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REGIONAL ECONOMIC REPERCUSSIONS OF AN ECONOMIC CRISIS: A SECTORAL ANALYSIS

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Abstract: This paper investigates the evolution of regional disparities in Finland between 1988 and 1997. The analysis focuses on per capita GDP and its subcomponents, particularly labour productivity, jobs and population. The results show, first, that the evolution of labour productivity and the number of jobs account for the emerged regional divergence of per capita GDP during 1990-1995. Second, even though inter-regional migration tends to have convergent effects on regional per capita GDP, its effect was not strong enough during 1990-1995: the divergence of productivity and jobs dominated. Third, among divergent factors (productivity and jobs), manufacturing contributes the most to the divergence of per capita GDP, whereas private services is the main convergent sector. One conclusion of the paper is that the divergent forces are gaining strength at the expense of convergent ones, as migration directs population into largest regional centres. A decline in convergent factors may occur as migration decreases the need for private sector jobs outside the centres.

Key words: Regional disparities, recession, labour productivity

JEL: E32, O47, R11

Tiivistelmä: Tässä työssä tarkastellaan alueellisten tuotantoerojen (asukasta kohti laskettuna) muutoksia Suomen 85 seutukunnan välillä vuosina 1988-1997. Analyysi keskittyy asukasta kohti laskettuun alue-bkt:een ja sen komponenttei-hin, kuten työn tuottavuuteen sekä työpaikkojen ja väestön määrään. Havaintona on, että useita vuosikymmeniä jatkunut alue-erojen supistuminen kääntyi 1990-luvun lamassa alue-erojen kasvuksi. Tutkimuksen päätulos on, että työn tuotta-vuuden ja työpaikkojen määrän muutokset alueittain saivat aikaan erojen kasvua, kun taas väestömuutokset hillitsivät sitä. Toimialoittain tarkasteltuna teollisuus sai aikaan eniten bkt/asukas –suhteen alueellista erilaistumista, kun taas yksi-tyisten palvelujen alueellinen kehitys pienensi eroja. Johtopäätöksenä on, että Suomen sisäisen muuttoliikkeen suuntautuessa viime vuosien osoittamalla tavalla eteläiseen Suomeen ja suurimpiin keskuksiin, yksityisten palvelujen tarve vähe-nee muuttotappioalueilla. Alue-eroja supistavan toimialan pieneneminen muut-totappioalueilla johtaa alue-erojen kasvuun.

Asiasanat: Aluekehitys, lama, työn tuottavuus

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1. Introduction

The long-run evolution of regional production structures and economic disparities have always been a central focus of study in regional economics. The question of the regional effects of short-run fluctuations in the aggregate economy has been addressed to much lesser extent, however. Yet economic fluctuations are likely to affect regions differently, because regional production structures differ from each other (e.g. Temple, 1994; Isard, 1982). For this reason, the business cycle should also have an impact on regional disparities. Indeed, previous empirical studies indicate that there is a tendency for regional disparities to grow during recessions, and diminish when the economy is expanding (Dunford and Perron, 1994; Mackay, 1994; Evans and McCormic, 1994; Hess and Shin, 1997). Moreover, regional labour market disparities show exactly the same tendency as production in the goods market (Audas and Mackay, 1997; Demertzis and Hughes Hallet, 1996)[1].

Finland experienced a rapid economic upswing and an overheat period in the late 1980s that abruptly turned into one of the worst recessions in the history of the nation. Between 1990 and 1993, national GDP fell altogether by 9.5 percent and unemployment rose from 3.2 to 16.6 percent. Since then the average annual growth in GDP has been over 4 percent and by 2000 unemployment had dropped to less than 10 percent. The recession in Finland was the deepest in Europe, and it treated regions very differently: some regions were in recession only for 4 years whereas others felt its effects for up to 8 or 9 years (Kuntaliitto, 1999). Moreover, the slump radically changed the relative positions of subregions in the GDP ranking, indicating noticeable repercussions on regional structure.

The economic crisis marked the end of a long period of regional economic convergence in Finland. Previous studies show that regional per capita incomes and GDP had been converging since the 1930s, and that convergence was particularly rapid in the 1960s and 1970s (Kangasharju, 1999; Pekkala, 1999; Loikkanen et al., 1998). The rate at which per capita disparities were narrowing had already begun to fall in the 1980s, and by the early 1990s, when the downturn began, no trace of a convergence process remained. In fact, Pekkala (2000) shows that regional convergence occurred before the slump, but that divergence dominated in the downturn and early recovery.

Despite a wide documentation of convergence and divergence, there are surprisingly few attempts in the literature to provide a detailed analysis of the

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[1] When differences are measured using incomes subject to public income transfers, the result tends to be the opposite, however (Loikkanen et al. 1998).

determinants of divergence that tends to occur during economic downturns.[2] This is exactly what we are aiming at in the present paper.

We analyse the observed pattern of convergence and divergence of per capita GDP among the 85 Finnish subregions[3] that are close approximations to commuting areas. The period of investigation runs from 1988 through 1997, hence including the period of exceptionally large aggregate fluctuations. We aim at providing a coherent picture of the mechanism behind evolving regional differences.

Apart from regional difference in sectoral compositions, the literature suggests that labour productivity has crucial role to play, as the periods of slumps contribute to improvement in labour productivity (Aghion and Howit, 1998a, 1998b). Another obvious candidate for regional effect is the regionally differing number of bankruptcies and job reallocation (Davis and Haltiwanger, 1992). Finally, it is widely documented that inter-regional migration tends to fluctuate together with economic activity (Dewhurst, 1998). Since migration has strongly affected the regional numbers of population in Finland, migration has immense effects on the patterns of convergence and divergence.

On the basis of discussion above, we start by disaggregating the change in regional per capita GDP into the components of productivity, jobs and population. Secondly, we analyse the changing regional production structure and evaluate the extent to which differences in industrial composition affect the evolution of regional disparities. Finally, a simple model quantifies the relative magnitudes of the impacts of employment and productivity upon regional divergence.

The results indicate that, firstly, the recession did exacerbate regional disparities in terms of regional GDP per capita, as found in earlier studies. The main reasons for this divergence were the slower decline in the number of jobs and faster growth in productivity among the initially rich subregions. Inter-regional migration flows and net fertility exerted convergent effects on the GDP per capita, but the effects were not sufficiently large to offset the growing disparity in productivity and jobs. Secondly, the results indicate that manufacturing and primary sector contributed to overall divergence, but private services contributed to convergence of per capita GDP.

The remainder of the paper is organised as follows. The second section presents a conceptual framework in which the effects of cyclical fluctuations on regional economy are analysed. The third section describes the data and methods used. The fourth section presents the main findings on the effects of the recession on

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[2] See however a preliminary attempt by Kangasharju and Pekkala (2000).

[3] The subregions are NUTS4-level regional units in EU standards.

regional productivity disparities, production structure and population composition. The last section discusses the policy implications of regional recession dynamics and concludes the paper.

