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REGIONAL CONVERGENCE ACROSS THE FINNISH PROVINCES AND SUBREGIONS, 1960–94*

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This paper analyses the convergence of regional products in Finland using two different data sets. Firstly, β- and σ-convergence was estimated for the 12 Finnish provinces during 1960–94. Convergence was found to be strong in 1960–80, but after 1980 regional disparities started growing again. Secondly, a similar study was conducted for the 88 small-scale subregions in 1988–94. As with the provinces, the subregions' relative growth performance and cross-sectional convergence dynamics were evaluated using Markov chain transition matrices. No clear evidence for σ- or β-convergence was found here, but the dynamic analysis revealed a rapidly evolving distribution of gross regional products. Thus the type of regional classification and method used can markedly affect the results obtained in a convergence study. (JEL O4, R1)

1. Introduction

The convergence of incomes and productivity has been one of the most debated economic issues in recent years. The study of convergence is interesting because of its theoretical and practical implications. Theoretically, convergence analysis can help to distinguish between alternative growth theories according to their predictions about economic growth. In practice, on the other hand, studying convergence can be of assistance in planning and evaluating regional policy measures, as we gain insight into how existing regional economic differences have developed. Hence convergence has been widely studied across countries and regions. Many studies have concentrated on the convergence of personal incomes, but, alternatively, the convergence of regional GDP provides equally important information. In Finland, results concerning convergence of regional products have not previously been published, and thus this study sheds new light on the development of Finnish regional economic structure. Moreover, it is interesting to compare convergence rates at different regional levels and see whether convergence is faster at one level than another.[1]

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[1] *This assumption is quite sensible as it has been hypothesized that regional differences in incomes and economic structures are greater the smaller the regions into which a given country is divided (see, for example, Kangasharju and Alanen, 1998, or Magrini, 1999).*

The aim of this study was to assess the extent to which Finnish provinces and subregions have converged in terms of their per capita gross regional products (GRP). Two different data sets are used along with a number of different methods. The longer data set consists of the GRPs of the 12 Finnish provinces from 1960 to 1994. The second data set comprises the 88 small-scale subregions for which gross regional products have been collected from 1988 onwards. The latter data were produced only recently and provide a very interesting period for study, in view of the fact that the economic recession of the 1990s was the deepest in Finnish history since the Second World War. On the other hand, the boom in the late 1980s provides a good contrast with the recession years.[2] Hence this paper presents new information about regional convergence on both the provincial and subregional levels.

The present study illustrates various aspects of regional convergence. Firstly, σ- and β-convergence are estimated from the provincial data, using the classical cross-section method of Barro and Sala-i-Martin (1991). The main finding of this study is that regional growth and convergence behaviour changed dramatically around 1980. The first two decades (1960–80) show strong convergence and rapid economic growth, whereas the years after 1980 are characterized by slower, divergent growth, and there is a clear end to the convergence period. This finding is in line with a number of regional convergence studies performed in other European countries (see Hofer and Wörgötter, 1997; Neven and Goyette, 1995; Persson, 1997). Moreover, a similar change took place somewhat earlier (in the mid-1970s) among the U.S. states, Japanese prefectures and the OECD countries (Sala-i-Martin, 1996b). However, this result differs strikingly from earlier convergence studies in Finland (see Kangasharju, 1998b) where only a diminishing rate of convergence across the Finnish *subregions* was found in the 1980s. It is therefore concluded that the Finnish provinces and subregions show convergence properties which markedly differ from each other. The explanation for this could lie in the fact that the initial disparities between provinces are not as large as those between subregions, and thus there is less room for convergence in the first place, at least in absolute terms.

Interestingly, the role of territorial aggregation is also discussed in other recent studies. Magrini (1999) emphasizes the importance of choosing the most appropriate regional classification. His study of the European regions reveals that income convergence occurs across smaller (NUTS2) regions but not across larger ones (FURs). Similarly, Hofer and Wörgötter (1997) find that the rate of β-convergence in Austria is greater the less aggregated the regions. Moreover, Kangasharju and Alanen (1998) note that for the Nordic Countries a greater coefficient of variation and wider scope for convergence is connected to more disaggregated regional levels.

Secondly, this study uses the alternative method introduced by Quah (1993b) for the analysis of convergence and distributional dynamics. It is interesting to compare the results of this method with the classical cross-section approach, as Quah is one of the main opponents of cross-section growth regressions (see Quah, 1993a). Moreover, unlike cross-section regressions, this method takes into account situations where convergence occurs between some regions but not others. Using the above methods in the analysis enables comparisons between this and other similar studies (e.g. Kangasharju, 1998a and 1998b). When used in analysing subregional products, the classical cross-section method pointed towards a stationary situation with no apparent convergence or divergence. However, when the alternative method was used, it was found that the situation is far from stagnated and that considerable intra-distribution mobility on the level of the subregions occurred, but this mobility cannot be revealed by standard convergence analysis. In the case of the provinces, though, the alternative method supports the findings of the cross-section method. Hence both the regional classification and the method used can affect the results obtained in a convergence study.

