemployed job seekers | Vacant jobs, stock | Vacant jobs, all | H/U (%) | Young | Old | Long-term | Other job seekers | Job seekers within ALMP | Size of population | Unemp. rate |
| **Turku** | 2 026 | 20 760 | 1 010 | 2 382 | 9.8 | 0.150 | 0.292 | 0.289 | 0.488 | 0.037 | 279 332 | 14.0 |
| **Seinäjoki** | 606 | 5 184 | 163 | 387 | 11.7 | 0.149 | 0.259 | 0.209 | 0.724 | 0.060 | 58 302 | 13.9 |
| **Kajaani** | 488 | 4 086 | 127 | 363 | 11.9 | 0.169 | 0.249 | 0.239 | 0.570 | 0.043 | 60 975 | 19.9 |
| **Kouvola** | 797 | 7 577 | 354 | 740 | 10.5 | 0.142 | 0.320 | 0.264 | 0.512 | 0.043 | 99 932 | 15.8 |
| **Oulu** | 1 343 | 14 939 | 534 | 1 278 | 9.0 | 0.181 | 0.231 | 0.271 | 0.502 | 0.039 | 183 523 | 15.9 |
| **Tampere** | 1 909 | 27 104 | 1 070 | 2 449 | 7.0 | 0.132 | 0.300 | 0.291 | 0.473 | 0.041 | 292 768 | 16.0 |
| **Joensuu** | 656 | 8 060 | 297 | 683 | 8.1 | 0.147 | 0.243 | 0.240 | 0.598 | 0.051 | 91 411 | 19.3 |
| **Kuopio** | 663 | 8 565 | 268 | 676 | 7.7 | 0.165 | 0.241 | 0.232 | 0.643 | 0.056 | 115 491 | 16.4 |
| **Hämeenlinna** | 476 | 5 800 | 240 | 567 | 8.2 | 0.134 | 0.332 | 0.324 | 0.523 | 0.041 | 87 300 | 14.1 |
| **Kokkola** | 356 | 4 435 | 158 | 374 | 8.0 | 0.173 | 0.286 | 0.276 | 0.485 | 0.049 | 52 602 | 16.3 |
| **Pori** | 798 | 11 808 | 405 | 869 | 6.8 | 0.131 | 0.337 | 0.302 | 0.540 | 0.044 | 116 692 | 19.0 |
| **Jyväskylä** | 787 | 13 016 | 380 | 880 | 6.0 | 0.166 | 0.270 | 0.317 | 0.460 | 0.040 | 31 681 | 18.0 |
| **Lappeenranta** | 431 | 6 931 | 189 | 446 | 6.2 | 0.147 | 0.311 | 0.292 | 0.502 | 0.042 | 68 826 | 17.5 |
| **Helsinki** | 3 135 | 72 866 | 4 420 | 9 827 | 4.3 | 0.109 | 0.304 | 0.325 | 0.435 | 0.030 | 1 159 861 | 10.8 |
| **Kotka** | 423 | 6 932 | 249 | 537 | 6.1 | 0.142 | 0.319 | 0.315 | 0.618 | 0.040 | 89 235 | 16.5 |
| **Mikkeli** | 270 | 4 579 | 166 | 337 | 5.9 | 0.134 | 0.314 | 0.320 | 0.584 | 0.043 | 70 816 | 17.6 |
| **Rovaniemi** | 309 | 5 718 | 153 | 379 | 5.4 | 0.161 | 0.225 | 0.284 | 0.466 | 0.040 | 62 496 | 21.4 |
| **Vaasa** | 269 | 4 922 | 370 | 815 | 5.5 | 0.169 | 0.310 | 0.301 | 0.670 | 0.039 | 87 987 | 11.9 |
| **Lahti** | 567 | 14 150 | 553 | 1 156 | 4.0 | 0.131 | 0.339 | 0.361 | 0.453 | 0.040 | 167 354 | 17.3 |
| **All, on average** | 858 | 13 023 | 585 | 1 323 | 7.5 | 0.149 | 0.289 | 0.287 | 0.539 | 0.043 | 167 189 | 16.4 |
| **Sum, all regions** | 16 309 | 247 432 | 11 106 | 25 145 | | | | | | | | |

## *Appendix 2. Development of the inefficiency regressors over time*

| | Young unemployed | | | Old unemployed | | | Long-term unemployed | | |
|---|---|---|---|---|---|---|---|---|---|
| | min | average | max | min | average | max | min | average | max |
| **1995** | 0.162 | 0.183 | 0.212 | 0.159 | 0.203 | 0.243 | 0.143 | 0.297 | 0.385 |
| **1996** | 0.142 | 0.166 | 0.200 | 0.184 | 0.235 | 0.374 | 0.196 | 0.302 | 0.366 |
| **1997** | 0.114 | 0.147 | 0.179 | 0.212 | 0.269 | 0.318 | 0.236 | 0.306 | 0.392 |
| **1998** | 0.101 | 0.141 | 0.171 | 0.224 | 0.289 | 0.341 | 0.224 | 0.304 | 0.379 |
| **1999** | 0.100 | 0.145 | 0.182 | 0.234 | 0.301 | 0.354 | 0.210 | 0.283 | 0.364 |
| **2000** | 0.086 | 0.141 | 0.174 | 0.242 | 0.315 | 0.368 | 0.213 | 0.279 | 0.350 |
| **2001** | 0.086 | 0.138 | 0.173 | 0.247 | 0.325 | 0.380 | 0.218 | 0.283 | 0.349 |
| **2002** | 0.089 | 0.139 | 0.177 | 0.255 | 0.326 | 0.387 | 0.199 | 0.270 | 0.340 |
| **2003** | 0.091 | 0.141 | 0.172 | 0.262 | 0.337 | 0.406 | 0.190 | 0.258 | 0.384 |

| | Other job seekers | | | Job seekers within ALMP | | | Size of population | | |
|---|---|---|---|---|---|---|---|---|---|
| | min | average | max | min | average | max | min | average | max |
| **1995** | 0.301 | 0.412 | 0.688 | 0.025 | 0.040 | 0.062 | 32 563 | 161 993 | 1 097 472 |
| **1996** | 0.353 | 0.464 | 0.677 | 0.028 | 0.043 | 0.060 | 32 356 | 163 395 | 1 114 214 |
| **1997** | 0.398 | 0.515 | 0.748 | 0.030 | 0.046 | 0.067 | 32 148 | 164 758 | 1 131 031 |
| **1998** | 0.430 | 0.526 | 0.751 | 0.030 | 0.044 | 0.068 | 31 901 | 166 092 | 1 147 895 |
| **1999** | 0.452 | 0.544 | 0.724 | 0.032 | 0.043 | 0.061 | 31 670 | 167 361 | 1 163 845 |
| **2000** | 0.478 | 0.559 | 0.755 | 0.034 | 0.041 | 0.055 | 31 403 | 168 563 | 1 178 190 |
| **2001** | 0.469 | 0.576 | 0.798 | 0.030 | 0.041 | 0.057 | 31 174 | 169 781 | 1 191 317 |
| **2002** | 0.466 | 0.607 | 0.765 | 0.031 | 0.044 | 0.064 | 31 037 | 170 936 | 1 202 761 |
| **2003** | 0.495 | 0.651 | 0.845 | 0.033 | 0.045 | 0.067 | 30 879 | 171 947 | 1 212 021 |

Note: The minimum and maximum are calculated from yearly averages among regions.

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