2. Conceptual background: the business cycle and the regional economy

Traditional macroeconomic theory predicts that in the long-run poorer regions tend to catch up with richer ones, due to the diminishing marginal product of capital and the diffusion of knowledge and innovations (Barro and Sala-i-Martin, 1995). Theory, however, ignores the effect of business cycles on economic growth or long-term development (Romer, 1996). Business cycles are considered merely as fluctuations around a steady trend. Therefore, they are not expected to have any long-lasting effects on regional structure either. Recently, however, this view has been challenged by the emergence of the "new growth theory" where endogenous growth is generated by "learning-by-doing", R&D and other internal processes. Here, economic fluctuations are seen as having a role in generating further growth during expansions when people are able to accumulate a stock of knowledge, enabling firms to invest more in further knowledge enhancing activities (Stadler, 1990; Saint-Paul, 1997).

Another approach emphasises the positive role of recessions in their tendency to improve productivity. According to Aghion and Saint-Paul (1998) there are several reasons for this (see also Aghion and Howitt, 1998). The first reason why recessions increase productivity is that recessions tend to cut the least productive activity and preserve only the most efficient firms (see Caballero and Hammour, 1994, for a formalisation). Secondly, the opportunity costs of productivity-improving activities, such as reorganisation and training, are lower during recessions. Reorganisation and training usually take place at the expense of directly productive activities, such as manufacturing. Since the demand for manufacturing goods is lower during recessions than booms, the opportunity costs in terms of foregone profits are also lower. Consequently recessions speed up productivity improvement. The third reason is the "disciplinary effect", which says that during recessions the likelihood of bankruptcy is lower for firms that undertake reorganisation investments. The final reason is that recessions may decrease the probability of a mistaken occupational choice. If, during recessions, the difference between efficient and inefficient workers can be observed more easily, then a recession can help to improve the worker selection.

Since the recent theoretical advances suggest for instance that recessions may have permanent effects on the level of productivity, it also follows that if productivity improvements differ across regions, then recessions may have permanent effects on regional economic disparities as well.

The theory of regional, or intranational, business cycles is rather similar to that of international business cycles, with, however, a few important exceptions. Even though the comovements of the central variables (GNP, consumption, prices, employment) are the same, in the regional context there are no restrictions on

trade or factor mobility (Hess and Shin, 1997). Moreover, it has been argued that business cycles tend to move from region to region via industries that comove in response to national factors, and that there tends to be a higher correlation between industries than individual regions (Kollman, 1995). In other words, the most important determinant of the comovement of economic activity across regions is the composition of industry, whereas other regional features tend to matter far less. It is only for the neighbouring regions that the level of activity will show a higher correlation at the regional than at the national level (Hess and Shin, 1997). Therefore, even though certain region-specific factors may be important in understanding the effects of intranational business cycles, the causes and consequences of economic fluctuations can best be understood through the industrial composition of regions.

Because regions differ in terms of their production and population composition, they experience business cycles differently, which, in turn, leads to growing or diminishing regional disparities. The important role of the industrial structure of regional economies is also emphasised by Isard (1982) and Temple (1994), who argue that divergence from the average structure explains why the business cycle of a given region may differ greatly from the average cycle, and why regional disparities are affected by economic fluctuations. In this context, a general observation is the tendency of regional disparities, such as per capita GDP and productivity, to diminish during economic upturns and increase in recessions (Myrdal, 1957; Dunford and Perron, 1994; Mackay, 1994; Evans and McCormic, 1994; Audas and Mackay, 1997).[4]

Apart from sectoral composition there are also several other reasons why disparities could grow during recessions. One reason for widening regional disparities during recessions is that firms in the initially richer regions are more modern and technologically advanced which, in turn, has made these regions richer than the others. One major reason why richer (often central) regions have more advanced firms relates to agglomeration and localisation benefits in innovative activity, production, labour markets etc. (Freeman 1990; Krugman, 1991; Kangasharju and Nijkamp, 2000). Because of their modern structure, firms in richer rather than poorer areas are better able to adjust their production to

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[4] Traditionally, reasons why poorer regions are finding it increasingly difficult to cope during contractions have been sought in the timing and duration of regional cycles (Saint-Paul, 1997). Assuming that the downswing begins with industry X at the aggregate level, then those regions where that industry is "over-represented" will fall into the slump first. This is called the "lead-and-lag" hypothesis of regional business cycle fluctuations (Fisher and Nijkamp, 1987). It states that the timing and severity of cyclical fluctuations tend to differ across regions owing to their differential proportions of lead and lag industries. A lead industry is one that falls into the slump (or starts growing in an upturn) ahead of the aggregate cycle, whereas lag industries are those that experience the downswing (or begin the upswing) after the aggregate cycle. During recessions regional disparities may widen, if initially lagging areas are more specialised in sectors that tend to suffer from longer and deeper downswings. Differences in the timing of recession are likely to cause rather temporary changes in regional disparities, whereas differences in the severity of recession between sectors tend to produce somewhat more long-lasting effects.

changes in aggregate demand. Thus, in recessions productivity increases more in the richer regions, which leads to growing regional disparities. The same reasoning applies also to the change in the number of jobs during slumps. More advanced firms of richer areas may be able to resist better the decline in demand during downswings. These types of changes are rather permanent in nature, since there is no theoretical reason to expect that poorer regions will improve their labour productivity or job creation relative to that of richer ones during the ensuing boom period.

Diminished migration activity is another reason for regional divergence during contractions. Migration is the key force in equalising per capita income and unemployment rates across regions. It is therefore important to analyse the mobility of labour during different phases of the business cycle. A well established fact is the lower tendency of labour to migrate during periods of recession (Pissarides and McMaster, 1984; Dewhurst, 1998; Attanasio and Padoa-Schioppa, 1991; Decressin, 1994).[5] In addition, as migrants are mostly young students and unemployed persons, their current productivity is lower than the average, and therefore their lower migration during contractions slows down the convergence process. Changes in migration activity are not likely to cause long lasting effects on economic disparities, since low migration activity during recessions is usually counteracted by accelerating activity during boom periods.

Net fertility is a migration-related factor that determines the structure of population in a region. Since the migrants are mostly young persons, they tend to improve the fertility of regions that enjoy net in-migration. Though young age profile promises a prosperous future for a region, it also means a high number of children which, artificially, decreases the current per capita income figures of a region enjoying positive net migration.

A final reason for the slow-down in convergence during recessions is the decreased role of regional policy instruments. During slumps there are fewer economic resources to be devoted to regional policy goals. This may depress the odds of poorer areas catching up with the richer ones. Decreased use of regional policy instruments during recessions has long lasting effects on regional disparities, if the use of instruments is not increased during economic upturns. Note however that the role of automatic stabilisers among regions increases during slumps. These stabilisers, such as grants from central government for local municipalities, are typically larger than resources for specific regional policy measures.

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[5] Particularly important is the mobility of human capital, i.e. highly educated individuals, during labour market shocks, as it has been suggested that they are the most prone to move away from the worst hit labour market areas (Mauro and Spilimbergo, 1999). This has serious consequences for the worst-off regions, as they may lose some of their productive labour force, and this will certainly have a long-lasting impact on their future economic growth.

In sum, aggregate economic fluctuations may have a long-run effect on regional disparities, since firms in the rich and poor regions may react differently to fluctuations, even where they operate in the same sector, and the severity of the recessions may differ between sectors which are unevenly located across regions. In other words, the differences within and between sectors may have long term effects on regional structure.

3. Data and Method

The regional level of analysis is the NUTS4 of the European Union. In Finland this classification comprises 85 subregional units, the borders of which follow those of commuting districts. The source of the data is Statistics Finland Regional Accounts and Employment Statistics. GDP is expressed in constant prices, meaning that we analyse the evolution of regional disparities in production volumes and disregard changes in prices.