The second section of this paper briefly in-

[2] *Real change in GDP was as much as –7,1 per cent in 1991 and –3,6 in 1992. The unemployment rate peaked at 18,4 per cent in 1994.*

troduces the theoretical background and empirical methods used in the study. Section 3 investigates the convergence behaviour of the provinces and section 4 that of the subregions. Finally, section 5 provides some discussion and future considerations, and concludes the paper.

2. Theoretical and empirical background of convergence analysis

Generally convergence is seen as an outcome of the neoclassical growth theory. According to the theory, for any set of economies, economic growth cannot continue indefinitely, but will eventually decline and the growth rates of the economies in that set converge towards a certain *steady state*, as the production function implies diminishing returns to capital. If the set of economies were very similar in terms of their economic structures, they would converge towards the same steady-state, and this would cause income disparities to diminish. In this case, convergence would be *absolute*. If, however, the economies are not identical, their steady states will differ, and the differences in income will not necessarily diminish even if (β-) convergence occurs. This concept is known as *conditional* convergence, where the steady state differences are proxied by a number of additional explanatory variables. (Barro and Sala-i-Martin, 1991)

Despite the recent criticism directed at neoclassical growth theory and cross-section regressions it can be argued that they provide at least a good starting point for the analysis of regional disparities, as they are straightforward to use and continue to be commonly employed in empirical studies of convergence. Using such an approach is also well suited to the regional context, as differences in regional steady states are generally much smaller than those between countries, factors of production move relatively freely and there is more rapid technological diffusion.

In a standard convergence analysis the existence of both *σ-convergence (*which refers to the narrowing of income disparities) and *β-convergence* (which tells whether poor economies are growing faster than rich ones) are studied. If conditioning variables are used, it can be determined whether the poor economies are approaching their own steady states at a faster rate than the rich economies are approaching theirs. Firstly, for σ-convergence to occur across a given set of economies, it is simply required that the standard deviation of per capita incomes diminishes over time. And, secondly, the estimation of β-convergence is conducted using a nonlinear least squares regression[3], applying the following empirical equation (1) derived from neoclassical theory (see e.g. Barro and Sala-i-Martin, 1995).

$$(1) \quad (1/T)\times\log(y_{i,t}/y_{i,t-T}) = a - [\log(y_{i,t-T})](1-e^{-\beta T})(1/T) + \text{other variables}$$

In the above equation, T is the length of the period under question and y denotes the per capita income of region i at the beginning (t-T) and end (t) of the period. The growth rate of an economy depends negatively on its initial income and declines as the difference between its steady state income level and actual income level diminishes. Convergence is said to occur when $\beta > 0$. The coefficient for the convergence parameter β is referred to as the annual rate of convergence. A number of additional explanatory variables can be included, if it is considered necessary to allow for differences in regional steady states. Note, however, that several potentially important variables, if included in the above regression, may suffer from the problem of endogeneity. Thus all the variables used in the analysis should be exogenous, meaning that they are not determined by regional growth rates. Interestingly, studies using this classical cross-section method have obtained very similar results in many different countries. Table 1 displays some of the main results of such regional studies.

[3] *OLS could also have been used, estimating the equation:* $\log(y_{i,t+T}/y_{i,t})/T = a - b\log(y_{i,t}) +$ *other explanatory variables. However, NLS gives precise estimates for β's whereas with OLS they need to be calculated from* $b = -(1/T)[1-\exp(-\beta T)]$*. See for example Sala-i-Martin (1996a) for a more exact description of estimation methods.*

Table 1: Rates of β-convergence in recent studies

AUTHOR(S)	SAMPLE AND PERIOD	ABSOLUTE β	CONDITIONAL β
Armstrong (1994)	82 European regions, 1950–90.	0,022	0,016
Barro and Sala-i-Martin (1995)	48 US States, 1880–1990.	0,017	0,022
	47 Japanese prefectures, 1930–90.	0,028	0,031
	90 European regions, 1950–90.	0,015	0,018
Hofer and Wörgötter (1997)	9 Austrian regions, 1961–89.	0,004	–
	84 Austrian districts, 1961–86.	0,010	0,023
Kangasharju (1998b)	88 Finnish subregions, 1934–93.	0,020	–
	88 Finnish subregions, 1964–93.	0,027	0,061
Persson (1997)	24 Swedish counties, 1906–90.	0,041	0,046

As indicated above, the present study also adopts an alternative approach to the analysis of regional growth and convergence. This method was introduced by Quah (1993b), who believes that the traditional cross-section approach described above does not reveal the dynamic features of growth processes. One advantage of Quah's method is that it does not require any assumptions about regional steady states, but reveals the existence of possible convergence clubs. In order to find out how the distribution of incomes evolves across a set of economies, Quah (1993b) forms a *Markov chain transition matrix (P)*, which describes how the cross-section distribution (d) transits from one state to another:

(2) $d_{t+1} = P \times d_t$.

