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Abstract
This study examines the relation between employment and output using panel data on 452 Finnish municipalities regrouped into 85 areas, presenting so called NUTS4-level regions in the EU. The results imply that: (i) the contemporaneous relation between changes in employment and output growth disappeared in early 1990s; (ii) there is certain evidence of a recovery of the relation in the mid 1990s; (iii) there are no substantial differences in the employment-output relation between the Southern and the Northern parts of Finland, although the link between employment and output growth appears to be somewhat higher for the Southern part of Finland.

Keywords: employment, output, regional-level data

JEL classification: E24, R11

1 Introduction

In the early 1990s Finnish unemployment rose within three years from 4 to about 18 per cent resulting in a fall in the total number of employed persons by 20 per cent. Since 1992 economic growth has been rapid with an annual GDP growth rate of around 4 per cent. This has led to a fall in unemployment of around 11 per cent. Although unemployment continues to show a steady decline, the process is generally regarded as too slow and it has been argued that economic growth is producing less employment than it did before the recession.

For example, *Vihriälä and Viren* (1997), who find that the relationship between unemployment and output growth varies between recoveries and recessions, argue that the ongoing recovery is not sufficient to bring unemployment back to the level of the late 1980s. According to *Linden* (1996) unemployment and output growth showed a much stronger relation in the late 1980s than in the early 1990s. In particular, he finds that in 1991-93 an increase of one per cent in output resulted in a reduction in unemployment that was only half of the corresponding impact in the late 1980s.

Valppu and Romppanen (1998), in turn, conclude that in Finland it requires more output growth to keep employment constant than, e.g., in the US or in the UK. According to their estimates the constant employment output growth rate in 1995 was about 2,5 per cent per annum. In the US, the corresponding figure was about 1 per cent. *Toivonen* (1996) reports similar results for Finland. According to his estimates the constant employment output growth rate in Finland is about 2,7 per cent per annum.

Although these studies are important contributions to the discussion on jobless growth and on the level of structural unemployment in Finland, they provide only limited information on whether the employment-output relation altered during the 1990s.[1] Some light has been thrown on this issue in recent studies by *Pehkonen* (1998) and *Kauhanen and Pehkonen* (1998), who focus on the stability of the employment-output relation at the aggregate level and in Finnish manufacturing, respectively. According to these studies no substantial

changes in the employment-output relation have taken place: output growth produces employment in a same way that it did in the late 1980s. There is, however, some evidence that the relation altered in the early 1990s, but that the change was only temporary. The obtained evidence is, however, rather weak and thus the issue requires a closer scrutiny. This is the first aim of this study. The purpose of this study is, in fact, twofold.

First we examine the stability of the employment-output relation. The data consist of a panel of 452 Finnish municipalities that have been grouped into 85 areas to represent so called NUTS4-level regions in the EU. The grouping of the data is based on commuting districts. The second aim and novelty of the study is to investigate whether there are differences in the output-employment relation between the regions. We experiment with the data that is either divided into two main regions (the South versus the East and North of Finland) or into two categories on the basis of their industrial specialisation.[2]

The study broadens the scope of the earlier debate on the Finnish employment-output relation which focused either on aggregate time series data (Ilmakunnas 1989, Pehkonen 1992, Pehkonen 1998) or manufacturing industries (Pehkonen and Kauhanen 1998). As far as we know this is the first attempt where a regional level data is utilised in examining the stability of the employment-output relation.

The remainder of the study is organised as follows. In Section 2, we outline models and discuss the data. The results on the stability of the relation are reported in Section 3. Section 4 reports the results on regional differences in the employment-output relation. Section 5 concludes the paper.

2 Employment and output across the Finnish regions 1988-1996

2.1 Models and data

The empirical analysis is based on models that relate change in employment to change in

output growth. To be precise, we focus on the *link* between employment growth and output growth. The empirical equations are of the following basic forms:

$$(1) \qquad \Delta \ln N_{it} = \alpha_0 + \alpha_1 \Delta \ln Q_{it} + \varepsilon_{it}$$

$$(2) \qquad \Delta \ln N_{it} = \beta_0 + \beta_1 \Delta \ln Q_{it} + \beta_2 \Delta \ln Q_{it-1} + \eta_{it}$$

$$(3) \qquad \Delta \ln N_{it} = \gamma_0 + \gamma_1 \Delta \ln Q_{it} + \gamma_2 \Delta \ln N_{it-1} + \mu_{it}$$

where subscript i refers to a region and t to time. The first equation depicts a static employment-output relation in a difference form. In order to allow for a lagged impact from output to employment, the second equation includes the lagged output level as an additional explanatory variable. The third equation generalises (2) further by allowing for lagged adjustment in employment.[3]

