Työpapereita
Working Papers

186

THE MICRO-LEVEL SOURCES OF REGIONAL PRODUCTIVITY GROWTH IN FINLAND

Petri Böckerman*
Mika Maliranta**

PALKANSAAJIEN TUTKIMUSLAITOS LABOUR INSTITUTE FOR ECONOMIC RESEARCH

PALKANSAAJIEN TUTKIMUSLAITOS • TYÖPAPEREITA
LABOUR INSTITUTE FOR ECONOMIC RESEARCH • DISCUSSION PAPERS

186

THE MICRO-LEVEL SOURCES OF REGIONAL PRODUCTIVITY GROWTH IN FINLAND

Petri Böckerman*
Mika Maliranta**

*Labour Institute for Economic Research, Pitkänsillanranta 3A, FIN–00530 Helsinki, Finland.
E-mail: petri.bockerman@labour.fi

**Statistics Finland, FIN–00022 Helsinki, Finland. E-mail: mika.maliranta@stat.fi

Helsinki 2002

ISBN 952–5071–75–8
ISSN 1457–2923

ABSTRACT

In this study, productivity growth of the Finnish regions is decomposed by using plant-level data from 1975 to 1999. The results show that there was an extremely strong performance in terms of labour and total factor productivity growth in the province of Oulu during the 1990s and an increasing part of the productivity growth in the province of Oulu can be explained by the reshuffling of the input shares among incumbent plants. The evolution of the so-called ”between component” of aggregate productivity growth is therefore the key to the understanding of the recent surge in productivity growth in certain regions of Finland. We further show that the acceleration of productivity growth through plant level restructuring has entailed compression of productivity dispersion between plants within regions. We examine factors behind productivity-enhancing restructuring as well. There seems to be evidence that exports stimulate productivity-enhancing restructuring at the plant level of the Finnish regions. (JEL: O12, R23).

TIIVISTELMÄ

Tutkimuksessa hajotetaan Suomen läänien tuottavuuskasvu käyttäen toimipaikkatason aineistoa vuosilta 1975–1999. Työn tuottavuuden ja kokonaistuottavuuden kasvuvauhti on ollut poikkeuksellisen voimakasta Oulun läänissä 1990-luvulla. Kehitystä voidaan selittää ns. osuusvaikutuksen jatkuvalla vahvistumisella, mikä kuvastaa sitä, että tehokkaimmat toimipaikat ovat lisänneet osuuttaan panoskäytöstä ennen kaikkea Oulun läänissä. Osuusvaikutus on siten keskeinen tuottavuuden kasvuhajotelman tekijä alueellisesta näkökulmasta. Tuottavuuden kasvun kiihtyminen rakennemuutoksen kautta on johtanut toimipaikkojen välisten tuottavuuserojen kaventumiseen läänien sisällä. Tutkimuksessa tarkastellaan myös rakennemuutosta selittäviä tekijöitä. Korkealla vientiosuudella on ollut rakennemuutosta toimipaikoilla vahvistava vaikutus Suomen lääneissä.

1. INTRODUCTION

Regional disparities in Finland are sharp and persistent by their nature. This pattern repeats itself in productivity, which is obviously a fundamental element in economic progress. As Paul Krugman (1994, p. 13) has famously put it: "Productivity isn't everything, but in the long run it is almost everything". The same view holds from the regional perspective, because a region's ability to improve its standard of living in the long run without transfers of economic resources from other regions depends on its ability to raise its output per available labour and other factors of production.

In particular, Loikkanen, Rantala and Sullström (1998) discover that although inequality across the Finnish regions has increased over time when factor income is considered, it has remained much the same in the case of disposable income and final income, until an increase occurs in the mid-1990s, after the deep depression years in Finland. From a long-term perspective, the ultimate cause of the disparities in factor incomes across regions and the need of regional transfers of resources in the Nordic welfare states are the disparities in regional productivity performance.

The aim of the study is therefore to characterize the evolution of regional productivity growth in the Finnish provinces (excluding the province of Åland). By doing this, the following empirical investigation fills an important gap in the existing literature on regional dynamics. This investigation is based on the detailed plant-level data that covers the Finnish manufacturing industries. More precisely, regional labour productivity growth rates in the period from 1975 to 1999 are decomposed into various micro-level sources, which help us to identify some important aspects of economic growth.

The study appears in eight parts. The first section introduces the most important hypotheses about the evolution of regional productivity growth based on the recent empirical investigations on regional gross flows of jobs and workers. The major finding concerning regional job and worker flows has been the stylized fact that the reallocation of regional labour markets was concentrated in certain parts of the country during the 1990s. This pattern indeed suggests that productivity growth can exhibit an interesting regional dimension. The second section provides selected theoretical underpinnings for the decompositions of regional productivity growth. The third section provides a snapshot of the earlier empirical literature on the characteristics of regional productivity in Finland. The fourth section of the study provides the basics of the applied productivity growth decompositions. The fifth section provides a description of the plant-level data that covers the Finnish manufacturing industries. The sixth section documents the stylized features of regional productivity growth by using decompositions and productivity dispersion measures of regions. The seventh section provides an elaboration of regional productivity growth elements by applying regression techniques. In particular, the investigation is concentrated on the so-called "between component" of productivity growth. The focus on this component of aggregate growth can be motivated from different angles. The last section concludes the study.

2. MOTIVATION

Regional economies are incessantly in a state of continuous turbulence. During the past ten years a growing body of literature has emerged that employs longitudinal, linked employer-employee data in analysing the pace of job reallocation and worker flows (see, for example, Abowd and Kramarz, 1999). The dynamics of labour market adjustment at the plant-level of the economy can be captured by applying the measures of gross job and worker flows (see, for example, Davis and Haltiwanger, 1999).