Economies are divided into a number of income groups, between which mobility is observed. This matrix reveals how likely it is for economies in poor income groups to become rich, and, on the other hand, for rich economies to become poor. Convergence refers to the movement of probability mass of the distribution towards the middle income group. If, however, mobility is directed towards the ends of the income range, the distribution is said to become twin-peaked.

The convergence of personal *taxable incomes* in the Finnish subregions has been analysed by Kangasharju (1998b), using the methods described above. He found that subregions showed relatively rapid convergence in 1934–80, but that the rate of convergence slowed down considerably thereafter. It is interesting to compare the province-based findings of the present study with those of Kangasharju, and see whether provinces and subregions in fact differ in terms of convergence. However, the present study analysed convergence using per capita *gross regional product*, meaning that the results are not fully comparable with Kangasharju's findings. Interestingly, Barro and Sala-i-Martin (1991) observed that the rate of regional convergence among the US states was virtually identical regardless of the data used (personal incomes or per capita gross state products). We may expect the same to be true in Finland, since GRPs and personal incomes are highly correlated (Kangasharju, 1998b).

The data consisted of provincial and subregional per capita GRPs, which were collected from various publications of Statistics Finland. The GRPs of the provinces had to be deflated to make the yearly observations comparable. Hence the figures were converted into 1994 prices using a national cost-of-living -index. The use of such an index may induce a slight measurement error tending to bias the estimate of β-coefficient. However, as Persson (1997) finds in the case of the Swedish counties, no qualitative difference appeared whether regional or national cost-of-living index was used. Below, per capita GRP will be understood as a *logarithmic* transformation. To apply the alternative method, the GRPs were normalized in order to separate the regional growth experience from the national economic growth common to all regions. Normalization was done by dividing each region's GRP by the national average per capita GDP for each year.

3. Convergence in the Finnish provinces, 1960–94

The aim of the present study was to analyse the convergence of regional products at both provincial and subregional level, and include all available data in the study. GRP data on the Finnish provinces were collected for the years 1960, 1970, 1973, 1976 and then every two years until 1994. There were, however, a number of problems involved in the use of this data. Firstly, the data suffered partly from a lack of homogeneity owing to changes in the basis on which GRP was calculated from year to year. The biggest change occurred after 1970, when the prices used changed from factor to producer prices. However, in a convergence analysis the main focus is on *relative* levels of GRP, as we wish to see if the initially poor regions have greater growth rates than the initially rich ones. And as the data were not susceptible to sample-selection bias (all the regions were included in the analysis) they can be relied on in the sense that the relative growth rates of the regions were largely comparable.

Secondly, Ahvenanmaa proved to be a somewhat problematic region, as it differed from the mainland provinces in many ways. Since it is a very exceptional region in the Finnish context, σ-convergence was analysed excluding Ahvenanmaa from the set. For the β-convergence analysis, a dummy variable was included to control for the special character of Ahvenanmaa; hence there was no need to omit it from the data set. And thirdly, we must remember that 1994 was not the best possible end-year for the analysis, as it was the turning point of a severe economic recession, when many regions had begun to recover from the downswing but some had not. Bearing in mind the above difficulties imposed by the nature of the data, we can continue with the course of the empirical study.

The regional products showed rapid growth until 1980. The annual logarithmic growth rates of the provinces ranged from 0,016 to 0,033. After 1980 growth slowed down markedly, with annual rates ranging between 0,002 and 0,006. At the beginning of the period (1960) the richest province was Uusimaa and the poorest was the province of Oulu. The GRP of the province of Oulu was 59 per cent of that of Uusimaa. In 1994, however, the richest province was Ahvenanmaa and the poorest was Pohjois-Karjala with a GRP of 57 per cent of that of Ahvenanmaa. Thus the gap between the richest and poorest province hardly diminished at all, despite a slight narrowing in the 1960s.

First, the existence of σ-convergence was analysed, that is the diminishing dispersion, or standard deviation, of gross regional products. No uniform trend appeared to exist, but the standard deviation fluctuated from year to year. When Ahvenanmaa was excluded, the dispersion of GRP diminished until 1980 (figure 1), meaning that σ-convergence occurred, but thereafter the GRP differences grew again until 1990 or so. During the 1990s the rate of dispersion has remained unchanged. The results indicate that there has even been some divergence in GRP since 1980. Thus it is concluded that the regional growth process in Finland seems to fall into two very different periods around the year 1980.

After reaching the above conclusion, the regional growth process in Finland was analysed to check whether regions which had a low level of GRP in 1960 grew faster than the initially rich regions. If this were the case, absolute β-convergence would be expected across the Finnish provinces. Figures 2 and 3 divide the period into two parts and show the cross-plot of initial product and subsequent growth rate. During the first half there is a clear negative relationship between per capita GRP in 1960 and growth, indicating that the poorer regions indeed grew faster than the richer ones. However, during 1980–94 no such relationship existed, but, conversely, it would seem that the two richest regions grew the fastest, with the remainder showing no apparent connection between their initial GRP and subsequent growth rates. Thus no absolute convergence looks likely after 1980, but, if anything, there is a positive correlation between a region's initial product and its subsequent growth (figure 3).