It should be emphasised that we do not provide any theoretical structure to these specifications. Although one can interpreted the equations (1)-(3) as (misspecified) short-run employment relations derived from a production function, we are solely interested in the employment-output *link*, and of possible changes in it: we do not give causality interpretation to these relations.[4]

The empirical analysis is based on the area-level data, corresponding to NUTS4-level regions in the EU. The regions - a total of 85 - are formed from 452 municipalities. The investigation period runs from 1988 to 1996, and thus includes the period of rapid employment growth of the late 1980s, the unemployment shock of the early 1990s and the years of recovery in the mid 1990s. Employment refers to the number of employees in an area, i.e. to the number of jobs.[5] The output variable is the regional gross domestic product (hereafter RGDP). The data source is Statistics Finland. The basic properties of the data are given in Table 1.

The turbulence of economic development over the investigation period shows up well in Table 1. In 1988-89 the average growth rate of RGDP was 5,4 %, the regional difference between maximum and minimum growth rates being 30 percentage points. Economic growth slowed down in 1990, and in 1991-1993 output declined by around 12 per cent in total. These were the gloomiest years of the recession. It should be noted that not all regions experienced decline in output every year: there was at least one region every year that was off the general trend. Since 1993, the annual output growth in the regions has been about 4 per cent per annum.

Table 1. Employment and output growth; basic statistics

Year	RGDP change, %				Employment change, %			
	Average	**Min**	**Max**	**Std devn.**	**Average**	**Min**	**Max**	**Std devn.**
1988-89	5.4%	-15%	15%	4.8%	0.3%	-5%	6%	2.0%
1989-90	0.9%	-12%	15%	4.8%	-2.7%	-10%	2%	1.8%
1990-91	-7.1%	-27%	8%	4.4%	-6.9%	-11%	-2%	1.8%
1991-92	-3.0%	-12%	15%	4.9%	-7.7%	-15%	1%	2.1%
1992-93	-0.3%	-25%	14%	5.7%	-6.7%	-19%	2%	2.4%
1993-94	4.8%	-9%	18%	5.0%	1.4%	-7%	9%	2.4%
1994-95	4.5%	-11%	25%	5.6%	-1.1%	-7%	7%	2.7%
1995-96	3.2%	-20%	11%	4.6%	-0.4%	-5%	5%	1.7%

Variations in output growth affect employment. As expected, the worst years for employment are par with those for output, allowing for a lag of one year. It is worth noting, as in the case of output growth, that there were regions that showed a steady increase in employment over the recession years, with the exception of 1990-91.

Figure 1, which depicts the coefficients of variation for employment and output, implies a marked change in the data generating process in 1995 and 1996: the variation in output across the regions increased substantially in 1994-1996. It remains to be seen whether this trend will reverse in the near future. It should be noted that similar trends are typical for other regional measures, including income, unemployment and migration; see Kangasharju,

Kataja and Vihriälä (1999), Böckerman (1998), Pehkonen and Tervo (1998).