As opposed to most previous studies, we do not merely analyse per capita GDP, but decompose it into GDP per employee, jobs and population.[6] In other words, we decompose the per capita GDP measure as follows:

(1) $\qquad GDP_i/N_i = GDP_i/E_i \times E_i \times 1/N_i,$

where N is the population and E is the number of persons employed in region i, irrespective of the place of residence, i.e. the number of jobs in region i. This can further be manipulated into the following "change"-decomposition where time change refers to a log difference between two points in time:

(2) $\qquad \left(\dfrac{\dot{GDP_i}}{N_i}\right) = \left(\dfrac{\dot{GDP_i}}{E_i}\right) + \left(\dfrac{\dot{E_i}}{N_i}\right) = \left(\dfrac{\dot{GDP_i}}{E_i}\right) + \dot{E_i} - \dot{N_i} = \dot{GDP_i} - \dot{N_i}$

Using this expression, we can analyse the change in per capita GDP in terms of various decompositions. We prefer here the decomposition where time change in per capita GDP consists of labour productivity[7] (GDP/E), jobs (E) and population (N). We also use briefly other decompositions, such as labour productivity and employment component (E/N).

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[6] We did not follow the total-factor-productivity approach either, due to the lack of data on regional capital stocks.

[7] We are of course talking here about labour productivity, which may have evolved very differently from total factor productivity.

4. Finnish regional economy and the economic crisis

4.1 The evolution of regional disparities

Aggregate, as well as per capita, GDP experienced radical changes during the recession period: both grew in 1988-90, then fell until 1993, after which they started steadily to climb up again (Figure 1). Between 1990 and 1993, national GDP fell altogether by 9.5 percent and unemployment rose from 3.2 to 16.6 percent. Since then the average annual growth in GDP has been over 4 percent and by 2000 unemployment had dropped to less than 10 percent.[8]

Compared with the movements in per capita GDP, there are even more noticeable changes in its subcomponents. Productivity has risen almost continuously, and the recession seems to have further accelerated its improvement. Hence, the well established "efficiency hypothesis" cannot be rejected here: an almost equal amount of per capita GDP can be produced with far fewer workers, when recession removes the most inefficient economic activity. A notable feature is that productivity started to increase already in 1991 when GDP was still decreasing. For example in the USA productivity normally starts to improve after slumps. The number of jobs started to dive at the beginning of the 1990s and showed only a modest rise since 1995. Similarly, inter-regional migration (between 85 subregions) declined for the slump period and strongly increased from 1993 onwards. Now it becomes clear why GDP should be divided into several subcomponents: the aggregate figure hides a lot of interesting information.

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[8] These figures are taken from the recently renovated National Account, and may not match precisely with the regional data analysed here.

Figure 1.   *GDP/capita, labour productivity (GDP/employed), migration and the number of jobs, 1988-97*
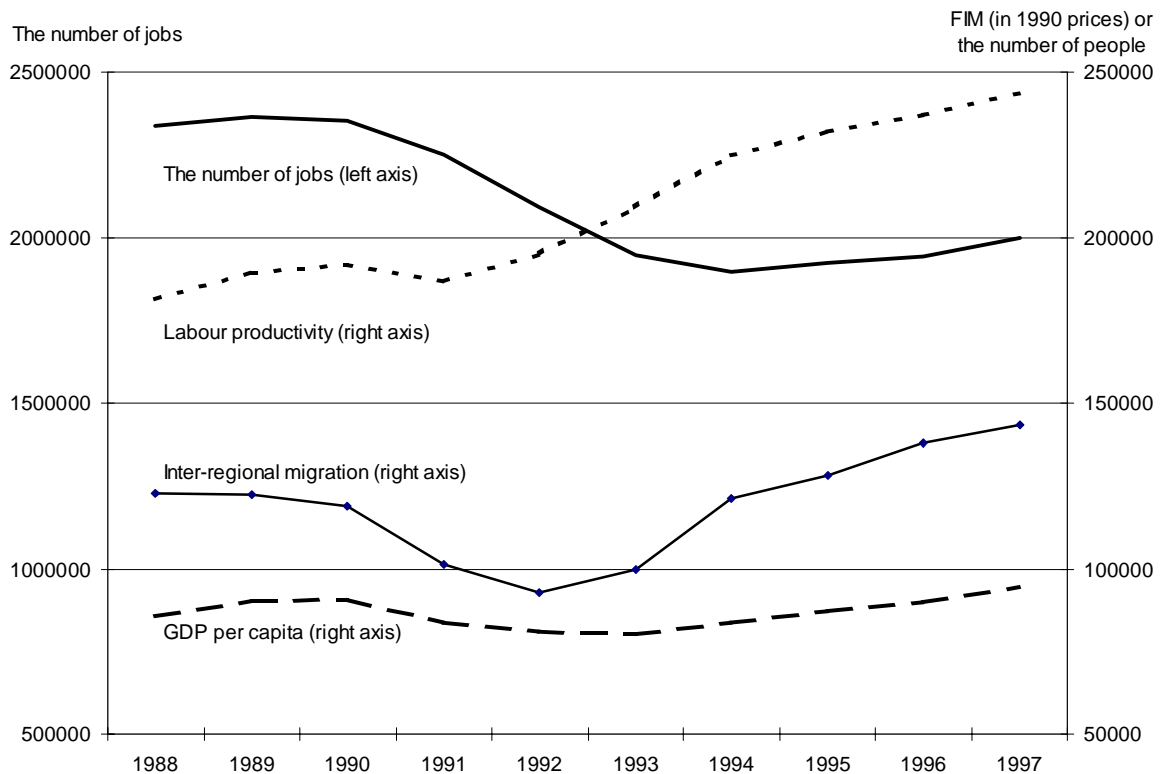
Moving on to a regional analysis of the above components, let us start with absolute figures. The coefficient of variation is drawn for GDP, the number of jobs and population (Figure 2). Regional population structure has experienced constant and continuous divergence, with, however, a change in the regime around 1993-1994. Until 1993, the annual increase in the variation coefficient was 1.2%-points. In 1993-1997, the change jumped to 2.3%-points a year, indicating that the growth of migration flows around the mid 1990s was accompanied by a growing net migration to the more populous subregions.[9] Similarly, the variation in the regional number of jobs has continuously increased in the 1990s, accelerating from 1995 onwards. And, finally, the evolution of GDP disparities indicates that disparities grew, in particular, between 1993 and 1996, but seem to have declined somewhat in 1997. This pattern suggests that the larger subregions (in terms of GDP) recovered sooner from the recession than the others.

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[9] Note that the new "resident municipality law" accounts for a large part of the increase in the concentration of population since 1994. Before 1994 students could not become official residents of the municipality of their school or university.