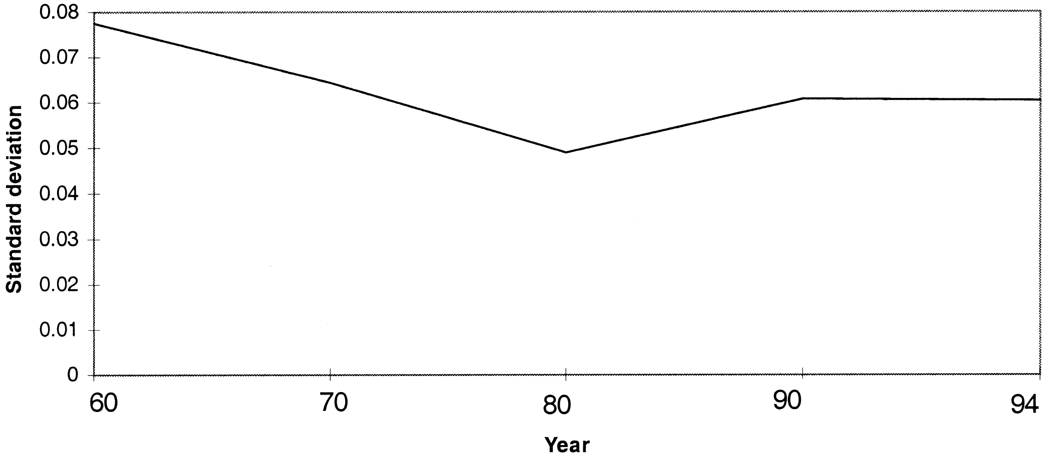

Figure 1. Dispersion of GRP in the Finnish provinces, 1960–94.

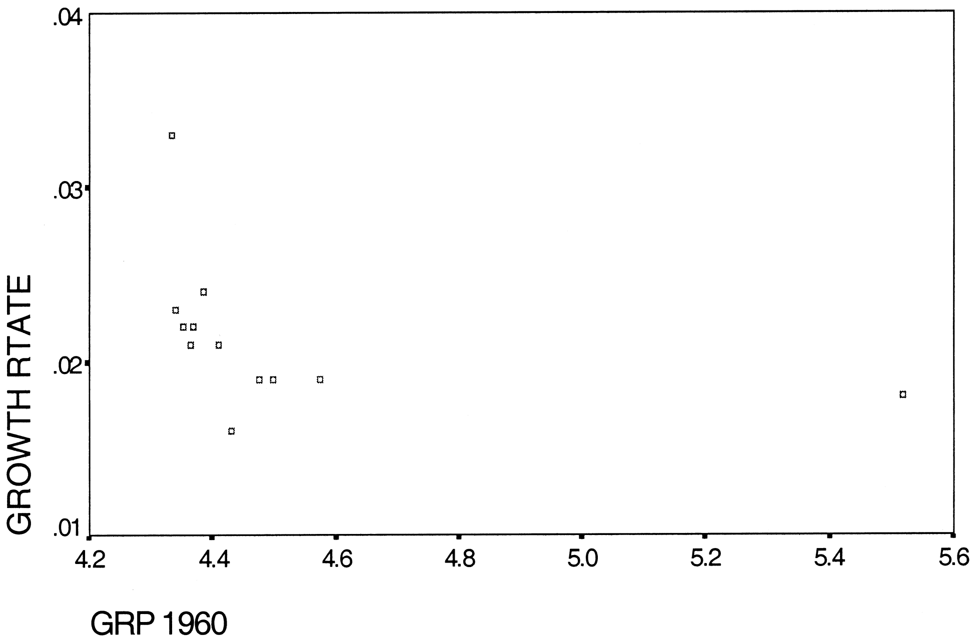

Figure 2. Initial GRP per capita and regional growth, 1960–80.

Next, β-convergence was estimated, first for the whole period and then for the two subperiods. Finally, the period was divided into decades for which separate estimates are reported. The estimation process was conducted in three stages as follows. At first, absolute convergence was estimated according to the basic equation (1). Secondly, a dummy variable was included to control for Ahvenanmaa, and finally, other explanatory variables were added to estimate conditional β-convergence. The results are reported below in table 2. Note that the first figure of each cell in the table is the estimate of β and the second one is Ra^2, the explanatory