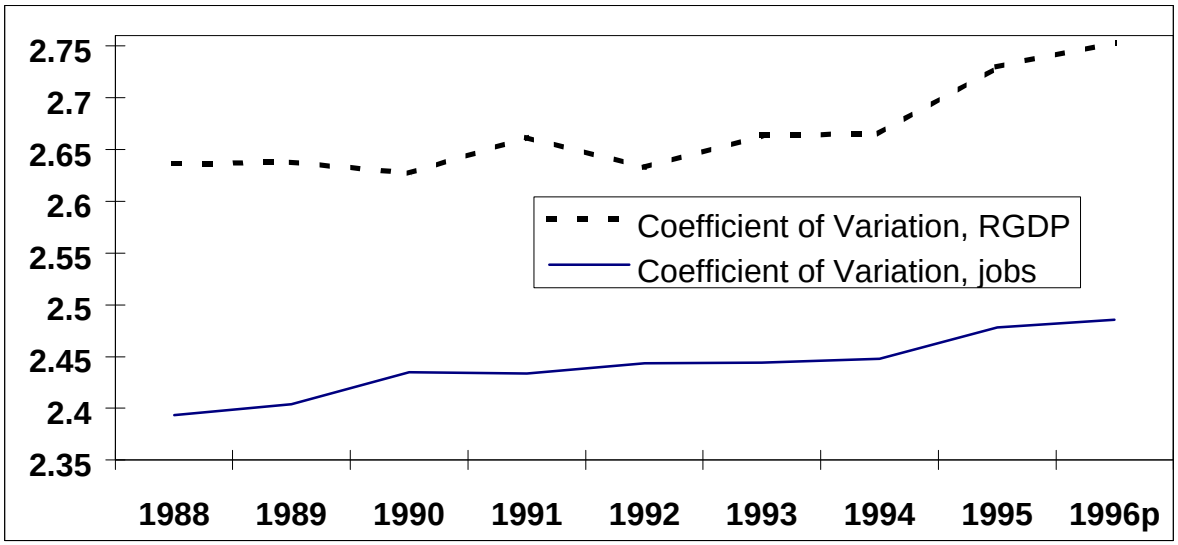

Figure 1. Coefficient of Variation for RGDP and the number of jobs in the regions

Table 2 shows that there were considerable differences in output growth and employment across the five main regions. The average growth rate was highest in the Capital Region (1,5%) and lowest in Eastern Finland (0,2%). These differences showed up in the development of employment. In the Capital Region the annual decline in employment was 2,1%, while in Eastern Finland it was as high as 3,3 %. As far as the sectoral compositions of the GDP of these regions are concerned, the Capital Region differs from the rest of the country by its low share of agriculture and forestry and by its high share of private services. Eastern Finland differs from the other areas by its proportion of agriculture and forestry, which is well above the average level.

Table 2. Employment and output growth by main regions and by industrial specialisation

	Capital Region	Southern Finland	Eastern Finland	Western Finland	Northern Finland
Average annual growth rate, 1988-1996p					
RGDP	1.5%	0.9%	0.2%	0.7%	1.3%
Number of jobs	-2.1%	-2.6%	-3.3%	-2.5%	-2.4%

Sectoral composition*)					
Agriculture and forestry	1%	6%	13%	10%	7%
Manufacturing and construction	25%	40%	29%	37%	37%
Private services	58%	37%	34%	33%	32%
Public sector	16%	18%	24%	20%	23%

Note: *) as a proportion of the total value-added of the region in question.

3 The stability of the employment-output relation

3.1. Contemporary correlation between employment and output

We begin by looking at the cross-section estimation results, reported in Table 3. The explanatory power of the model that relates annual change in employment to that of output is poor. This is especially true in the late 1980s and early 1990s.

Table 3: Cross-section estimations of the employment-output relation, 85 regions, dependent variable is $\Delta \ln N_{it}$

Method: OLS	Constant	ΔlnQ	R^2
Sample			
1988-89	0,00 (0,41)	0,02 (0,51)	0,01
1989-90	-0,02 (13,3)	0,04 (1,06)	0,01
1990-91	-0,06 (16,2)	0,01 (0,29)	0,01
1991-92	-0,07 (29,2)	0,12 (2,66)	0,08
1992-93	-0,06 (26,8)	0,16 (3,97)	0,16
1993-94	0,00 (1,78)	0,18 (3,92)	0,15
1994-95	-0,01 (5,11)	0,19 (4,15)	0,17
1995-96	-0,00 (2,91)	0,08 (2,12)	0,05

Notes: t-values in brackets (heteroskedastic robust). Mean of the coefficients of ΔlnQit is 0,10 and mean of the coefficients of constant is -0,027.

The results differ between two broadly defined sub-periods. Between 1988-1991 there seemed to be no contemporary effect from output to employment. For 1991-1996 such an effect was detected, the magnitude of the immediate impact being about 0,15. This estimate is line with the short-term results obtained from time series data as well that of industry-level data; see Pehkonen (1998) and Kauhanen and Pehkonen (1998), respectively. The results for

the years 1991-1993 are consistent with the view that the extent of labour scrapping during the depression years was above the norm: at the given output level the annual decline in employment varies between 4-7 per cent. As a whole, however, the results do not provide a useful basis for policy conclusions, and therefore, the models need to be augmented. Consequently, the next sub-section shows estimation results for the equation (2) which includes the lagged term of the explanatory variable, and tests the stability of the intercept terms and the slope coefficients.