Böckerman and Maliranta (2001) stress that the adjustment of the Finnish regional labour markets can be divided into two distinct phases during the 1990s. The rapid rise in the regional unemployment rate disparities during the slump of the early 1990s (from 1991 to 1993) can be explained by the sharp rise in the variation in job destruction as well as in separation rates of workers across regions.[1] At the same time, there was actually a decline in the regional disparities of job creation and hiring of workers. The highest level of job destruction at the bottom of the slump was in the provinces of Eastern and Northern Finland. For instance, in 1991 almost a third of the jobs within the private sector of the economy were destroyed in the province of Kainuu. In contrast to the adjustment of labour markets during the slump of the early 1990s, during the recovery of the economy (from 1994 to 1997) there was a decline in the regional disparities in job destruction rates and in separation rates of workers, but an increase in the regional disparities of job creation rates and hiring rates of workers.

On the other hand, Maliranta (2001a) has argued that job destruction in low and job creation in high productivity plants has positively contributed to the aggregate productivity of Finnish manufacturing since the late 1980s. In particular, as a consequence of the restructuring, the level of labour productivity and total factor productivity in Finnish manufacturing had reached the level of the U.S. by the end of the 1990s (see Maliranta, 2001b). The empirical findings obtained from the measures of gross flows of jobs and workers are therefore in keeping with the conjecture that this productivity-enhancing restructuring has had an interesting regional dimension that needs to be addressed in detail by using plant-level data. This study focuses on the productivity-enhancing plant level restructuring and its role in regional productivity growth.[2]

3. THEORETICAL UNDERPINNINGS

One explanation of the regional concentration of job destruction during the slump of the early 1990s is the presence of the fatter left-hand tail of low-productivity jobs in Eastern and Northern Finland. This means that the rapid economic slowdown of the early 1990s that hit all regions of Finland caused a more intensive time of “cleansing” in Eastern and Northern Finland compared with Southern Finland, outlined in the model by Caballero and Hammour (1994), when outdated or unprofitable techniques were pruned out of the production system. The empirical findings about the concentration of job creation, in turn, suggest that jobs destroyed during a slump are disproportionally reallocated during the recovery to regions that have favourable conditions for job creation. Those factors are likely to include a skilled labour force, exposure to foreign markets and technological spillovers from surrounding firms that are fuelled by agglomeration, to list some of the most obvious candidates.

4. PREVIOUS RELATED STUDIES

The earlier empirical research into the determination of regional productivity in Finland can be summarized in a nutshell as follows. Maliranta (1997a) provides selected fundamental patterns of productivity within manufacturing industries across provinces in Finland. The results show that the level of labour productivity is at its highest in the province of Uusimaa and Northern Finland. In contrast, total factor productivity is definitely highest in the province of Uusimaa. Maliranta (1997b) provides an unpublished empirical evaluation for the factors in Finnish regional labour productivity within manufacturing industries. However, the study does not include the decomposition of productivity growth at the establishment level of the economy.

Lehto (2000) discovers that investments in R&D have large regional impacts on productivity in the Finnish regions. Böckerman (2002) relates regional labour productivity to industry structure, demographic factors and the variables that capture the reorganization of labour markets. The data covers 85 Finnish regions over the period of 1989–1997. Industry structure is an important determinant of labour productivity in the Finnish regions. In particular, the emerging new economy in terms of ICT manufacturing yields an increase in labour productivity measured by the value-added divided by the total hours of work of the regions, but the positive impact of ICT manufacturing is tightly restricted to its direct contribution.

Kangasharju and Pekkala (2001) report that there was an increase in regional disparities in labour productivity across the Finnish regions during the 1990s. In addition, they discover that the manufacturing industries have been the most important segment of the Finnish economy in the increase of regional disparities. In particular, this pattern of adjustment provides the motivation to focus on the manufacturing industries in the following decompositions of labour productivity growth. In a related study, Susiluoto and Loikkanen (2001) provide a empirical study into the private sector inefficiency of 83 Finnish labour market areas from 1988 to 1999 by using Data Envelopment Analysis (DEA), which is a non-parametric linear programming method. The results indicate that the more efficient regions tend to be in the southern part of the country. On the other hand, the most inefficient regions are small, usually peripherally located, and their economic development has been weak during the 1990s.

5. EMPIRICAL STRATEGY

Aggregate productivity level P in year t is defined as follows:[3]

(1) $$P_t = \frac{Y_t}{X_t} = \frac{\sum_i Y_{it}}{\sum_i X_{it}},$$

where Y is output, X is input and i denotes the plant. In order to measure labour productivity, input X is measured here by hours worked and Y is value added. In the case of total factor productivity (TFP) input X is an index of various types of inputs. We use the simple Cobb-Douglas formula:

(2) $$X = \prod_j X_j^{\alpha_j},$$

where j denotes input type and α is a parameter. We require that $\sum_j \alpha_j = 1$. The input index includes labour (L) and capital (K). Output elasticity of labour (i.e. α_L) is defined as the proportion of labour compensation (wages plus supplements) to value added. Output elasticity of capital α_K is then one minus α_L.

In this study we focus on the sources of productivity growth. We calculate the annual aggregate productivity growth rate in year t by using the following formula:[4]

(3) $$\frac{\Delta P_t}{\overline{P}_t} = \frac{P_t - P_{t-1}}{(P_t + P_{t-1})/2}.$$

This provides a very close approximation to the log-difference of aggregate productivity that is commonly used in the analysis of aggregate productivity growth. We consider the micro-level components of productivity growth among continuing plants (i.e. we use successive, pair-wise balanced panels).[5] Then our measure of aggregate productivity (aggregate) change can be broken down into various additive components in the following way:

(4) $$\frac{\Delta P_t^C}{\overline{P}_t^C} = \sum_{i\in C} \overline{w}_{it} \frac{\Delta P_{it}}{\overline{P}_{it}} + \sum_{i\in C} \Delta w_{it} \frac{\overline{P}_{it}}{\overline{P}_t^C} + \sum_{i\in C} \overline{w}_{it} \left(\frac{\overline{P}_{it}}{\overline{P}_t^C} - 1 \right) \frac{\Delta P_{it}}{\overline{P}_{it}},$$

where C (continuing plants) denotes that only those plants are included in the calculations that are observed both in year t and t-1. The weight of plant i (w_{it}) is the plant's input share, i.e. $w_{it} = X_{it}/\Sigma X_{it}$. In this decomposition formula the average share in the initial and final year is used (indicated by $\overline{w}_{it}$).