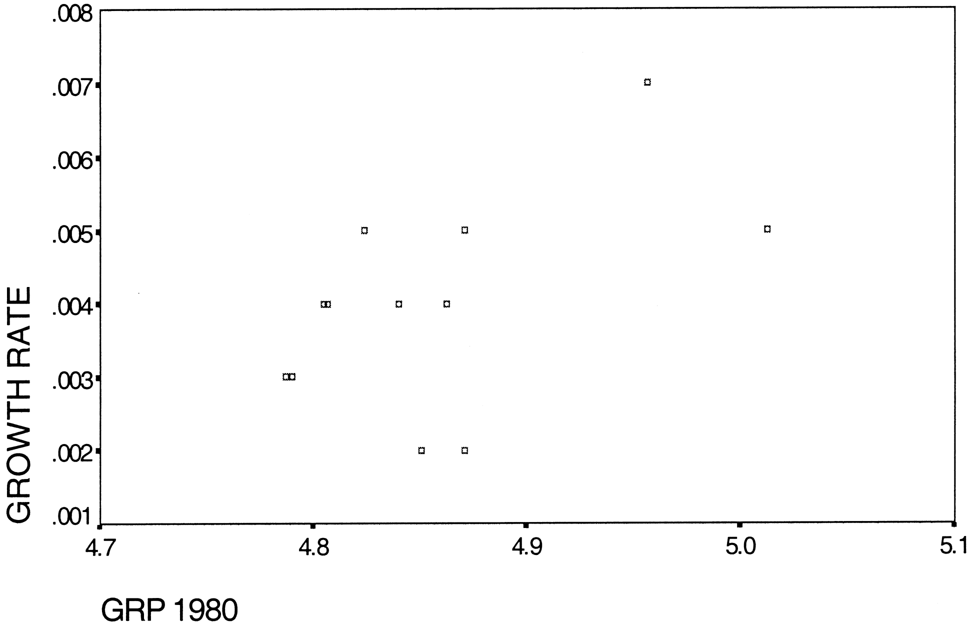

Figure 3. Initial GRP per capita and regional growth, 1980–94.

power of the model. This coefficient of determination has been adjusted to take into account the number of explanatory variables used. Under β is reported the standard error associated with the estimate of β and under Ra^2 the standard error of the residual. The likelihood ratio test of equal β's for the subperiods was rejected in all three specifications (statistic not reported, however).

For the whole period under investigation, the rate of absolute β-convergence was close to the often reported two per cent per annum[4]. Convergence was rapid, especially before 1980, but the β-coefficient acquires a negative sign in 1980–94, indicating that no convergence occurred. The fast rate of convergence in 1960–80 might partly be explained by the fact that Ahvenanmaa developed from one of the poorest provinces into the richest region of the country during precisely that period. A trial regression was conducted without Ahvenanmaa and it produced a much lower rate of convergence for the first two decades (β = 0,028). Hence the exceptional character of Ahvenanmaa may affect the results, and a dummy variable was included to control for that fact in the next stage. When the individual decades were examined, it was found that β-convergence was fastest in the 1970s (nearly 10 per cent per annum), but came to a complete halt in the 1980s and 1990s. Note that the negative coefficients of determination in table 2 arise because of the adjustment of R^2 to take into account the number of explanatory variables. Note also that some of the estimates are not statistically significant, because of the large standard errors. As indicated above, the next step was to add a dummy variable to the analysis (table 2, second column). Most of the earlier conclusions remain valid, but it should be noted that the sign of the β-coefficient in 1990–94 changed from negative to positive.

The final step was to introduce further explanatory variables to estimate conditional convergence. Following Barro and Sala-i-Martin (1995), a structural variable was added to proxy steady state differences in the regional economic structures. The idea is to take into account the fact that aggregate shocks (like oil crises or

[4] Note that this 2 per cent result has recently been challenged, as studies using panel data report much higher estimates for convergence. See for example Caselli et al (1996) and Islam (1995).

Table 2. Regressions for GRP across the Finnish provinces, 1960–94.

PERIOD	BASIC EQUATION		REGIONAL DUMMY		DUMMY AND CONDITIONING VARIABLES	
	β	Ra² (σ)	β	Ra² (σ)	β	Ra² (σ)
1960–94	0,022	0,21	0,012	0,86	0,018	0,90
	(0,011)	(0,002)	(0,001)	(0,001)	(0,001)	(0,001)
1960–80	0,050	0,31	0,028	0,94	0,038	0,96
	(0,033)	(0,003)	(0,001)	(0,001)	(0,001)	(0,001)
1980–94	–0,008	0,13	–0,010	0,08	0,005	0,38
	(0,001)	(0,001)	(0,001)	(0,001)	(0,001)	(0,001)
1960–70	0,017	0,41	0,019	0,42	0,026	0,53
	(0,001)	(0,001)	(0,001)	(0,001)	(0,001)	(0,001)
1970–80	0,098	0,22	0,035	0,94	0,051	0,95
	(0,069)	(0,007)	(0,003)	(0,002)	(0,003)	(0,002)
1980–90	–0,001	–0,09	–0,015	–0,21	0,007	0,083
	(0,003)	(0,003)	(0,002)	(0,003)	(0,002)	(0,002)
1990–94	–0,004	–0,07	0,007	0,02	0,023	–0,15
	(0,009)	(0,004)	(0,008)	(0,004)	(0,011)	(0,004)

changes in the prices of agricultural products) affect regions differently, depending on their economic structures. The structural variable is calculated for each region i as follows:

$$(3) \quad S_{i,t} = \sum_{j=1}^{3} w_{i,j,t-T} \times [\log (y_{j,t}/y_{j,\,t-T})/T],$$

where j represents the sector (primary production, industry and services) and $w_{i,j,t-T}$ indicates the weight of that particular sector in the region's GRP at the beginning of the period. The average per capita GDP of Finland is y. The structural variable shows the growth rate of region i on the assumption that all its sectors grow at the same rate as the national average of those sectors. As the greatest regional differences in 1960 between the provinces were in the share of services, a control variable was also used for that sector. The estimates for conditional convergence (table 2, final column) show positive signs for the β-coefficient for all subperiods.