3.2 Panel data results

Table 4 reports estimates of the specifications that utilise panel properties of the data at hand. To examine the stability of employment-output relation, we allowed for time effects (a change in constant) as well as for interactions between the time effects and the independent variable (for a change in correlation between employment and current as well lagged output). Column 1 reports the results of the specification that includes time dummies but excludes the interaction terms. The interaction terms are included, and the time dummies excluded, in column 2. Columns 3, 4 and 5, in turn, allow for both effects. Column 4 omits all lagged interactions terms (due to their insignificance) and in column 5 all remaining insignificant terms are excluded from the specification. Since the initial and terminal year of the investigation period is fixed, the number of observations is 595 in all cases.

There are three main findings that are worth noting. First, the explanatory power of the alternative specifications is at a reasonable level. The changes in output account for about 70 per cent of the variation in employment. As shown in column 1, the inclusion of the lagged change in output as well as time dummies improve the fit considerably compared to the cross-section results of table 3. The inclusion of the interaction terms simultaneously excluding the time dummies decreases the fit; see column 2 that provides the LM-test for the hypothesis that there is no variation in the intercept over cross-sections. The results in columns (3) - (5) suggest that the importance of the interaction terms is only limited: the time effects are far more important.

Second, at the given output level the annual decline in employment is about 3 per cent in 1990. Between 1991-1993 the estimate varies between 6 and 7 per cent. In 1994, the estimate is effectively zero. In 1995-96 the estimates are again on a rise, being about 2 per cent per annum. These results are in line with a view that that the extent of labour scrapping during the depression years was excessive.

Table 4: Employment-output relation with panel data, 1990-1996, 85 regions, 595 observations, dependent variable is $\Delta \ln N_{it}$

Explanatory variables	(1) OLS	(2) OLS / random eff.	(3) OLS	(4) OLS	(5) OLS
Constant	-0,03 (13)	-0,03 (18)	-0,03 (8,3)	-0,03 (12)	-0,03 (13)
$\Delta \ln Q_t$	0,13 (7,9)	0,06 (1,0)	0,06 (1,2)	0,06 (1,4)	0,08 (3,2)
$\Delta \ln Q_{t-1}$	0,05 (3,0)	0,05 (1,0)	0,05 (1,0)	0,05 (3,0)	0,05 (2,8)
Time dummies					
1991	-0,03 (7,4)		-0,04 (6,4)	-0,04 (7,4)	-0,03 (8,2)
1992	-0,04 (9,6)		-0,04 (7,0)	-0,04 (9,4)	-0,04 (10)
1993	-0,03 (9,6)		-0,03 (7,4)	-0,03 (9,6)	-0,03 (9,8)
1994	0,04 (12)		0,04 (7,7)	0,04 (9,4)	0,04 (9,5)
1995	0,02 (5,2)		0,01 (3,1)	0,01 (4,3)	0,01 (4,4)
1996	0,02 (7,2)		0,02 (4,8)	0,02 (6,8)	0,02 (7,6)
Interaction terms					
1991*$\Delta \ln Q_t$		0,31 (4,1)	-0,06 (0,9)	-0,06 (0,9)	
1992*$\Delta \ln Q_t$		0,21 (2,4)	0,06 (0,9)	0,07 (1,0)	
1993*$\Delta \ln Q_t$		0,22 (2,7)	0,12 (1,8)	0,11 (1,8)	0,10 (2,2)
1994*$\Delta \ln Q_t$		0,49 (6,3)	0,13 (1,9)	0,13 (2,0)	0,12 (2,3)
1995*$\Delta \ln Q_t$		0,18 (2,2)	0,13 (2,1)	0,13 (2,2)	0,12 (2,6)
1996*$\Delta \ln Q_t$		0,27 (3,2)	0,05 (0,7)	0,04 (0,5)	
Lagged interaction terms					
1991*$\Delta \ln Q_{t-1}$		-0,10 (1,3)	0,02 (0,2)		
1992*$\Delta \ln Q_{t-1}$		0,34 (5,3)	-0,05 (0,7)		
1993*$\Delta \ln Q_{t-1}$		0,32 (4,1)	0,03 (0,4)		
1994*$\Delta \ln Q_{t-1}$		-0,05 (0,7)	-0,01 (0,2)		
1995*$\Delta \ln Q_{t-1}$		0,12 (1,9)	-0,02 (0,3)		
1996*$\Delta \ln Q_{t-1}$		0,18 (2,7)	0,05 (0,7)		
Long-run ε_q	0,18	0,52	0,20	0,18	0,24
R^2-adj.	0,74	0,51	0,74	0,74	0,74
LM test, $\chi^2(1)$	0,02	5,14**	0,13	0,10	0,13
Hausman, $\chi^2(14)$		16,00			
Joint significance of					