The first term in the right-hand side of the equation (4) indicates the productivity growth rate within plants (withbj). The second term, the between component (betwbj), is the main focus of the study.[6] It specifies how much the plant-level restructuring contributes to aggregate productivity growth. It is positive when relatively high-productivity plants expand their share of input usage.

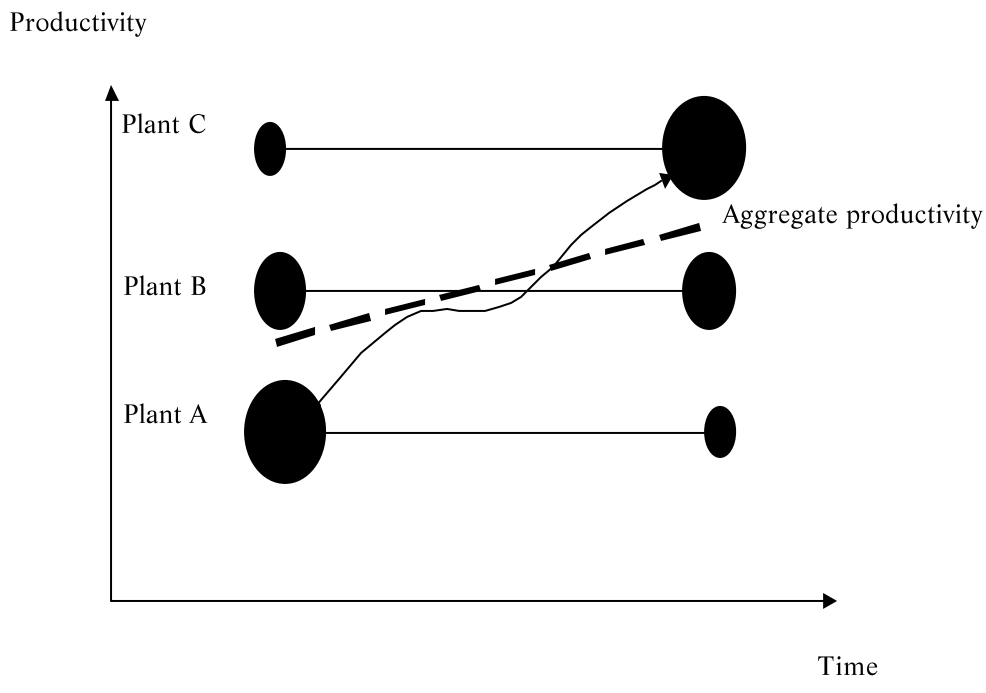
Figure 1 provides an illustration of the between component in a region which has three plants. The size of a ball indicates the amount of input usage. The level of productivity is constant within each plant. The aggregate productivity level, which is an input-weighted average of the plant productivity level, rises, as is indicated by an upward sloping dashed line. This is because weights (input shares) are changing, owing to reallocation of inputs from the low productivity plant to the high productivity plant. The so-called "between component" quantifies this effect.

Maliranta (2001a) shows that the between component usually varies, quite a similar way with the entry (entry) and the exit (exit) components of productivity growth. This means that the so-called "between component" appears to be a suitable indicator of the process of "creative destruction" à la Schumpeter (1942), especially when we remember inaccuracies we are bound to have when identifying entries and exits of plants. In particular, entries and exits observed in data include true as well as some artificial births and deaths, possibly in somewhat varying proportions. The series of the entry and exit components can therefore be argued to be subject to less reliability. The fact that the entry and exit components vary with the between component is consistent with the view that entry and exit of plants is a time-consuming process.[7]

However, it is worth noting that the between component may be linked to the changes in the productivity dispersion when the dispersion is measured with input weights. If there are a lot of jobs in very inefficient, low productivity plants then labour input weighted productivity dispersion is high and input weighted productivity average low. Input weighted productivity dispersion declines, if there is a cleansing effect in operation at the left-hand tail of the productivity dispersion. This is the case when the resource shares move from low productivity units to average and high productivity units. Then the productivity dispersion narrows. As this type of reallocation of resource shares is reflected as a positive between component, we might expect a negative correlation between the change in the productivity dispersion and the between component.[8]

The last component in the equation (4) can be called the catching up (catchbj) term.[9] If the size and the productivity level are mutually uncorrelated, a negative value of this component suggests that plants that have a relatively low productivity level are able to catch up, thanks to the above-average productivity growth rate. Therefore it can be used as an indicator of the productivity converge.[10] In other words, negative values should predict narrowing productivity dispersion.

Figure 1. An illustration of the between component in a region of three plants. The dashed line indicates the evolution of aggregate productivity of the region. The magnitude of the balls shows the amount of input usage in each of the plants.