*Figure 2.*   *Subregional GDP, jobs and population between 1988 and 1997: Coefficient of variation*
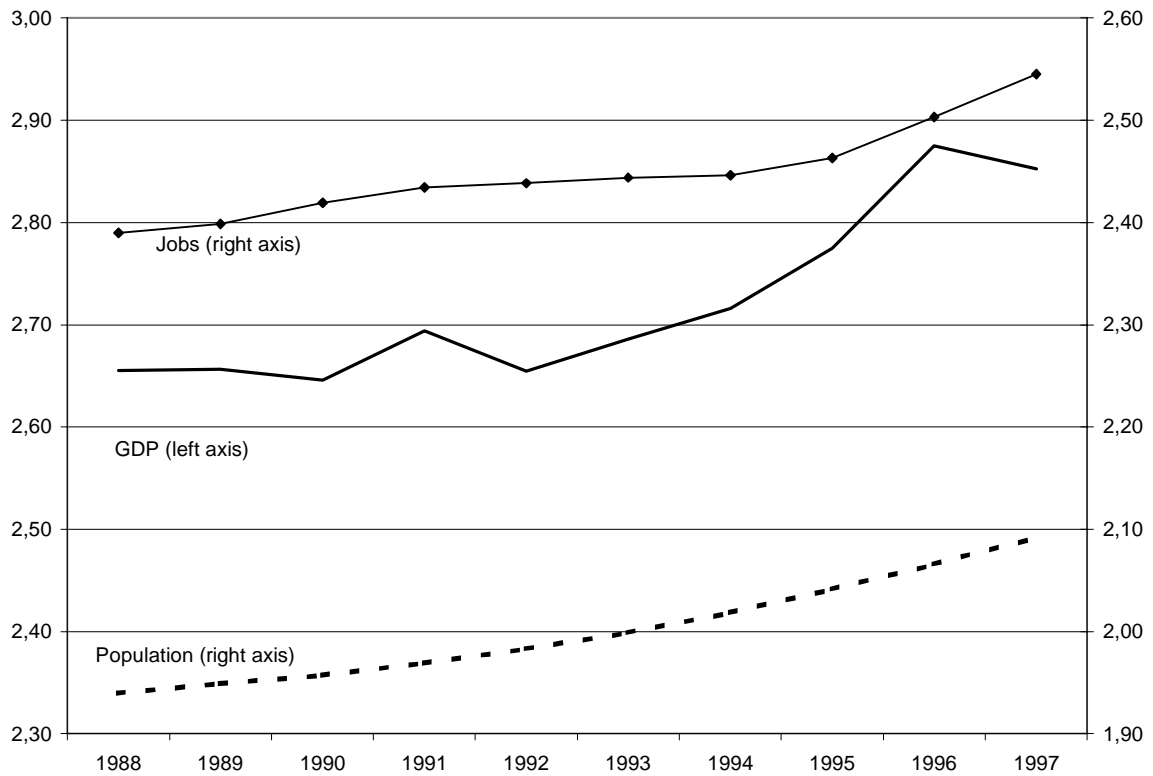
One difficulty with the analysis of regional "aggregate" measures (as opposed to per capita measures), however, is that they do not take into account concomitant population movements and thus these measures do not reveal the evolution of regional well-being. When using relative measures, the coefficient of variation confirms that per capita GDP did exhibit a degree of convergence in the pre-recession period, whereas divergence dominated during the slump years and early recovery (Figure 3). After 1995 the divergent trend levelled off, indicating the end of the recession in most parts of Finland. Rather than the employment component (E/N), labour productivity seems to dominate the changes in regional disparities of per capita GDP, since the productivity component shows a pattern similar to that of per capita GDP: productivity disparities fall before the slump and then grow until 1995. The employment component, however, appears to be somewhat different, displaying growing disparities all the way until 1996, and then falling in 1997. The fall in the "employment rate"[10] disparities implies that the "employment rate" started to improve in the lagging subregions relative to the leading subregions as late as 1997. The fall in the "employment rate"

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[10] The real employment rate, of course, relates the number of employees to the working age population.

disparities also partially explains why the disparities in per capita GDP grew somewhat in 1997.[11]

Figure 3.   *Subregional GDP per capita, productivity and employment components between 1988 and 1997: Coefficient of variation*
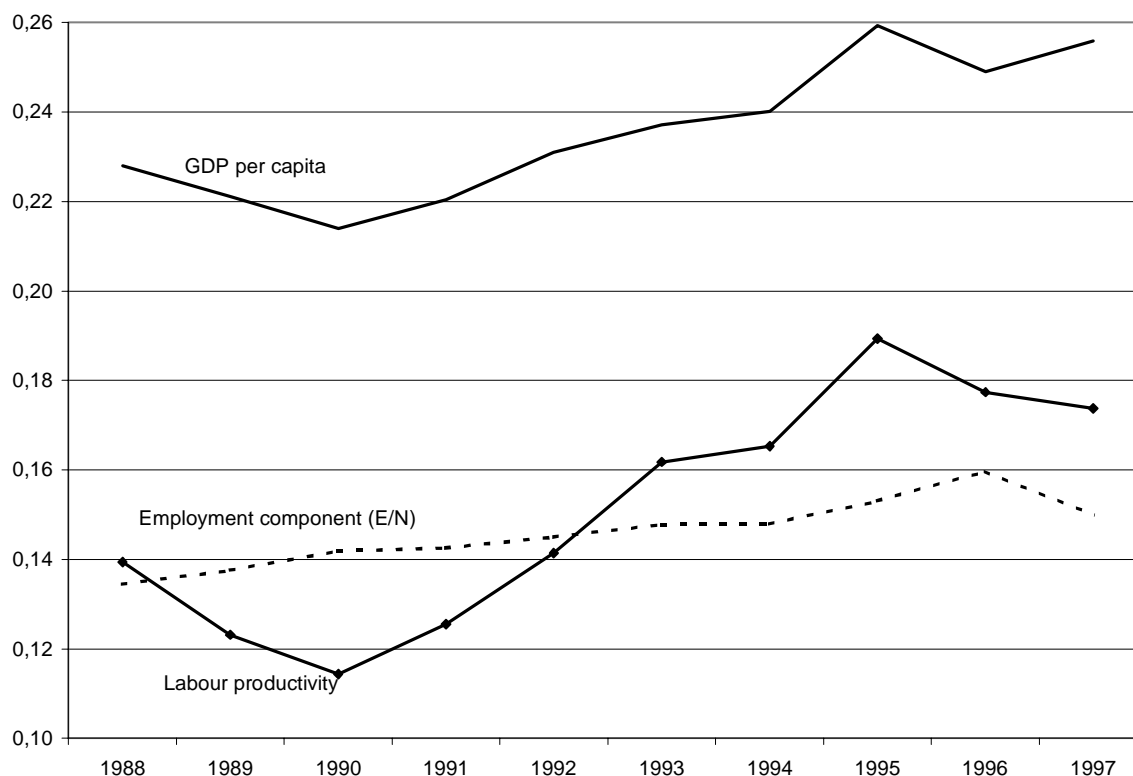
In sum, aggregate and per capita GDP started to recover from the slump as early as in 1994, but in terms of production the recession was over in most subregions only after 1995. Hence, in the regional context, the period of recession was effectively 1990-1995: a period during which regional disparities grew in per capita GDP, and in the productivity and employment components.

The number of subregions that diverged from the national mean of per capita GDP supports this result (Table 1). The number of diverging subregions was 41 in 1989, thereafter increasing with the severity of the recession, and rising to 49

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[11] The attentive reader may wonder why a rise in the coefficient variation of per capita GDP was lower between 1990 and 1995 than that of productivity, even when the coefficient variation of the "employment rate" also rose. The reason is that the partial correlations between the growth rates of per capita GDP, productivity and the "employment rate" are not all very high. The correlation coefficient between the growth rate of per capita GDP during 1990-1995 and the productivity growth rate is 0.91, whereas that between the per capita growth rate and the change in the "employment rate" is 0.59. The correlation between productivity change and the change in the "employment rate" is as low as 0.21.

in 1991. Between 1992 and 1994 the number remained above 45, but increased again to 51 during the early recovery phase in 1995, implying regional differences in the timing and duration of the slump. Since then, the number of diverging subregions dropped, being 31 in 1997.