time dummies, χ^2(DF)	125,48*** (6)	-	90,06*** (6)	667,04*** (6)	688,92*** (6)
Current interaction terms, χ^2(DF)		47,04*** (6)	2,41** (6)	14,97** (6)	11,19** (3)
Lagged interaction terms, χ^2(DF)		65,68*** (6)	0,50 (6)		

Note: For specification 2, OLS and random-effects models produce identical parameter estimates. t-values (in absolute terms) are given in brackets. Interaction terms refer to the product of explanatory variable and time dummy. In LM test the null hypothesis is that there is no variation in the intercept terms over cross-sectional units. In Hausman test the null hypothesis is that the nature of the variation in the cross-sectional units is random.

Third, the link between employment and output changes is poorly determined at the beginning of the sample. In certain specifications the magnitude of the impact coefficient implies that it takes more than 100 per cent growth in output to keep employment stable.[6] The estimates for the last years of the sample are more in line with a priori beliefs. To summarise, the results reflect the turbulence of the economic situation of the early 1990s, showing a tendency towards a stable relation between employment and output growth during the last years of the sample.

In order to check whether a further generalisation of the model sheds more light to the issue, the lagged endogenous variable was also included as a regressor. Due to the inclusion we used the GMM estimation methods.[7] Results are reported in Table 5. Like Table 4, the results are based on the model that utilises panel properties of the data. As shown in the bottom part of the Table, the Sargan test for the validity of the instruments cannot be rejected.[8] The specifications shown in columns 1-3 do display first-order, but not second-order, autocorrelation.[9] It must be emphasised, however, that the analysis is based on seven cross-sections: it is likely that the results are biased and thus they must be treated with care.

In line with the previous results, the time dummies play an important role in explaining the data, although the inclusion of the interaction terms diminishes their relative importance. According to the results employment declines, on average, about 3 per cent per annum if there is no growth of output. This estimate, however, varies from +5 per cent in 1994 to –7 per cent in 1991. It should be noted that these results do not depend on the empirical

specification and they accord with those given by the less efficient estimation method, i.e. OLS, reported in Table 4.

The link between employment and output changes appears to be, on average, stronger compared to that given in Table 4. The estimate is either 0,43 (column 1) or 0,39 (column 2) when annual variation in the coefficient is not allowed. When we allow for interactions (column 3), the estimate varies between -0,45 in 1992 and 1,0 in 1996! Since the interactions dummies are clearly significant and the other diagnostics of the specification remain unchanged, it is reasonable to assume that the results of column (3) describe the underlying data better than the specifications (1) and (2). To summarise, the results reflect the turbulence of the early 1990s that shows up as a disappearing relation between employment and output changes in 1991-1993 and as a gradual recovery of the relation in 1994-96.[10]

Table 5: GMM-estimations of the employment-output relation, 85 regions, observations 595, estimable years 1990-1996, dependent variable is $\Delta \ln N_{it}$