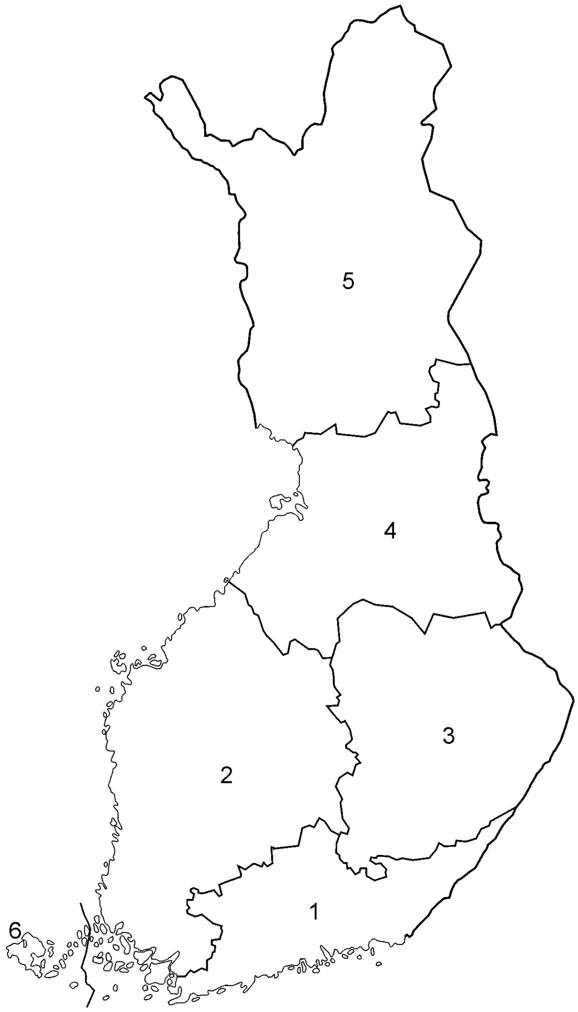
6. THE DATA

The measures for productivity growth rates and micro-structural components of aggregate productivity growth are calculated by using a detailed plant-level panel data set constructed especially for economic research purposes. The data is based on the annual Industrial Statistics survey that basically covers all Finnish manufacturing plants employing at least five persons up to 1994. Since 1995 it basically includes all plants owned by firms that have no less than 20 persons. In order to ensure comparability over the whole period up to the year 1998, we have dropped plants with fewer than 20 persons when generating the dispersion series.[11] The focus on the manufacturing sector naturally neglects the reallocation between sectors of the Finnish economy.

In the labour and total factor productivity indicators, output is measured by value added. Nominal output measures are converted into end-year prices by means of industry-specific producer price indexes. Labour input is measured by total hours worked. Capital stock, which is used as a measure of capital input, is estimated by using the perpetual inventory method and assuming 10 percent annual depreciation (see Maliranta, 2001a).

We have followed a similar procedure as Mairesse and Kremp (1993) when defining outliers. Those plants are dropped whose log productivity differs more than 4.4 standard deviations from the input weighted industry-average in the year in question.[12] Finland is divided into six provinces (the so-called NUTS2-level in the European Union). Figure 2 shows the geographic location of these provinces in Finland.

Figure 2. The location of the provinces in Finland. The provinces of Finland are as follows: 1=Southern Finland, 2=Western Finland, 3=Eastern Finland, 4=the province of Oulu, 5=the province of Lapland, and 6=the province of Åland (Source: Statistics Finland).



7. STYLIZED FEATURES OF REGIONAL PRODUCTIVITY

7.1. The level of productivity

There are indeed large disparities in the level of labour productivity across the regions in Finland. The highest level of labour productivity was in the providence of Oulu in 1976 (Table 1). Maliranta (1997a) shows that the high-level of labour productivity in the province of Northern Finland from 1990 to 1994 can be explained by high capital intensity in the region. In contrast, the lowest level of labour productivity was in the province of Eastern Finland in 1976.

There has been some convergence in labour productivity across regions during the past few decades. Thus, the province of Eastern Finland has been able to perform better than the province of Southern Finland in terms of labour productivity growth. The productivity gap of Eastern Finland is therefore nowadays narrower with respect to the province of Southern Finland than it used to be back in 1976. The process of convergence has been, however, far from uniform. In particular, the province of Lapland has actually fallen behind with respect to the province of Southern Finland.

The highest level of labour productivity was in the province of Oulu in 1999 (Table 2). The level of labour productivity is about twenty per cent higher in the province of Oulu than in the province of Southern Finland. The outstanding success of province of Oulu in terms of labour productivity growth can most likely be explained by the cluster of information technology that increased its share of value added within the Finnish manufacturing industries during the 1990s. The ICT sectors have definitely been the main strength of the recovery from the great slump of the 1990s (see IMF, 2001). In contrast, the lowest level of labour productivity was in the province of Lapland in 1999.

7.2. The decompositions of productivity growth

The decompositions of productivity growth for incumbents reveal the underlying dynamics and the heterogeneity at the plant level of the regions.[13] These decompositions indicate that the labour productivity growth rate was extremely rapid in the province of Oulu during the past two episodes of this study (i.e. 1991–1994 and 1995–1999) (Table 3). In particular, in the province of Oulu, there was a strong positive contribution from the so-called “between component” of the decomposition to the measure of labour productivity growth, which constitutes a measure of restructuring between the plants of the region. In other words, the population of relatively high-productivity plants expanded its share of input usage in the province of Oulu during the 1990s. The most striking finding is that this effect had an accelerating impact on labour productivity growth. The dynamics that comes from the between component did not, therefore, dry up during the recovery of the great slump of the early 1990s. In other words, there is no empirical evidence for the “chill” in the pace of restructuring, as discussed by Caballero and Hammour (2000), in the province of Oulu after the great slump of the early 1990s.

There is therefore empirical evidence that so-called creative destruction has played an important role in the increase of labour productivity growth in the province of Oulu. There was an increase in the between component in all other provinces of Finland during the slump (i.e. 1991–1994), but the acceleration of restructuring between plants has, in a way, melted away during the recovery. The province of Oulu is also highly interesting in the sense that the contribution of between component to labour productivity growth was negative during the episodes 1976–1980 and 1981–1985. Since then the situation has turned upside down. In contrast to the situation in the province of Oulu, the contribution of the between component to the rate of labour productivity growth was strongly negative during the recovery of the Finnish economy (i.e. 1995–1999) in the province of Lapland, but was, however, quite high during the slump of the early 1990s.

The decompositions further reveal that the so-called ”catching-up” term has been positive in most provinces and during most episodes (Table 3). This pattern suggests that the population of plants with low labour productivity has not been able to perform exceptionally well in terms of the productivity growth rate. However, the results for TFP (i.e. the negative values of the catching-up component) are in line with the conjecture that there has been some convergence in performance through the above-average growth rates among low productivity plants (Table 4).[14]

All in all, the empirical evidence strongly suggests that the evolution of the so-called ”between component” is the key to the understanding of the recent surge in labour productivity growth of certain regions of Finland. In other words, the between component has definitely been the proximate driving force of different fortunes of regions in terms of the labour productivity growth rate during the 1990s. The decomposition of TFP growth broadly reveals the same pattern. In particular, it should be noted that the between component is generally higher when the input measure includes both labour and capital as in the case of TFP (see Maliranta, 2001a). This pattern of adjustment suggests that the reallocation of capital constitutes an important element of restructuring at the plant level of the regions (see, e.g. Ramey and Shapiro, 1998).