Following Quah (1993b), Markov chain transition matrices were formed to analyse the distribution dynamics among the Finnish provinces which were divided into four income groups by setting the limits for relative GRP. The aim was to observe the movement of regions from one group to another and calculate the probabilities of this mobility, and the probabilities of regions to remain in their original group. To enable comparisons between the cross-section method and this one, Ahvenanmaa is now included in the data set. This is justified as we do not need to impose assumptions on regional steady states, but it is possible that some regions are converging while others are not (see Magrini, 1999).[5] The matrix (table 3b) has an ergodic distribution, as the modulus of its second largest eigenvalue is strictly less than one. The stationary ergodic distribution can be computed as:

$$(4) \quad \pi_j = A_{jj}(1)/\sum_k a_{kk}(1) \quad j,k \in C$$

where the (j,j)th cofactor, $A_{jj}(1)$, of the matrix A(1) = (I – P) is divided by the sum of cofactors (Magrini, 1999). The transition probability matrix P describes a set C of income classes over which the summation goes. A long-run ergodic distribution is one towards which regions have tended to move during the period under scrutiny. However, this is by no means a prediction of future regional distribution, but merely a data-dependent characteristic in the Markov chain models (Quah, 1993b).

[5] *Note also that adding the Ahvenanmaa dummy did not markedly change the results when estimating β-convergence. Therefore the inclusion of Ahvenanmaa in the alternative method can be rationalized.*

Table 3a. Gross regional product per capita, relative to the Finnish average. A 4-state Markov Chain Matrix for the Finnish provinces: a 34-year transition from 1960 to 1994.

	Upper endpoint			
(Number)	85,0	95,0	115,0	155,0
(3)	0,33	0,33		0,33
(3)	0,33	0,67		
(3)		0,33	0,67	
(3)		0,33	0,33	0,33

* Notes: The group limits for relative GRP per capita, from richest to poorest, were constructed as: Group 1: GRP ≥ 115, Group 2: 115 < GRP < 95, Group 3: 85 ≤ GRP ≤ 95 and Group 4: GRP ≤ 85. The groups appear in increasing order, with the poorest group displayed in the upper left-hand corner. The diagonal represents the probability of a region remaining in its original income group. The off-diagonals show the probabilities of regions to move into other income groups. The number in parentheses refers to the number of subregions in that particular group at the beginning of the period.

Table 3b. Gross regional product per capita, relative to the Finnish average. A 4-state Markov Chain Matrix for the Finnish provinces: Transitions from 1960 to 1994.

	Upper endpoint			
(Number)	85,0	95,0	115,0	155,0
(25)	0,61	0,39		
(41)	0,10	0,83	0,05	0,02
(60)		0,12	0,88	
(18)			0,08	0,92
ergodic	0,31	0,30	0,20	0,18

* Notes: See table 3a. This matrix has an ergodic distribution attached to it as the modulus of its second largest eigenvalue is strictly less than one. It should be noted, however, that this is by no means a prediction of the future distribution, but merely characterises the data. The provinces have tended to move towards such a distribution during 1960–94.

Here the upper matrix (table 3) shows the transition from 1960 to 1994. Mobility was high, especially for the poorest and richest groups. More interestingly still, the lower matrix shows all the transitions from observation to observation, together with the long run ergodic distribution. Again, considerable mobility was revealed and, clearly, convergence was present as the majority of provinces cluster in the middle income groups (the numbers of provinces in the middle income groups are 41 and 60). Therefore, the alternative method seems to support the cross-sectional findings for the whole period, 1960–94.

However, as the above analysis shows, there has been no uniform, continuous trend in the evolution of provincial disparities in Finland across the individual decades. Instead, both σ- and β-convergence have fluctuated between subperiods, and even divergence seems to have occurred. The results clearly show that regional convergence was rapid in 1960–80, when all provinces were growing steadily in terms of gross regional product, but that this development ended in 1980. Regardless of the explanatory variables used, little evidence was found for convergence in 1980–94, as the richest provinces were growing much faster than the poorer ones. The change in convergence rates before and after 1980 was only in part explained by the fact that Ahvenanmaa experienced fast growth, especially during the 1970s, progressing from a poor region into the richest in the country, in per capita terms. Other reasons for the change might lie in regional policy measures or the economic structures of the regions (agricultural regions had somewhat lower growth rates as the size of agricultural sector as a whole was shrinking). For example, the emphasis in regional policy may have changed somewhat even though no marked changes in the commitment to the policy itself could be detected during 1972–92 (Tervo, 1997).