Explanatory Variables	(1)	(2)	(3)
Constant	-0,03 (21)	-0,03 (24)	-0,03 (11)
$\Delta \ln N_{-1}$	0,61 (25)	0,60 (25)	0,57 (15)
$\Delta \ln Q_t$	0,17 (8,1)	0,16 (9,0)	0,18 (1,7)
$\Delta \ln Q_{t-1}$	-0,02 (1,7)		
Time dummies			
1991	-0,01 (2,8)	-0,01 (3,2)	-0,04 (6,6)
1992	-0,00 (1,5)	-0,00 (0,7)	-0,01 (2,6)
1993	0,01 (4,3)	0,01 (4,8)	0,01 (2,1)
1994	0,08 (22)	0,08 (26)	0,07 (14)
1995	0,01 (4,9)	0,01 (5,5)	0,01 (2,5)
1996	0,03 (12)	0,03 (16)	0,02 (5,1)
Interaction terms			
1991*$\Delta \ln Q_t$			-0,38 (2,2)
1992*$\Delta \ln Q_t$			-0,33 (1,7)
1993*$\Delta \ln Q_t$			0,02 (0,1)
1994*$\Delta \ln Q_t$			0,05 (0,3)
1995*$\Delta \ln Q_t$			0,17 (1,0)
1996*$\Delta \ln Q_t$			0,24 (1,3)
Long-run ε_q	0,43	0,39	0,35
Joint Significance of			

time Dummies, $\chi^2(6)$	3320,2***	3767,4***	1406,2***
other variables, χ^2(DF)	854,5*** (3)	851,8*** (2)	649,6*** (8)
Interaction terms, $\chi^2(6)$	-	-	99.03***
1st order serial correlation, MA(1)	-4,81***	-4,695***	-4,98***
2nd order serial correlation, MA(2)	0,997	0,762	0,716
Sargan test for validity of instruments, χ^2(DF)	65.65 (53)	65.74 (54)	58.70 (48)

4 Regional variation in the employment-output relation

To examine the regional variation in employment-output relation, we start with an experiment where we compare two groups of regions which represent both distinct parts of Finland and the opposing groups of regions in terms of economic performance. The first group, which includes the Capital Region and the rest of Southern Finland, is characterised by a lower-than-elsewhere level of unemployment, and by in-migration and a relatively high per capita income. The second group consists of Eastern and Northern parts of Finland. This group, in turn, represents regions with a higher-than-elsewhere level of unemployment, and with out-migration, a relatively large agricultural sector and a low per capita income. In the first group the number of regions is 33 and in the latter 31.[11] There are also some differences in sectoral composition between the groups. Most visibly, in the Southern group of regions the proportion of private services is higher than in the other group consisting of the Eastern and Northern regions (see Table 2 above).

The division of the data into Southern and Northern regions show up in the results to some degree. The estimate on exogenous change in employment for the Capital and Southern regions is slightly lower than that for the Eastern and Northern regions throughout the whole period. Although the difference is statistically significant, the result is only tentative. The correlation between employment and output growth is weak in both cases, although interaction dummies for certain years are statistically significant. In this respect there are no

visible differences across the regions.

Since the geographic location or economic performance of the regions does not show up well in the results, we also compare output-employment link between two groups of regions which differ in terms of industrial specialisation. The first class contains those 39 regions where the manufacturing and construction sectors have higher proportion of the region's own cross value-added than any other sector (agriculture and forestry, private services, or public sector). The second class contains those 42 regions where the private services sector is the largest. This grouping excludes 4 regions dominated by agriculture and forestry. The results of these experiments are reported in Table 6. As in Table 4, the estimation method is the OLS.[12]

Table 6. Panel data estimations of the employment-output relation, dependent variable is $\Delta \ln N_{it}$

Explanatory variables	Capital region and Southern Finland	Eastern and Northern Finland	Manufacturing and construction-oriented regions	Regions specialised in private services
	OLS	Fixed eff.	OLS	OLS
Constant	-0,023 (7,1)	-0,03 (9,6)	-0,03 (9,1)	-0,04 (9,9)
$\Delta \ln Q_t$	0,044 (1,3)	-0,00 (0,0)	0,04 (1,7)	0,15 (4,9)
$\Delta \ln Q_{t-1}$				0,14 (4,4)
Time dummies				
1991	-0,04 (7,3)	-0,04 (7,1)	-0,04 (7,0)	-0,02 (4,2)
1992	-0,05 (9,8)	-0,05 (11)	-0,05 (10)	-0,03 (3,8)
1993	-0,04 (7,8)	-0,04 (8,5)	-0,03 (7,6)	-0,03 (5,2)
1994	0,04 (8,3)	0,03 (4,9)	0,05 (10)	0,04 (8,5)
1995	0,02 (3,4)	0,01 (2,3)	0,02 (4,2)	0,02 (4,5)
1996	0,02 (3,8)	0,02 (5,1)	0,02 (5,3)	0,03 (5,8)
Interaction terms				
1991*$\Delta \ln Q_t$				
1992*$\Delta \ln Q_t$				
1993*$\Delta \ln Q_t$	0,14 (2,3)		0,16 (2,9)	
1994*$\Delta \ln Q_t$		0,27 (4,0)		
1995*$\Delta \ln Q_t$	0,20 (3,0)	0,16 (2,2)	0,12 (2,3)	
1996*$\Delta \ln Q_t$				
Lagged interaction terms				
1991*$\Delta \ln Q_{t-1}$				