7.3. The role of entry and exit

There is some role for the turnover of plants through the entry and exit of plants in the determination of labour productivity growth in the regions of Finland despite the stylized feature that restructuring among continuing plants has been a somewhat more important driving force of productivity growth than net entry during the period of the investigation.[15] There was, therefore, an increasing positive contribution from the exits of plants in the provinces of Southern Finland, Western Finland, Eastern Finland and in the province of Oulu, to the measure of labour productivity growth, during the years 1995-1999 compared with the period of depression (i.e. 1991-1994) (Table 3). In other words, these provinces have been characterized by the process of exits of low productivity plants during the recovery from the great slump of the early 1990s that has accelerated the growth rate of labour productivity.[16] In the province of Lapland, however, in contrast to this broad pattern of adjustment, the contribution of exits of plants has been *negative* to the growth rate of labour productivity during the years 1995–1999.

The decomposition of input-weighted TFP growth reveals a more complicated picture (Table 4). Thus, the contribution of exits of plants was *negative* to the growth rate of TFP even in the province of Oulu during the slump years of the early 1990s. When it comes to the entry effect, the labour productivity indicator shows negative values usually, whereas the TFP indicator more often suggests that entry has a positive effect on aggregate productivity. This is to say that it seems to be important to control the use of capital input when one is analysing entries since new plants initially seem to have initially relatively low capital intensity and high capital productivity.

7.4. The evolution of productivity dispersions

The dispersion of labour productivity reveals other important aspects of the dynamics of labour productivity growth (Table 5). In particular, one interesting pattern of the 1990s is that there was a strong narrowing tendency in the dispersion of labour productivity among plants in the province of Oulu and other provinces at the same time as there was an accelerating positive contribution from the so-called “between component” to labour productivity growth. These observations are nicely in line with the notion that there was process-intensive restructuring in terms of the so-called “creative destruction” in the Finnish regions during the 1990s, especially, in the province of Oulu.

In other words, the empirical evidence is in line with the thinking that the province of Oulu has indeed been characterized by a process of cleansing of the fat left-hand tail of low-productivity jobs that has yielded an increase in the growth rate of labour productivity in that region. Regressions give additional support to the notion that an increase in the magnitude of the so-called "between component" is certainly able to yield a compression to the dispersion of input-weighted labour productivity at the plant level of the regions (Table 6).[17] In particular, the effect is realized with a lag of two years. This pattern of productivity growth across regions was, in fact, already hinted at by the measures of gross flows jobs and workers, which showed that there was a sharp rise in the rate of job destruction in Eastern and Northern Finland compared with Southern Finland during the slump of the early 1990s.

Table 1. The level of labour productivity in the provinces of Finland in 1976 (Southern Finland=100).

Southern Finland	100.00
Western Finland	116.50
Eastern Finland	90.22
Oulu	126.26
Lapland	100.46

Table 2. The level of labour productivity in the provinces of Finland in 1999 (Southern Finland=100).

Southern Finland	100.00
Western Finland	95.43
Eastern Finland	96.28
Oulu	118.68
Lapland	95.22

Table 3. The decomposition of the labour productivity growth rates among incumbents, annual averages, % (and the contribution of entry and exit of plants).

	1976–1980	1981–1985	1986–1990	1991–1994	1995–1999
Southern Finland					
AGGREGATE	3.10	4.20	6.35	3.74	2.97
WITHBJ	2.50	2.77	4.96	1.44	2.74
BETWBJ	0.42	0.72	1.19	1.63	0.98
CATCHBJ	0.18	0.71	0.21	0.67	-0.76
ENTRY	-0.08	0.01	-0.23	-0.14	0.05
EXIT	0.20	0.17	0.74	0.56	1.28
Western Finland					
AGGREGATE	3.62	4.15	5.61	3.20	4.93
WITHBJ	3.51	3.14	4.38	0.86	4.06
BETWBJ	-0.12	0.83	0.60	1.07	0.53
CATCHBJ	0.23	0.18	0.63	1.28	0.34
ENTRY	-0.66	-0.35	-0.14	-0.35	-0.72
EXIT	0.50	0.83	0.96	1.04	1.27
Eastern Finland					
AGGREGATE	3.22	3.50	5.60	6.96	3.50
WITHBJ	4.20	2.70	4.14	3.96	3.23
BETWBJ	0.47	0.26	0.53	1.09	0.35
CATCHBJ	-1.45	0.55	0.93	1.90	-0.08
ENTRY	-0.24	-0.59	-0.64	-0.42	-0.93
EXIT	-0.30	0.52	1.36	1.15	1.85
Oulu					
AGGREGATE	1.92	3.36	5.14	9.35	8.70
WITHBJ	1.35	2.99	6.79	3.59	6.46
BETWBJ	-0.49	-0.64	0.60	1.00	2.00
CATCHBJ	1.07	1.02	-2.25	4.75	0.24
ENTRY	-1.09	-0.55	0.10	-0.31	-1.94
EXIT	1.14	0.86	0.59	1.09	1.82
Lapland					
AGGREGATE	4.15	1.80	10.82	6.28	1.86
WITHBJ	5.56	1.18	8.51	5.20	1.18
BETWBJ	-0.47	0.30	0.03	1.58	-1.48
CATCHBJ	-0.94	0.32	2.29	-0.50	2.15
ENTRY	-0.91	-0.54	-0.88	-0.94	-1.12
EXIT	0.65	1.11	1.24	2.89	-1.18

Table 4. The decomposition of TFP growth rates among incumbents, annual averages, % (and the contribution of entry and exit of plants).