The former results are, unexpectedly, somewhat in conflict with Kangasharju (1998a and 1998b). Kangasharju studied the convergence of personal incomes in the Finnish subregions and found that this occurred, especially in 1934–80, but slowed down markedly thereafter. He did not, however, observe any divergent patterns during the subperiods, but instead, even in 1983–93, found a rate of absolute β-convergence of 1,3 per cent per annum. Conditional convergence during 1983–93, on the other hand, was as high as 3,7 per cent. Thus the provinces showed different convergence properties from those of the subregions, as the present study revealed not only a slow-down, but a complete reversal of convergence in the 1980s. Hence the regional classification used in

Table 4: Estimates of β-convergence in the Finnish subregions, 1988–94.

Explanatory variables	β	Ra^2	St. Error	σ
GRP88	–0,001	0,003	0,006	0,006
GRP + Dummies	0,004	0,046	0,007	0,006
GRP + Structure	0,004	0,003	0,006	0,006
GRP + Dummies + Services	–0,001	0,068	0,007	0,006
GRP + Dummies + Services + Primary production	–0,002	0,057	0,011	0,006

* Notes: Variables "Services" and "Primary production" refer to the shares of those industries in the total product of the regions.

a convergence study can markedly affect the results. The reason why convergence between provinces has been slower than that between subregions could be that the per capita GRP of a province does not perfectly represent each individual subregion's GRP. A province may be too large a unit and include very heterogeneous subregions, whereby actual regional differences may get "aggregated away". Hence the initial disparities between provinces are much smaller than those between subregions, meaning that there is less room for convergence in the first place. Similar observations appear in Magrini (1999), Hofer and Wörgötter (1997) and Kangasharju and Alanen (1998). Using the more detailed regional classification (with 88 subregions) may also produce more accurate results when studying convergence, because the subregions reflect the actual economic and commuting areas (Kangasharju and Alanen, 1998).

4. *Convergence in the Finnish subregions, 1988–94*

The 88 small-scale subregions form the most disaggregated regional level for which GRP data are available. This was also a relevant level at which to assess convergence (see the explanation above), as large intra-subregional disparities were unlikely to exist. This data provided an interesting object of study as it was gathered recently and encompassed the severest economic recession in Finnish history since the Second World War. Firstly, β-convergence was estimated to see if there were differences in the growth and convergence patterns of the provinces and subregions, but a highly detailed analysis was not considered necessary, as none of the results were statistically significant. The annual rate of absolute β-convergence was more or less zero per cent, tending, if anything, to be slightly negative (table 4). This result is very similar to that obtained using the provincial GRPs, indicating that absolute convergence has not so far occurred in the 1990s. Moreover, the dispersion of GRP remained almost unchanged, at around 0.1, indicating that no σ-convergence occurred in the subregions either.

For the estimation of conditional convergence, four regional dummies were used as control variables together with a structural variable (3) and the shares of services and primary production of the total product of the regions. Only the most interesting results of this operation are reported in table 4. The incorporation of the control variables did not improve the results markedly, but signalled that convergence was indeed non-existent. On the other hand, no clear divergent trend was apparent either. However, we must remember that a six-year period is too short to say anything conclusive about the rate of regional convergence. The explanatory power of the model also shows that the regional growth process remains unexplained by the above analysis.

Next the growth dynamics and convergence behaviour of the subregions, which remained unexplained by the cross-section regressions, were analysed. The distribution of products across the 88 subregions was assessed to see whether it tended to be straight or twin-peaked. Again, Markov chain transition matrices were formed. Firstly, the subregions were divided into five income groups by defining the limits for relative GRP so as to obtain groups of roughly the same size. Table 5 displays both the

Table 5a: Gross regional product per capita, relative to the Finnish average. A 5-state Markov Chain Matrix for the Finnish subregions: A 6-year transition from 1988 to 1994.

	Upper end-point				
(Number)	65,0	74,9	85,0	99,9	145
(16)	0,69	0,31			
(20)	0,30	0,55	0,15		
(15)		0,20	0,47	0,33	
(18)			0,22	0,44	0,33
(19)				0,21	0,79

* Notes: The group limits for relative GRP per capita, from richest to poorest, were constructed as: Group 1: GRP ≥ 100, Group 2: 100 < GRP < 85, Group 3: 75 ≤ GRP ≤ 85, Group 4: 65 < GRP < 75 and Group 5: GRP ≤ 65. The groups appear in increasing order, with the poorest group displayed in the upper left-hand corner. The diagonal represents the probability of a region remaining in its original income group. The off-diagonals show the probabilities of regions to move into other income groups. The number in parentheses refers to the number of subregions in that particular group at the beginning of the period.

Table 5b: Gross regional product per capita, relative to the Finnish average. A 5-state Markov Chain Matrix for the Finnish subregions: One-year transitions from 1988 to 1994.