1992*ΔlnQ_{t-1}				
1993*ΔlnQ_{t-1}				
1994*ΔlnQ_{t-1}				
1995*ΔlnQ_{t-1}				-0,22 (3,0)
1996*ΔlnQ_{t-1}				
Long-run ε_q	0,10	0,07	0,09	0,25
R^2-adj.	0,77	0,81	0,77	0,76
LM test, $\chi^2(1)$	0,67	6,34**	1,14	2,55
Hausman, $\chi^2(9)$	-	40,14***	-	-
Joint significance of Time dummies, $\chi^2(6)$	443,94***	378,83***	574,50***	359,17***

Note: see notes for Table 4.

Similarly to the previous categorisation, the division of the data into manufacturing- and private sector-oriented areas, respectively, implies that in the both groups of regions the exogenous decline in employment is rather similar. In 1990, the estimate of the exogenous decline in employment is 3 per cent per annum for the manufacturing and constructing-oriented regions and 4 per cent for the regions specialised in private services. As above, the time dummies are highly significant and the estimates on exogenous fall in employment rise up to 6-8 per cent in early 1990s and then drop to around 1 per cent per annum. Again, the year 1994 is an exception, since the estimate on exogenous decline in employment is positive, implying an overshoot in the output-employment relation. The estimates thus do not provide clear support for a common notion that technological change is faster in manufacturing than in private services.

The estimates of the link between employment and output growth are rather similar for the manufacturing and construction-oriented regions as they are for the groups in the previous categorisation, whereas the estimates tend to differ for the regions specialised in private services. Excluding column 4, there appears to be no strong relation between employment and output growth, although there are certain interaction dummies that are statistically significant. The significance of the interaction dummies for 1993-1995 is consistent with observations that the influence of the rapid growth of output in 1991-1992 in the export sector of the economy on employment was of a modest magnitude and affected employment only with a considerable lag. In the areas dominated by private services (column 4), the

relation is the strongest throughout the whole period. We can thus expect that current increase in the services of the private sector result in an increase in employment.

5 Concluding remarks

Finnish unemployment quadrupled from about 4 to 18 per cent within three years in the early 1990s. Since 1992 economic growth has been rapid with an annual GDP growth rate of around 4,5 per cent. This has resulted in a fall in unemployment to around 11 per cent. Although unemployment continues to show a steady decline, the process is generally regarded as too slow and number of economists have argued that economic growth is producing less employment than it did before the recession.

This study examines the employment-output relation using panel data on 452 Finnish municipalities that have been grouped into 85 areas. The study thus broadens the scope of the earlier debate on the Finnish employment-output relationship that focused either on aggregate time series data or manufacturing industries.

Three basic features can be brought forward. First, the turbulence of the economic development of the early 1990s shows clearly in the results: the link between employment and output changes disappears in 1990-91. Second, there is certain evidence on a tendency towards normality. The results for the last year of the sample are, in particular, in line with a priori beliefs on the employment-output relation. Third, the findings of the correlation between employment and output changes are sensitive to model specification. The observed sensitivity reflects, in part, the turbulence of the period as well as short investigation period that may affect the reliability of the estimation methods.

As far as the regional features of the data are concerned, we do not find any robust signs of diverging features. In particular, the results do not suggest the existence of substantial differences between the Southern and the Northern part of Finland, although the elasticity of employment with respect to output growth appears to be somewhat higher for typical a

southern region, i.e., a region that is specialised in private services. Since the observed differences are relatively small and they can reflect a number of alternative sources, including the quality of jobs and migration process, all possible interpretations are premature. This calls for further empirical investigations with more disaggregated data, including also control variables such as regional wage level.