	1976–1980	1981–1985	1986–1990	1991–1994	1995–1999
Southern Finland					
AGGREGATE	-0.21	0.65	2.28	2.33	0.28
WITHBJ	-0.21	-0.55	0.95	1.81	0.93
BETWBJ	1.36	1.08	1.35	2.35	1.29
CATCHBJ	-1.36	0.11	-0.02	-1.83	-1.95
ENTRY	1.01	0.45	0.47	0.84	0.64
EXIT	0.17	-0.17	-0.06	-0.07	-0.13
Western Finland					
AGGREGATE	0.31	0.82	1.96	1.94	2.00
WITHBJ	0.79	-0.03	1.33	0.61	1.74
BETWBJ	1.17	0.85	1.31	1.67	1.60
CATCHBJ	-1.65	-0.01	-0.67	-0.34	-1.34
ENTRY	0.68	0.25	0.93	0.46	0.62
EXIT	0.18	0.40	0.17	0.10	-0.06
Eastern Finland					
AGGREGATE	0.09	0.63	2.95	5.01	0.79
WITHBJ	2.46	-0.51	1.67	6.30	1.06
BETWBJ	-0.13	1.35	1.74	0.62	0.55
CATCHBJ	-2.24	-0.20	-0.47	-1.91	-0.82
ENTRY	0.46	0.20	0.42	0.36	0.84
EXIT	-0.68	0.10	0.11	0.35	0.51
Oulu					
AGGREGATE	0.65	1.01	3.04	7.24	2.42
WITHBJ	-0.74	0.13	4.61	5.11	1.04
BETWBJ	0.64	0.22	1.74	2.77	1.49
CATCHBJ	0.75	0.66	-3.32	-0.64	-0.11
ENTRY	0.50	0.12	0.90	0.26	0.68
EXIT	-0.08	0.33	-0.27	-0.25	0.72
Lapland					
AGGREGATE	6.80	0.62	4.28	11.76	-1.58
WITHBJ	8.81	-0.10	2.74	14.15	-1.79
BETWBJ	0.65	0.89	1.12	1.73	1.42
CATCHBJ	-2.66	-0.17	0.42	-4.12	-1.21
ENTRY	-2.07	0.02	0.30	0.32	0.17
EXIT	-0.08	0.23	0.01	0.01	0.26

Table 5. The dispersion of labour productivity among incumbents.

	1976–1980	1981–1985	1986–1990	1991–1994	1995–1999
Southern Finland					
STDLNPL	65.30	70.89	68.36	66.75	61.10
P50-P10	68.23	75.22	67.85	65.68	54.01
Western Finland					
STDLNPL	60.76	66.71	64.81	66.44	55.48
P50-P10	68.90	73.40	71.49	70.12	52.65
Eastern Finland					
STDLNPL	63.28	62.01	58.49	75.75	54.68
P50-P10	142.59	131.88	133.10	145.46	125.75
Oulu					
STDLNPL	69.63	78.88	66.99	74.76	64.44
P50-P10	155.00	167.71	152.30	173.24	149.22
Lapland					
STDLNPL	62.11	73.65	69.95	90.58	67.15
P50-P10	73.03	68.49	58.69	67.05	44.98

Notes: STDLNPL refers to the standard deviation of the logarithm of labour productivity across plants. The dispersion measures are input weighted. P50-P10 refers to the difference between 50th percentile and 10th percentile of logarithm labour productivity across plants.

Table 6. The estimation results for the determination of dispersion of labour productivity across plants (dependent variable: the difference in the standard deviation of logarithm of labour productivity across plants).

	Model 1		Model 2	
Variables	Coefficients	t-statistics	Coefficients	t-statistics
BETWBJ	1.24	3.52	3.14	1.57
BETWBJ (t-1)	0.77	1.35	1.54	0.72
BETWBJ (t-2)	-2.59	-4.38	-5.31	-2.67
CATCHBJ	..	..	0.60	0.96
CATCHBJ (t-1)	..	..	0.14	-0.21
CATCHBJ (t-2)	..	..	-1.34	-2.08
AR(1)	-0.47		0.47	
Number of observations	100		100	

Notes: The models are estimated over the period from 1976 to 1999 by GLS, in which heteroskedasticity with cross-sectional correlation and common AR(1) is allowed. Model 1 is estimated with the dummy variables that are attached to years and provinces. The same results as reported as Model 1 hold when the model is estimated by including a common trend across provinces or when the model is estimated without any controls for the variation that arises from the years from 1976 to 1999. Model 2 is estimated with trends that are specific to the provinces of Finland.

8. EXPLANING REGIONAL DIFFERENCES

By using decompositions of the productivity growth rate, we have discovered that the between component has been an extremely important element in the acceleration of regional productivity growth since the 1980s. This source of aggregate economic growth deserves some extra notice, as it calls for job creation and destruction and the concentration of investments into certain plants characterised by high labour and capital productivity. Moreover, we have shown that this factor of growth is related to the development of productivity dispersion within the Finnish regions, which, in turn, seems to be associated with wage dispersion (see Dunne, Haltiwanger and Troske 2000; Maliranta, 2001b).

These notions invite us to explore the economic fundamentals that are behind the evolution of the between component of regional labour productivity growth decomposition. In particular, we investigate, in the following, the determination of the between component by explaining it by means of a vector of the economic fundamentals that includes the export shares (the variable EXPSH) and a measure of R&D-intensity (the variable R&D) of the Finnish provinces during the past few decades.

The motivation for these variables emerges from the notion that the export share is a proxy variable for exposure to competition from foreign markets. In particular, the recovery from the great slump of the early 1990s was indeed an export-led expansion. This means that exposure to competition from foreign markets most likely shaped the pace of evolution of restructuring in the Finnish regions during the 1990s. Investments in research and development are likely to be an important catalyst for the reorganization and the reallocation of scarce resources in the population of plants within regions. This feature means that there should therefore be more turbulence in the provinces measured by the between component that have a high R&D intensity compared with the rest of the regions.

The export shares and the R&D intensities of the Finnish provinces are reported in Table 7. The export share of the manufacturing industries is at its lowest level and the R&D intensity of the Finnish regions is at its highest level in the province of Southern Finland. However, these average figures mask, for instance, the fact that there has been a rapid increase in the export share of the manufacturing industries that are located in the province of Oulu during the period of investigation.

Table 7. Export shares and R&D intensities in the manufacturing industries for the provinces of Finland (the variable EXPSH is reported as average from 1976 to 1999 and the variable R&D is reported as average from 1985 to 1999).