Table 1.   *Number of diverging subregions*

	Number of Subregions	Proportion %
1989	41	48
1990	45	52
1991	49	58
1992	46	54
1993	47	55
1994	45	53
1995	51	60
1996	44	52
1997	31	36

4.2 Differences in Growth

In order to find out what accounts for the observed divergence between the rich and poor subregions, we divide the subregions into two classes according to their per capita GDP relative to the national average at the beginning of the recession, in 1990. Clearly, the divergence observed during the slump must be a result of either poor regions growing more slowly (or declining more quickly) than the average, or rich regions growing more quickly (or declining less) than the average, or both. Indeed, it appears that on average per capita GDP fell annually by 2.93 percentage points less between 1990-95 in the rich than in the poor regions (Table 2). Note that growth rates in Table 2 are the averages over the regional units.

Table 2.   *Average changes in per capita GDP and its subcomponents,*
                   1990-1995

	$\Delta GDP/N$	=	$\Delta GDP/E$	+	ΔE	-	ΔN
Rich regions, %	-4.07	=	16.52	+	-19.14	-	1.45
Poor regions, %	-7.00	=	14.31	+	-22.56	-	-1.26
Difference, %-points	2.93	=	2.21	+	3.43	-	2.71

Note: Growth rates are the averages over the regional units.

As expected, labour productivity and the number of jobs exert a divergent effect: the efficiency effect of slump has been greater in the rich subregions and the job destruction was milder. Results also seem to indicate that migration and/or

fertility have been convergent forces, since the population of the rich subregions has increased at the expense of the poorer subregions. However, the convergent effect is not strong enough to offset the divergent effect of GDP (the net effect of labour productivity and jobs, that is), as the difference in population growth rates is only 2.71 percentage points annually.

The lesson here is that even though inter-regional migration and regional differences in the net fertility (fertility-mortality) tend to have convergent effects on regional incomes, these effects have not been strong enough during the recession. One reason for this may be that the migration flows have not been large enough (a common observation is that migration activity decreases in a recession) or that the migrants from the poor to rich regions have been employed persons, who bring gains in GDP to their destination region.[12] In sum, the effects from labour productivity and job destruction have been the cause of regional divergence during the recession.

We also checked the relative magnitudes at which migration and net fertility account for the convergent effect of population movements. The role of fertility in population movements is highlighted by the fact that the majority of migrants tend to be rather young. Therefore, a large in-migration may also, by increasing its fertility, lead to population growth.

Table 3.   *Average composition of regional population growth, 1990-95*

	Net fertility*)	Net in-migration**)	Net immigration***)	Population Growth rate
Rich regions, %	1.29	-0.77	0.53	0.29
Poor regions, %	-0.30	-1.90	0.40	-0.25
Difference, %-points	1.59	1.13	0.14	0.54

Notes: Net growth rates of fertility, in-migration and immigration do not sum to population growth rate, since growth rates are the averages over the regional units.
*)   (births-deaths)/population;
**)   (in-migration- out-migration)/population; and
***) (immigration-emigration)/population

It can be seen that on average population growth has been much faster in the rich regions that in their poorer counterparts during the recession (Table 3). The reason for this difference is both the greater average in-flow of migrants (both domestic and foreign) to the rich regions (even though, owing to the extremely concentrated flows, it is negative on average) and, to an equal extent, greater average fertility, compared to mortality, in the rich regions. In other words, the in-flows of young migrants to the rich regions contribute to population growth in

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[12] See e.g. Pekkala and Kangasharju (2000), who recently investigated the adjustment of regional labour markets in Finland.

many ways, further emphasising the convergent (in per capita terms) effect of migration.

4.3 The effect of regional industry composition

As the analysis above showed, both the productivity and job components cause regional divergence of per capita GDP. It is obvious, however, that analysing these components at the aggregate level hides important information. Not all sectors grow or diminish at the average rate, but experience recessions very differently. This has strong implications in terms of regional disparities, as the sectoral structure of a region will strongly determine how badly it suffers from a recession. In this section, regional productivity and the number of jobs is decomposed into five sectors: primary sector, manufacturing[13], construction, private services and public services. Further, manufacturing and private services are also divided into sub-sectors.

The evolution of regional productivity disparities has differed widely across sectors (Figure 4). Regional productivity disparities have evolved most visibly in primary sector and manufacturing. During both economic upturns (1988-1990 and 1995-1997) the level of productivity in these sectors converged across subregions, whereas the period between 1990-1995 was characterised by divergence. Since 1995 convergence re-emerged in manufacturing, whereas in primary sector divergence continued to dominante. Note that the divergence of 1990-1995 means that productivity improved more in subregions where it was already higher. As far as the other sectors are concerned, convergence was the trend in construction throughout the period, whereas in private services productivity development has not exerted any clear influence on regional disparities. Productivity figures for public services are not available.

Compared with sectoral productivity patterns, job patterns have showed regionally more even evolution. In 1997 the index values among sectors range from 75 to 140 in productivity, whereas they range from 90 to 105 in the number of jobs. The number of jobs has regionally converged most visibly in construction, whereas slight divergence occurred in agriculture and forestry (Figure 5).

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[13] Manufacturing includes here mining and the supply of electricity, heating and water.