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Appendix 1.

Table 1A. Solutions of the estimated OLS equations.

	Y when x=0	Partial correlation	Growth needed for constant employment
Specification 1			
1990	-0.03	0.18	0.17
1991	-0.06	0.18	0.32
1992	-0.07	0.18	0.38
1993	-0.06	0.18	0.35
1994	0.01	0.18	-0.05
1995	-0.02	0.18	0.08
1996	-0.01	0.18	0.04
Specification 2			
1990	-0.03	0.11	0.29
1991	-0.03	0.32	0.10
1992	-0.03	0.66	0.05
1993	-0.03	0.65	0.05
1994	-0.03	0.54	0.06
1995	-0.03	0.41	0.07
1996	-0.03	0.56	0.05
Specification 5			
1990	-0.03	0.12	0.25
1991	-0.06	0.12	0.51
1992	-0.07	0.12	0.58
1993	-0.06	0.22	0.29
1994	0.01	0.24	-0.03
1995	-0.02	0.24	0.07
1996	-0.01	0.12	0.05

Appendix 2.

Table 2A. Solutions of the estimated GMM equations.

	Y when x=0	Partial correlation	Growth needed for constant employment
Specification 2			
1990	-0.03	0.39	0.08
1991	-0.04	0.39	0.10
1992	-0.03	0.39	0.08
1993	-0.02	0.39	0.05
1994	0.05	0.39	-0.12
1995	-0.02	0.39	0.05
1996	0.00	0.39	0.00
Specification 3			
1990	-0.03	0.44	0.07
1991	-0.07	-0.45	-0.15
1992	-0.04	-0.33	-0.13
1993	-0.02	0.48	0.04
1994	0.04	0.55	-0.08
1995	-0.02	0.85	0.03
1996	-0.01	1.00	0.01

Endnotes:

[1] The stability of the employment-output relation is connected to the questions on the *determination* of employment and that of aggregate production process. Since the aim of this study is solely focus on the stability of the relation, these issues are not discussed.

[2] Hernesniemi (1997) provides an interesting study where industries are classified into seven groups according to their expected employment potential. Industries that are likely to grow and increase employment include, e.g., private services and electronics. The group that is likely to show a decline in employment include industries such as agriculture and textiles. Hernesniemi does not, however, look at regional differences at the composition of the industries or examine the stability of the employment-output relation.

[3] It should be noted that the last two alternatives differ in their methods of estimation. Notably, since the lagged dependent variable is non-exogenous, the third equation must be estimated by the instrumental variable techniques (IV); see, e.g., Davidson and MacKinnon (1993).

[4] A more sophisticated alternative would be to construct a model for a labour demand equation which is based on the cost-minimising behaviour of firms. In this framework we could relate employment to exogenously given output, wages, capital stock etc. Due to the lack of data this alternative is not, however, examined in this paper. Empirical models based on a solution of dynamic optimisation problem with forward-looking expectations, discussed for example by Nickell (1986) and analysed empirically by Ilmakunnas (1989) and Pehkonen (1992), are also out of the scope of this paper.

[5] The quality of jobs is ignored here, although it can be argued that the issue is important in the case of regional and sectoral analyses. We will discuss this issue in section 5.

[6] See Appendices 1 and 2 that provide estimates on annual change in employment at given output (column 1), correlation between employment and output (column 2) and estimates on output growth that keeps employment stable (column 3).

[7] See Lee et al (1998) for an interesting study that examines the robustness of empirical results with respect to alternative estimators. The study suggest that the GMM estimator by Arellano and Bond yields plausible estimates on growth convergence.

[8] The set of instrumental variables for $\Delta \ln N_{it-1}$ are given by $\ln Z_{it-2}$ where Z includes N and Q) and t runs from 2 to T.

[9] According to Arellano and Bond (1991) first-differencing of the data (as done in the present study) will induce MA(1) serial correlation even where the error term in levels is a white-noise disturbance.

[10] See Appendix 2 for detailed calculations.

[11] Altogether 21 regions located in Western Finland and Åland do not clearly belong to either of the groups. Therefore those regions are excluded from this comparison.

[12] GMM results are similar but less precise. The results are available on a request.