	Upper end-point				
(Number)	65,0	74,9	85,0	99,9	145
(72)	0,75	0,25			
(135)	0,14	0,78	0,08		
(88)		0,11	0,74	0,14	0,01
(118)		0,01	0,09	0,75	0,16
(105)			0,01	0,16	0,83
Ergodic	0,20	0,21	0,20	0,21	0,18

* Notes: See Table 5a. Note that here the number in parentheses represents the sum of subregions belonging to that income group throughout the period. This matrix has an ergodic distribution attached to it as the modulus of its second largest eigenvalue is strictly less than one. It should be noted, however, that this is by no means a prediction of the future distribution, but merely characterises the data. During 1988–94 subregions have tended to move towards such a distribution.

annual transitions and the six-year transition from 1988 to 1994. The upper matrix indicates that the Finnish subregions displayed quite a high degree of mobility in the six-year period under question, as the diagonal entries range from only 0,440 to 0,790, and the off-diagonals are relatively large. The lower matrix shows the yearly transitions from one state to another, and leads to conclusions resembling those of the six-year matrix. The diagonal entries are again rather low, suggesting that the probability of regions to move out of their original group was noticeable. In fact, some regions even moved more than one group up or downwards, which means that large changes in GRP occur from one year to another, indicating high mobility. However, the relative shares of the income groups remained fairly stable throughout the period, indicating that no group was vanishing. Here the ergodic distribution shows that the shares of the income groups tend to remain relatively stable (table 5b) and there is no sign of twin-peakedness of the distribution.

As the above analysis of the Finnish subregions showed, the estimation of β-convergence revealed little of the relative growth patterns among the Finnish subregions, mainly because the period under scrutiny was so brief. Alternatively, 1994 may not be the best end year, as it marked the end of a profound economic recession. Nevertheless, the message is that subregional growth patterns cannot be explained either by differences in the initial GRP levels or by the differing economic structures of the regions. The period 1988–94, however, was characterised by large fluctuations in the aggregate economy, and it is unlikely that all the subregions would have experienced these fluctuations in exactly the same way. It is more likely that some regions suffered more from the recession, or benefited more from the boom, than others. Hence two Markov chain transition matrices were formed in order to see if this method would be more informative than the cross-section approach, which it indeed was. The analysis of cross-sectional dynamics revealed substantial movement, both upwards and downwards, on the part of the subregions, from one income group into another. This result conflicts with the rather stationary picture given by the β- and σ-estimates. It is therefore possible to agree with Quah (1996) that it makes sense to use alternative methods in analysing regional growth dynamics, if perhaps not to the extent of abandoning the cross-section method completely, since it can give detailed estimates and does not require so many assumptions on structure. Instead, it would be preferable to see these methods as complementary.

When the subregional figures were compared with the above provincial convergence results, it was noted that the speed of convergence seemed to be faster, or the pace of divergence slower, when using a more detailed regional classification.[6] As noted earlier, the convergence result obtained depends heavily on the statistical classification of the regions. Therefore the choice of suitable regional classification deserves thorough consideration. These issues and other questions that could not be answered in this study are discussed in the concluding section which follows.

5. *Discussion and conclusions*

The aim of this study was to analyse the convergence of regional products in the Finnish provinces and subregions. At province level, β-convergence was found to be strong in 1960–80, but to come to a complete halt thereafter. In fact, a degree of divergence even occurred in the 1980s. The incorporation of control variables to proxy differences in regional steady-states improved the explanatory power of the model, but did not change the results markedly. The analysis of σ-convergence proved that regional income disparities have fluctuated from decade to decade and that no uniform trend has existed. All the above findings imply that the Finnish provinces were converging in terms of per capita gross regional product in 1960–80 and diverging in the 1980s. In the first half of the 1990s the situation remained rather stationary. This behaviour is very different from that displayed by the subregions during the same period, as noted when comparing the results with Kangasharju (1998b). Hence even if convergence occurs on one regional level, it is possible that on another level income differences are growing. For that reason, further research is necessary to confirm the theoretical impacts of the level of regional aggregation.

The analysis of β- and σ-convergence in the Finnish subregions did not reveal any clear convergence or divergence patterns, but regional differences remained almost unchanged in 1988–94. However, the analysis of regional growth dynamics and mobility proved that the distribution of regional incomes was evolving throughout the period, but this mobility was not revealed by the cross-section method. In fact, the Finnish subregions proved to be highly mobile across the regional income groups. This finding implies that regional convergence can and should be studied in more than just one way, as none of the available methods alone can produce a complete picture of relative regional growth patterns. Finally, it is acknowledged that a panel data model might have provided more insight into the convergence issue by solving at least some of the problems associated with cross-section regressions. Indeed, such approaches have recently yielded interesting results.

[6] *Recall that at the provincial level the 1980s and 1990s were a time of divergence, when absolute convergence was assessed. The subregions, however, showed no clear divergent trend during 1988–94.*

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