Figure 4.   *Subregional labour productivity by sector: Coefficient of varia-tion (index 1988=100)*
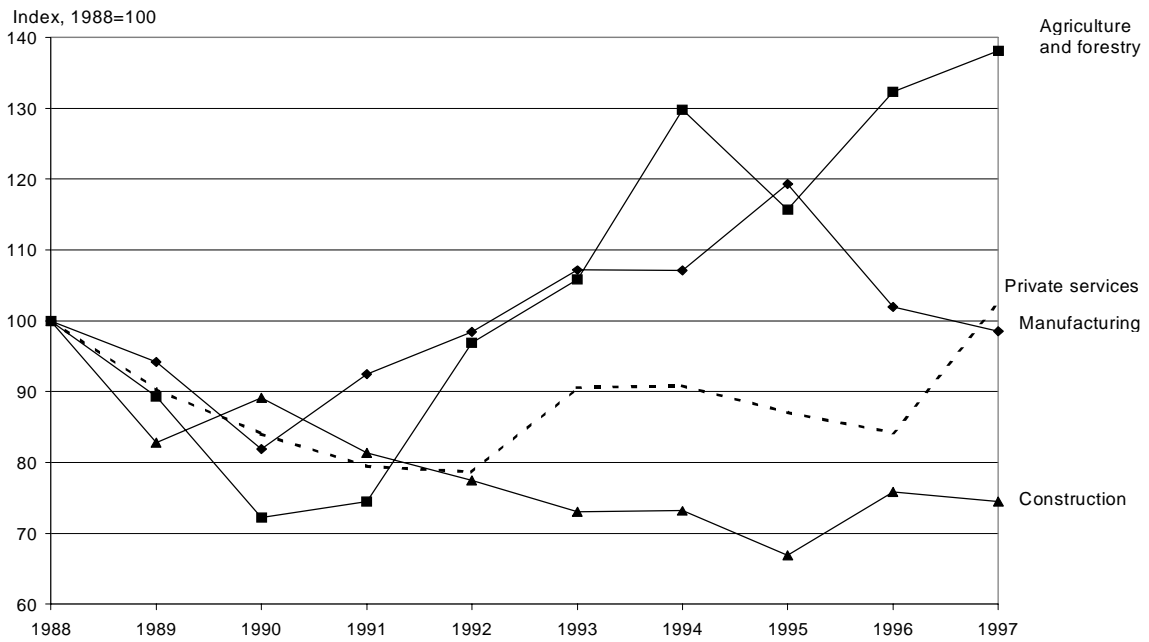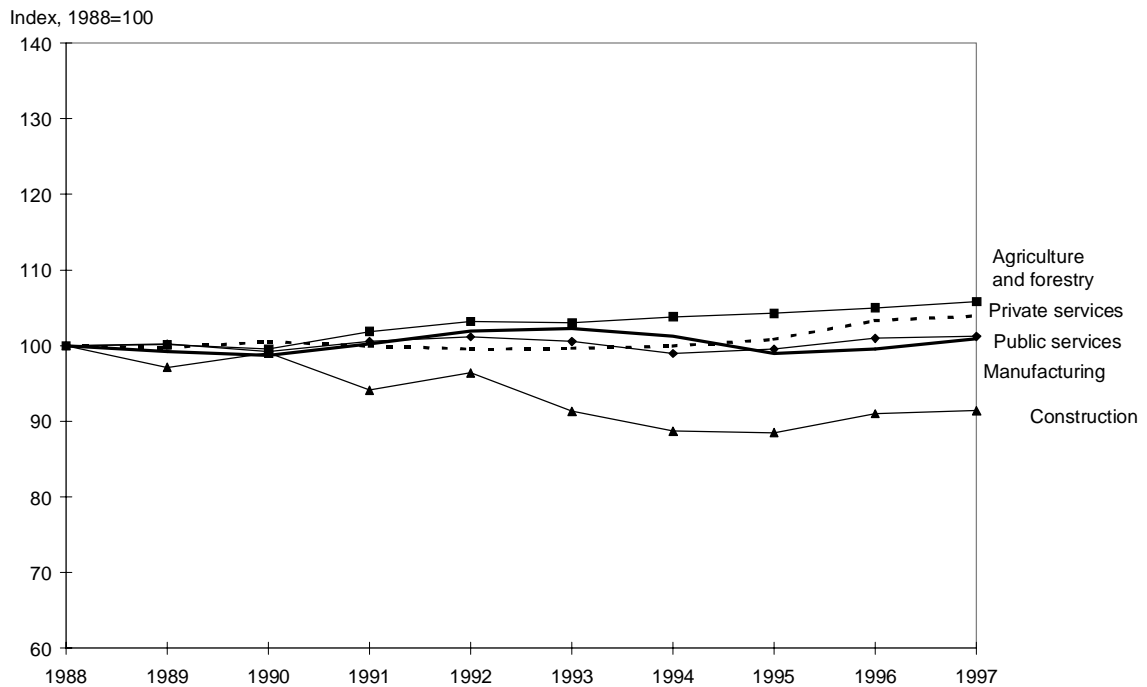

Figure 5.   *Subregional number of jobs by sector: Coefficient of variation (index 1988=100)*

However, when compared with the convergence and divergence patterns obtained above, we note that the evolution of productivity and job disparities may not result in similar patterns across rich and poor regions. In other words, regional divergence of productivity or jobs in a sector does not necessarily contribute to regional divergence of per capita GDP. A different result may occur, either due to the fact that the evolution within the sectors is different in the rich group from that in the poor one, or due to differences in sectoral composition between rich and poor subregions.

Let us first focus on growth differences in productivity within sectors. Using the same division of rich and poor regions as above, we analyse whether the sectors contribute to divergence or convergence of the productivity component of per capita GDP during 1990-1995. On average overall productivity grew faster by 2.21 percentage points in the rich than in the poor regions (Table 4).

This difference in favour of the rich regions was the greatest in construction and manufacturing (top panel). For manufacturing, this result is similar to that obtained above, implying that on average the richer subregions also have a higher level of labour productivity. For construction, however, the result is the opposite to that obtained above, implying that on average the level of productivity is lower in the richer subregions than that in the poorer subregions. In other words, productivity in the construction sector grew more in the subregions with a lower initial level of productivity and in the subregions with a higher initial level of per capita GDP. This is why the coefficient of variation points to convergence, but productivity increases more in the rich group than in the poor one. To put it differently, the construction sector had a convergent effect on productivity differentials, but a divergent effect on per capita GDP. Results also indicate that within manufacturing, the metal sub-sector contributed the most to the divergence, whereas forest related manufacturing was a convergent sub-sector.

Second, let us consider the effect of sectoral composition on the productivity results. After weighting the sectors by their job shares, manufacturing shows up as the most divergent sector (bottom panel).[14] Primary sector turns to a highly convergent sector mainly because of large regional discrepancy in the proportion of jobs.

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[14] The reason why job shares are used is the following:

$GDP/E=(GDP_1+GDP_2)/(E_1+E_2)= (GDP_1/E_1)*(E_1/E)+(GDP_2/E_2)*(E_2/E)$, where subscripts refer to industries in an area and E without a subscript to the total of industries.

Table 4.   Average change in productivity by sector, 1990-1995

	Rich, %	Poor, %	All, %	Difference, %
All	**16.52**	**14.31**	**15.35**	**2.21**
Agriculture and forestry	**38.82**	**36.95**	**37.83**	**1.87**
Manufacturing	**31.65**	**24.60**	**27.91**	**7.05**
Forest	23.41	26.33	24.94	-2.92
Metal	26.56	21.11	23.67	5.45
Other manufactring	25.22	23.17	24.13	2.06
Construction	**9.22**	**-2.37**	**3.09**	**11.58**
Private services	**4.93**	**4.61**	**4.76**	**0.32**
Wholesale and retail trade, hotels and restaurants	-2.22	-1.61	-1.90	-0.61
Transportation	-29.46	-31.61	-30.60	2.15
Other private services	13.48	14.86	14.21	-1.38
Public services	**-0.20**	**0.18**	**0.00**	**-0.38**
The share of sector, jobs				
All	**100**	**100**	**100**	
Agriculture and forestry	**9**	**23**	**16**	**-13.53**
Manufacturing	**25**	**18**	**21**	**6.51**
Forest	7	5	6	2.24
Metal	9	5	7	4.38
Other manufactring	9	9	9	-0.11
Construction	**6**	**5**	**5**	**1.04**
Private services	**29**	**23**	**26**	**6.20**
Wholesale and retail trade, hotels and restaurants	14	11	12	2.47
Transportation	4	4	4	0.69
Other private services	11	8	9	3.04
Public services	**30**	**29**	**29**	**0.35**
Weighted by GDP shares				
All	**16.52**	**14.31**	**15.35**	**2.21**
Agriculture and forestry	**3.54**	**8.37**	**6.16**	**-4.83**
Manufacturing	**7.89**	**4.53**	**6.00**	**3.36**
Forest	1.63	1.25	1.44	0.39
Metal	2.50	1.06	1.68	1.44
Other manufactring	2.15	2.00	2.07	0.15
Construction	**0.55**	**-0.12**	**0.17**	**0.66**
Private services	**1.43**	**1.05**	**1.23**	**0.38**
Wholesale and retail trade, hotels and restaurants	-0.31	-0.18	-0.24	-0.12
Transportation	-1.32	-1.20	-1.26	-0.12
Other private services	1.45	1.15	1.30	0.30
(Public services*	**-0.06**	**0.05**	**0.00**	**-0.11)**

Note: Sectoral growth rates do not sum to that of all sectors, since growth rates are the averages over the regional units. *) Change in productivity of public services is zero by definition in these data. Differences in rich and poor regions is explained by differences in the representation of local relative to central government.