Provinces	EXPSH	R&D
Southern Finland	28.4	2.8
Western Finland	38.1	1.7
Eastern Finland	34.1	1.3
Oulu	34.7	1.3
Lapland	35.9	2.2

Notes: The EXPSH variable is defined as nominal exports divided by nominal sales in a region. The R&D variable gauges the average R&D intensity of the plants (weighted by nominal gross output) operating in the region. The R&D intensity (R&D expenditures per nominal gross output) of a plant is defined by the R&D intensity of the owner firm. This approach can be motivated by the assumption that technological knowledge flows without any friction within the same firm. R&D surveys are not available for the years 1986, 1988 and 1990. The applied measure of R&D intensity for those missing years is therefore calculated simply by taking the arithmetic average of two neighbouring years.

The estimation results are reported in Table 8. The results provide some support for the view that the evolution of the so-called "between component" has indeed been driven by the export shares of the Finnish regions. In particular, an increase in the export share seems to yield a rise productivity-enhancing restructuring among incumbents measured by the between component with a lag of two years. The reason for this feature is most likely the fact that exposure to foreign markets generates more intensive competition that induces restructuring among the plants of the regions.

When it comes to the role of R&D, our empirical evidence does not provide any support for the notion that investments in R&D are an important stimulus of the between component of labour productivity that is at odds with the findings in Maliranta (2001a; 2002). There are at least two potential problems in our data that may prevent us from finding a relationship between R&D and the between component. The estimation period is indeed quite short in the case of Model 2, which is reported in Table 8. The positive effect of R&D on productivity can be expected to emerge after a considerable lag. By using a panel of countries and industries, Rouvinen (1999) shows that it takes three or four years before R&D is reflected in the aggregate productivity growth rate. In turn, Maliranta (2001a; 2002) discovers that it takes three to five years before R&D contributes to aggregate productivity through plant-level restructuring. The second problem is that our regional R&D-intensity measure may be inaccurate.

Table 8. The estimation results for the determination of the between component for the provinces of Finland (dependent variable: betwbj).

	Model 1		Model 2	
Variables	Coefficients	t-statistics	Coefficients	t-statistics
EXPSH	-0.11	-2.76	-0.03	-1.97
EXPSH (t-1)	-0.01	-0.32	..	..
EXPSH (t-2)	0.08	7.69	..	..
R&D	..	..	-0.34	-1.71
R&D (t-1)	..	..	0.08	0.44
AR(1)	0.06		-0.01	
Number of observations	100		70	

Notes: The models are estimated by GLS, in which heteroskedasticity with cross-sectional correlation and common AR(1) is allowed. Model 1 is estimated over the period from 1976 to 1999 with the dummy variables that are attached to years. The results remain the same when the dummy variables to the provinces of Finland are also attached to Model 1. Model 2 is estimated from 1985 to 1999 with the dummies that are attached to the provinces of Finland.

9. CONCLUSIONS

The aim of the study was to decompose the regional productivity growth rate in the Finnish provinces by using detailed plant-level data from 1975 to 1999. The results show that there was an extremely strong performance in terms of labour productivity growth in the province of Oulu during the 1990s and an increasing part of labour productivity growth in the province of Oulu can be explained by the reshuffling of the input shares among incumbent plants.

The evolution of the so-called ”between component” of productivity growth decompositions is therefore the key to the understanding of the recent surge in labour productivity growth in certain parts of Finland. In other words, there is empirical evidence in favour of the perspective that so-called creative destruction shaped the evolution of the labour productivity growth rate across the regions of Finland during the 1990s. The acceleration of productivity growth through plant level restructuring has indeed entailed compression of productivity dispersion between plants within regions. In turn, there is empirical evidence that the development of the so-called ”between component” has been driven by the export shares of the regions. In particular, an increase in a region’s export share seems to generate a reallocation of inputs among incumbent plants in a productivity-enhancing way.

REFERENCES

Abowd, J.M. and F. Kramarz (1999). “The analysis of labor markets using matched employer-employee data.” In *Handbook of Labour Economics,* Vol. 3B, 2629–2710. Eds. O. Ashenfelter and D. Card. Amsterdam: North-Holland.

Bartelsmans, E.J. and M. Doms (2000). “Understanding productivity: lessons from longitudinal microdata.” *Journal of Economic Literature* XXXVIII, 596–594.

Bernard, A. B. and C.I. Jones (1996). “Productivity across industries and countries: time series theory and evidence.” *The Review of Economics and Statistics* LXXVII, 135–145.

Böckerman, P. (2002). “Understanding regional labour productivity in a Nordic welfare state: does ICT matter?”. Discussion Papers, 798. The Research Institute of the Finnish Economy.

Böckerman, P. and M. Maliranta (2001). “Regional disparities in gross job and worker flows in Finland.” *Finnish Economic Papers* 14, 83–104.

Caballero, R.J. and M.L. Hammour (1994). “The cleansing effect of recessions.” *The American Economic Review* 5, 1350–1368.

Caballero, R.J. and M.L. Hammour (2000). “Institutions, restructuring, and macroeconomic performance.” Unpublished. MIT.

Davis, S.J., and J. Haltiwanger (1999). “Gross job flows.” In *Handbook of Labour Economics,* Vol. 3B, 2711–2805. Eds. O. Ashenfelter and D. Card. Amsterdam: North-Holland.

Dunne, T., J. Haltiwanger, and L. Foster (2000), “Wage and productivity dispersion in U.S. manufacturing: the role of computer investment.” Working Papers 7465. National Bureau of Economic Research.

Foster, L., J. Haltiwanger and C. J. Krizan (2001). ”Aggregate productivity growth: lessons from microeconomic evidence.” In *New Developments in Productivity Analysis. Studies in Income and Wealth Volume 63.* Eds. C.R. Hulten, E.R. Dean and M.J. Harper. Chicago: The University of Chicago Press.

IMF (2001). Finland: Selected Issues.

Kangasharju, A., and S. Pekkala (2001). “Regional economic repercussions of an economic crisis: a sectoral analysis.” Discussion Papers 248. Government Institute for Economic Research.