Table 5.   *Average change in the number of jobs by sector, 1990-1995*

	Rich, %	Poor, %	All, %	Difference, %
All	**-19.14**	**-22.56**	**-20.95**	**3.43**
Agriculture and forestry	**-42.55**	**-41.74**	**-42.12**	**-0.82**
Manufacturing	**-20.15**	**-21.77**	**-21.01**	**1.63**
Forest	-26.14	-26.92	-26.55	0.78
Metal	-12.54	-15.19	-13.95	2.65
Other manufactring	-30.74	-29.16	-29.90	-1.58
Construction	**-52.94**	**-47.28**	**-49.94**	**-5.65**
Private services	**-12.70**	**-12.06**	**-12.36**	**-0.64**
Wholesale and retail trade, hotels and restaurants	-28.80	-27.40	-28.06	-1.40
Transportation	29.40	23.09	26.06	6.31
Other private services	-13.11	-11.90	-12.47	-1.22
Public services	**-13.04**	**-13.52**	**-13.29**	**0.49**
The share of sector, jobs				
All	**100**	**100**	**100**	
Agriculture and forestry	**9**	**23**	**16**	**-13.53**
Manufacturing	**25**	**18**	**21**	**6.51**
Forest	7	5	6	2.24
Metal	9	5	7	4.38
Other manufactring	9	9	9	-0.11
Construction	**6**	**5**	**5**	**1.04**
Private services	**29**	**23**	**26**	**6.20**
Wholesale and retail trade, hotels and restaurants	14	11	12	2.47
Transportation	4	4	4	0.69
Other private services	11	8	9	3.04
Public services	**30**	**29**	**29**	**0.35**
Weighted by GDP shares				
All	**-19.14**	**-22.56**	**-20.95**	**3.43**
Agriculture and forestry	**-3.88**	**-9.45**	**-6.86**	**5.57**
Manufacturing	**-5.02**	**-4.01**	**-4.51**	**-1.01**
Forest	-1.82	-1.28	-1.54	-0.55
Metal	-1.18	-0.77	-0.99	-0.42
Other manufactring	-2.62	-2.52	-2.57	-0.10
Construction	**-3.14**	**-2.31**	**-2.69**	**-0.83**
Private services	**-3.68**	**-2.75**	**-3.18**	**-0.93**
Wholesale and retail trade, hotels and restaurants	-3.96	-3.09	-3.49	-0.87
Transportation	1.31	0.87	1.07	0.44
Other private services	-1.41	-0.92	-1.14	-0.49
Public services	**-3.85**	**-3.94**	**-3.90**	**0.10**

Note: Sectoral growth rates in the bottom panel do not sum to that of all sectors, since growth rates are the averages over the regional units.

As far as the number of jobs are concerned, results are more or less opposite to those obtained for productivity, a result which is mainly explained by the fact that productivity is typically enhanced by layoffs during recessions (Table 5). After weighting the sectors by their job shares, most of the sectors are convergent, manufacturing being the most convergent. In contrast, primary sector is a highly divergent sector.

In order to find out the net effect of sectors on convergence and divergence, we combined the bottom panels of Tables 4 and 5 above (Table 6). Note that this combination of productivity and jobs equals to the change in the value added. It appears that the net effect for primary sector and manufacturing is divergent, whereas it is convergent for construction and private services. Manufacturing shows up as the most divergent sector, caused mainly by metal industries. Within private services, wholesale and retail trade as well as hotels and restaurants were the most convergent sub-sector. The public sector appears to be neutral in this respect.

Table 6.   Difference in growth rate of value added between rich and poor subregions

	Rich – poor group of subregions		
	Change in productivity, %	Change in the number of jobs, %	Sum, %
All	**2.21**	**3.43**	**5.64**
Agriculture and forestry	**-4.83**	**5.57**	**0.74**
Manufacturing	**3.36**	**-1.01**	**2.35**
Forest	0.39	-0.55	-0.16
Metal	1.44	-0.42	1.02
Other manufactring	0.15	-0.10	0.05
Construction	**0.66**	**-0.83**	**-0.17**
Private services	**0.38**	**-0.93**	**-0.56**
Wholesale and retail trade, hotels and restaurants	-0.12	-0.87	-0.99
Transportation	-0.12	0.44	0.32
Other private services	0.30	-0.49	-0.19
Public services	**-0.10**	**0.10**	**0.00**

4.4 Modelling the effects of recession on regional growth disparities

In this final section a simple model is developed to quantify the relative effects of productivity, jobs and population on the divergence of per capita GDP among 83 subregions in continental Finland. We omit two coastal subregions of

Ahvenanmaa, which differ from the other subregions in many respects (Kangasharju, 1998). Divergence is measured by a growing gap in per capita GDP compared to the richest subregion, Helsinki, between 1990-1995. The gap variable (GAP) measures per capita GDP in Helsinki relative to the subregion in question:

(3) $\qquad$ $GAP_i = \ln[(GDP/population)_{Helsinki} / (GDP/population)_i]$.

In 1990 the Helsinki region was 68 % richer than the average, and the average GAP was 2.5 percentage points larger in 1995 than 1990. This development was very heterogeneous over the subregions, however, since only 53 out of the 82 subregions diverged from Helsinki during the period. The minority of subregions that caught up with Helsinki did that so rapidly that the mean change turned to negative, i.e. pointing to convergence (Table 7). For example, subregion of Salo became actually richer than Helsinki during the period. The mean gap decreased by 8.8 percents. During that period, productivity rose on average by 16 % and the number of jobs fell by 21 %. Appendix 1 provides a detailed description of the convergent and divergent subregions.

Firstly, the change in GAP is regressed on the aggregate change in productivity, the number of jobs and population (Table 7). Note that we use the decomposition of regional per capita GDP presented in Table 2. In addition, a dummy variable is added for the Salo subregion, since it outgrew Helsinki subregion during the period and it's production structure is highly dominated by a single corporation, Nokia. As suggested by tests applied, we apply White's heteroskedasticity correction for the standard errors of estimated coefficients. Results indicate that the productivity and job variables are statistically significant and negative, indicating that an increase in productivity growth or a smaller drop in the number of jobs decreases divergence. Having expected sign, the change in population is not statistically significant, however. These variables (plus the dummy) explain up to 95 % of the variation in the change in GAP.

Table 7. $\qquad$ *The decomposition model, (N=82)*

Variable	Descriptive statistics		The model	
	The mean	Std. Devn.	Coefficient	t-value
ΔGAP	-0.088	0.738		
Constant			0.137	0.8
Δ(GDP/E)	0.155	0.093	-3.491	-5.1***
Δ(E)	-0.213	0.053	-1.747	-3.9***
Δ(N)	-0.001	0.032	1.046	1.4
Salo			-4.420	-22.9***
R^2 (σ)			0.95 (0.172)	

Note:*** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5 % level, and * denotes statistical significance at the 10 % level.

The previous sections indicate that divergence is caused by both productivity and jobs. The regression suggest that productivity would be the dominant factor (Table 7). The elasticity of the change in productivity with respect to catching up is about twice as large as the corresponding elasticity of the change in the number of jobs.

Secondly, we estimate the relative importance of sectors for the observed divergence. For this purpose the value added (equalling to the joint effect of changes in productivity and the number of jobs) is decomposed into sectors. On average the value added increased in manufacturing only, whereas in all other sectors the value added decreased (Table 8).

In the model, apart from public services and primary sector, other sectors explain observed divergence of regional per capita GDP in a statistically significant manner (Table 8). However, the explanatory power of the model is somewhat lower than that in the previous model. Manufacturing appears to be a divergent sector, whereas all the other sectors induce a convergent effect. Of the convergent sectors, private services has the greatest elasticity for catching up. Note however, that private services is only a marginally significant variable and private and public services were insignificant. Finally, the population component is statistically significant in this model and contributes to the change in gap more than any individual sector. The elasticity of population variable with respect to the change in gap implies that a one-percent faster drop in population contributes to convergence by 1.7 percent.

Table 8.   *The sector model, (N=82)*

Variable	Descriptive statistics		The model	
	The Mean	Std. Devn.	Coefficient	t-value
ΔGAP	-0.880	0.738		
Constant			-0.196	-3.1***
Δ(agriculture and forestry)	-0.045	0.187	-0.175	-0.7
Δ(manufacturing)	0.074	0.278	-0.799	-3.3***
Δ(construction)	-0.470	0.247	-0.311	-2.6**
Δ(private services)	-0.077	0.070	-0.942	-2.0*
Δ(public services)	-0.100	0.089	-0.046	-0.2
Δ(N)	-0.001	0.031	1.654	2.1**
Salo			-5.046	-16.0***
R^2 (σ)			0.87 (0.266)	

Note:*** denotes statistical significance at the 1% level, ** denotes statistical significance at the 5 % level, and * denotes statistical significance at the 10 % level.

5. Conclusions and discussion

The tradition of analysing the causes and consequences of regional business cycle fluctuations is not a very old or solid one, and these subjects have been somewhat neglected in regional economics. The present study has analysed the evolution of Finnish regional economic disparities during the economic crisis of the 1990s. The change in per capita GDP was decomposed into labour productivity, number of jobs and population also taking advantage of regional sector shares.

Our results support the view that regional economic disparities tend to widen during recessions. The recession of the 1990s marked a break in the long-term convergence of per capita GDP across the 85 subregions of Finland. Our main finding is that regional differences in the evolution of labour productivity and the number of jobs contributed to the per capita GDP divergence observed during 1990-1995.

The effects of productivity and jobs are the opposite to each other. As far as productivity is concerned, manufacturing contribute the most to divergence, whereas the primary sector is the convergent sector. In contrast, primary sector is the most divergent and manufacturing the most convergent sector, as the changes in the number of jobs are scrutinised. The net effects indicate that manufacturing is the most divergent, whereas private services is the most convergent sector. Within manufacturing metal industries appeared to be the most divergent sub-sector. Within private services, wholesale and retail trade as well as hotels and restaurants formed the most convergent sub-sector.

This sectoral result implies that divergent forces will gain strength in the future. It follows from the current trend in migration towards largest cities and Southern Finland that the need for private services may decline outside the areas of positive net migration. If this is the case in the future, it contributes to a decrease in convergent forces, since private services was found to be the most convergent sector.

It is reasonable to expect that the regional effects of the recession will be rather permanent in nature. We found that the job component caused a great deal of regional divergence of GDP. Moreover, divergence in the job component refers to more permanent effects than that in the productivity component, due to possible temporary changes in production volumes in capital intensive production. Apart from these possible temporary changes in production, the differences in the evolution of productivity are otherwise rather permanent in nature, since there is no theoretical reason to expect that the productivity gap emerging during a recession would be caught up during subsequent upturns.

Instead, abundance of evidence suggests that convergence is a slow and long-lasting process.

We also found that the regional divergence of productivity or jobs does not result in similar divergence of per capita GDP. The effect of the evolution of productivity and jobs depends on the development between rich and poor subregions as well as the sectoral composition of regions. Finally, we found that the effects of recession last longer in Finland at the regional than aggregate level. The aggregate measures of economic activity pointed to recovery in 1994, whereas the regional economic measures gave this indication only after 1995.

Acknowledgements

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Appendix

Here we provide a description of four groups of subregions that were catching up or lagging behind the leading subregion, Helsinki, between 1990-1995. The two catching-up groups mainly comprise the coastal or border subregions. With a few exceptions, all the Northern subregions belong to the group that lagged the most behind Helsinki. Although the overall development was one of divergence, nonetheless 30 out of the 84 subregions partially caught up with Helsinki (Table 1A). As a result of divergence during the period, the catching-up groups consisted of richer subregions than the lagging-behind groups. The catching-up groups also have higher labour productivity. Sectoral composition shows that the catching-up groups are more specialised in manufacturing and less specialised in the other sectors than the lagging-behind groups. They are also smaller than the lagging-behind groups in terms of population.

As far as the extreme groups are concerned, there are 16 subregions that caught up with Helsinki by more than 10 percentage points (mean –23 percentage points). In this group, labour productivity and the proportion of the population with higher education was larger than elsewhere. In terms of sectoral specialisation, these subregions were less specialised in primary production than the others and more specialised in manufacturing. 31 subregions lagged more than 10 percentage points behind Helsinki. In this group, the subregions were poorer and had lower a "employment rate" than the others. On the other hand, their net fertility (birth rate - mortality rate) was surprisingly high. This group is less specialised in manufacturing and more specialised in public services than the others.

Table 1A. *Descriptive statistics for convergent and divergent subregions*

	Subregions that			
	Catch up more than 10 %-points	Catch up less than 10 %-points	Lag behind less than 10 %-points	Lag behind more than 10 %-points
Number of subregions	16	14	23	31
Mean change in GAP				
1990-1995, percentage points	-0.23	-0.05	0.05	0.21
GDP per capita 1990	80499	76237	74953	72543
GDP per capita 1995	91931	75630	69683	62411
Population 1990	47107	33124	63478	41370
Population 1995	47772	32888	64601	41930
Labour productivity 1990	199019	183614	177454	181594
Labour productivity 1995	268914	221574	201962	198576
Jobs per capita 1990	0.41	0.41	0.42	0.40
Jobs per capita 1995	0.35	0.34	0.34	0.31
Population with higher Education, proportion 1990	7.5	6.8	7.2	7.0
Population with higher Education, proportion 1995	9.9	8.9	9.5	9.3
Net fertility/1000 Inhabitants, 1990-1995	4.6	-3.7	3.8	8.0
Net migration/1000 inhabitants, 1990-1995	-9.2	-11.6	-8.4	-10.1
GDP proportion				
Agriculture and forestry	0.12	0.19	0.16	0.16
Manufacturing	0.34	0.26	0.23	0.21
Construction	0.09	0.10	0.11	0.12
Private services	0.28	0.28	0.32	0.31
Public services	0.17	0.17	0.18	0.20