Kiander, J., and P. Vartia (1996). “The great depression of the 1990s in Finland.” *Finnish Economic Papers* 1, 72–88.

Krugman, P. (1994). *The Age of Diminished Expectations.* Cambridge, MA.: The MIT Press.

Lehto, E. (2000). “Regional impacts of R&D and public R&D funding.” Studies 79. Labour Institute for Economic Research.

Loikkanen, H.A., A. Rantala and R. Sullström (1998). “Regional income differences in Finland, 1966–96.” Discussion Papers 181. Government Institute for Economic Research.

Mairesse, J., and E. Kremp (1993). “A look at productivity at the firm level in eight French service industries.” *Journal of Productivity Analysis* 4, 211–234.

Maliranta, M. (1997a). “Plant productivity in the Finnish manufacturing. Characteristics of high productivity plants.” Discussion Papers 612. The Research Institute of the Finnish Economy.

Maliranta, M. (1997b). ”Productivity performance in regions. Some findings from Finnish manufacturing.” Unpublished. The Research Institute of the Finnish Economy.

Maliranta, M. (1997c). “Suomen, Yhdysvaltojen ja Ruotsin metalliteollisuuden tuottavuusvertailu.” (In Finnish). In *Metalliteollisuuden tuottavuus kansainvälisestä näkökulmasta,* Eds. MET and McKinsey & Company. Helsinki: Metalliteollisuuden Keskusliitto.

Maliranta, M. (2001a). “Productivity growth and micro-level restructuring. Finnish experiences during the turbulent decades.” Discussion Papers 757. The Research Institute of the Finnish Economy.

Maliranta, M. (2001b). “Tuottavuutta mikrotason rakennemuutoksesta.” (In Finnish). The Research Institute of the Finnish Economy, Suhdanne 2/2001, 80–83.

Maliranta, M. (2002). “From R&D to productivity through plant-level restructuring.” Discussion Papers 795. The Research Institute of the Finnish Economy.

Ramey, V.A. and M.D. Shapiro (1998). “Capital churning.” Unpublished. University of California, San Diego, Department of Economics.

Rigby, D.L. and J. Essletzbichler (2000). “Impacts of industry mix, technological change, selection and plant entry/exit on regional productivity growth.” *Regional Studies* 34, 333–342.

Rouvinen, P. (1999). “Issues in R&D-productivity dynamics: causality, lags, and dry holes.” Discussion Papers 694. The Research Institute of the Finnish Economy.

Schumpeter, J.A. (1942). *Capitalism, Socialism, and Democracy.* Harvard: Harper and Row.

Susiluoto, I. and H.A. Loikkanen (2001). “Seutukuntien taloudellinen tehokkuus 1988–1999”. (in Finnish). Research Series 2001:9. City of Helsinki Urban Facts.

[1] Kiander and Vartia (1996) provide a description of the great slump of the 1990s in Finland.

[2] To take an example, the province of Kainuu (defined at the NUTS3 level of the European Union) is a part of the province of Oulu in the following decomposition of productivity growth in the regions of Finland. This means that the following investigation emphasizes the view that there was a great deal of reallocation of scarce resources within the provinces in Northern Finland during the 1990s.

[3] Bartelsman and Doms (2000), and Foster, Haltiwanger, and Krizan (2001) provide detailed surveys of the literature that have investigated the evolution of productivity growth at the plant level of the economy by using these kind of decompositions.

[4] Nominal output figures are converted into the end-year (*t*) prices by using the producer's price index at the 2- or 3-digit industry level when computing productivity changes between pairs of successive years. In this way, we avoid a fixed base year bias that will arise if a certain fixed base year is used and different price indexes are used for plants in different industries (see Maliranta, 2001a).

[5] The effect arising from entrants and exitors (net entry) can be measured by substracting the aggregate productivity growth rate among incumbents from the total aggregate productivity growth rate. This is the aggregate productivity growth rate among all plants. Thus, the total aggregate productivity growth rate is net entry plus productivity growth components among incumbents (see Maliranta 1997b; 2001).

[6] The name of this variable is due to the fact that it is the between component obtained by a modified version of the formula presented by Bernard and Jones (1996).

[7] The conclusion on the entries and exits of plants is based on the successive, pair-wise comparisions of productivity from year to year. The role of entries and exits of plants for the growth rate of productivity naturally increases as the time-horizon of the comparisions extends.

[8] Regarding the empirical evidence, see Maliranta (2001a).

[9] Catching up component (catchbj) is a term that is obtained by reformulating the decomposition formula presented by Bernard and Jones (1996) (see Maliranta, 2001a).

[10] If the relative productivity levels across size groups are reasonably stable over time, short-term variation in this component may reveal something interesting about the changes in the economic environment. This term can be expected to be low when the productivity-improving adjustment among low productivity plants is common.

[11] For robustness of the reported results, we have examined how sensitive the patterns of the dispersion series over time are to changes in the cut-off limit from 5 to 20 in the period 1975–1994. It turns out that patterns are indeed quite similar.

[12] In addition to this we have dropped 8 influential observations from those plants, about 10 000 in number, that appear at least once in the period from 1975 to 1998 when one is calculating total factor productivity components (14 in labour productivity computations). They have clearly erroneous information that is reflected, for example, so that the absolute values of between and catching up terms of equation (4) are quite large and have opposite signs.

[13] Rigby and Essletzbichler (2000) provide the decompositions of labour productivity growth for the US states over the period from 1963 to 1992.

[14] The assumption that the size and productivity level are uncorrelated among plants is more realistic in the case of TFP than labour productivity so that our catching up component can be expected to capture better the negative correlation between the productivity level and the growth rate (with a negative value) (see discussion in Maliranta, 2001a, 30–31).

[15] An important feature of the calculations is that this conclusion is based on the successive, pair-wise comparisions of productivity from year to year.

[16] It is worth noting that high positive exit components appear in the latter part of the 1990s, which was a period of strong growth in Finland.

[17] The variable catchbj gets a negative sign in the regressions. This result is in conflict with the notion that the 'catching up effect' should work in the same direction as the external restructuring implied by the between component.